(12) 특허협력조약에 의하여 공개된 국제출원

(19) 세계지식재산권기구
국제사무국

(43) 국제공개일
2019 년 1 월 24 일 (24.01.2019)

WIPO | PCT

(10) 국제공개번호
WO 2019/017633 A1

(51) 국제특허분류:
C07D 493/04 (2006.01) *H01L 51/00* (2006.01)
C07D 495/04 (2006.01) *H01L 51/50* (2006.01)
C07D 487/04 (2006.01)

(21) 국제출원번호: PCT/KR2018/007740

(22) 국제출원일: 2018 년 7 월 9 일 (09.07.2018)

(25) 출원언어: 한국어

(26) 공개언어: 한국어

(30) 우선권정보:
10-2017-0090829 2017 년 7 월 18 일 (18.07.2017) KR

(71) 출원인: **주식회사 엘지화학 (LG CHEM, LTD.)** [KR/KR]; 07336 서울시 영등포구 여의대로 128, Seoul (KR).

(72) 발명자: **이우철 (LEE, Woochul)**; 34122 대전시 유성구 문지로 188 LG화학 기술연구원, Daejeon (KR). **구기동 (KOO, Ki Dong)**; 34122 대전시 유성구 문지로 188 LG화학 기술연구원, Daejeon (KR). **김동헌 (KIM, Dongheon)**; 34122 대전시 유성구 문지로 188 LG화학 기술연구원, Daejeon (KR). **이기곤 (LEE, Ki Kon)**; 34122 대전시 유성구 문지로 188 LG화학 기술연구원, Daejeon (KR). **금수정 (GEUM, Sujeong)**; 34122 대전시 유성구 문지로 188 LG화학 기술연구원, Daejeon (KR). **윤정민 (YOON, Jung Min)**; 34122 대전시 유성구 문지로 188 LG화학 기술연구원, Daejeon (KR). **김공겸 (KIM, Kongkyeom)**; 34122 대전시 유성구 문지로 188 LG화학 기술연구원, Daejeon (KR). **이형진 (LEE, Hyungjin)**; 34122 대전시 유성구 문지로 188 LG화학 기술연구원, Daejeon (KR). **허난슬아 (HEO, Nansra)**; 34122 대전시 유성구 문지로 188 LG화학 기술연구원, Daejeon (KR).

(74) 대리인: **정순성 (CHUNG, Soon-Sung)**; 06253 서울시 강남구 강남대로 318, 타워837 빌딩, 6층, Seoul (KR).

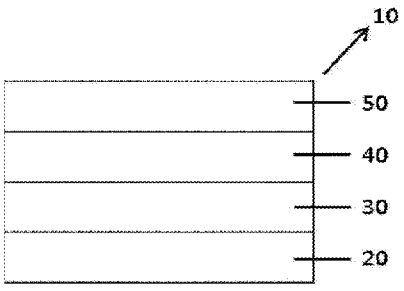
(81) 지정국 (별도의 표시가 없는 한, 가능한 모든 종류의 국내 권리의 보호를 위하여): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) 지정국 (별도의 표시가 없는 한, 가능한 모든 종류의 역내 권리의 보호를 위하여): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), 유라시아 (AM, AZ, BY, KG, KZ, RU, TJ, TM), 유럽 (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

공개:
— 국제조사보고서와 함께 (조약 제21조(3))

(54) Title: NOVEL COMPOUND AND ORGANIC LIGHT EMITTING DEVICE COMPRISING SAME

(54) 발명의 명칭: 신규한 화합물 및 이를 포함하는 유기 발광 소자



(57) Abstract: The specification relates to a compound represented by chemical formula 1 and to an organic light emitting device comprising the same.

(57) 요약서: 본 명세서는 화학식 1 로 표시되는 화합물 및 이를 포함하는 유기 발광 소자에 관한 것이다.

WO 2019/017633 A1

명세서

발명의 명칭: 신규한 화합물 및 이를 포함하는 유기 발광 소자

기술분야

[1] 본 출원은 2017년 7월 18일에 한국특허청에 제출된 한국 특허 출원 제 10-2017-0090829호의 출원일의 이익을 주장하며, 그 내용 전부는 본 명세서에 포함된다.

[2] 본 명세서는 신규한 화합물 및 이를 포함하는 유기 발광 소자에 관한 것이다.

배경기술

[3] 일반적으로 유기 발광 현상이란 유기 물질을 이용하여 전기에너지를 빛에너지로 전환시켜주는 현상을 말한다. 유기 발광 현상을 이용하는 유기 발광 소자는 통상 양극과 음극 및 이 사이에 유기물층을 포함하는 구조를 가진다. 여기서 유기물층은 유기 발광 소자의 효율과 안정성을 높이기 위하여 각기 다른 물질로 구성된 다층의 구조로 이루어진 경우가 많으며, 예컨대 정공주입층, 정공수송층, 발광층, 전자수송층, 전자주입층 등으로 이루어 질 수 있다. 이러한 유기 발광 소자의 구조에서 두 전극 사이에 전압을 걸어주게 되면 양극에서는 정공이, 음극에서는 전자가 유기물층에 주입되게 되고, 주입된 정공과 전자가 만났을 때 엑시톤(exciton)이 형성되며, 이 엑시톤이 다시 바닥상태로 떨어질 때 빛이 나게 된다.

[4] 상기와 같은 유기 발광 소자를 위한 새로운 재료의 개발이 계속 요구되고 있다.

발명의 상세한 설명

기술적 과제

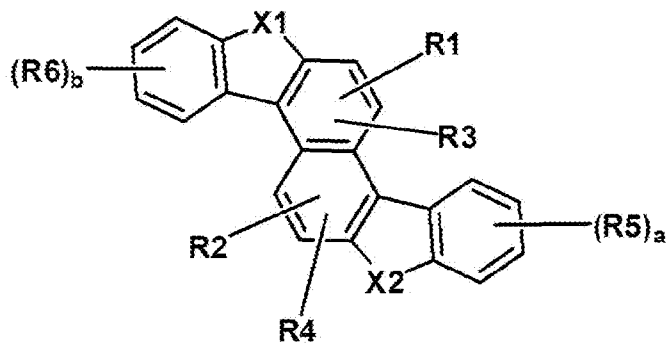
[5] 본 명세서는 신규한 화합물 및 이를 포함하는 유기 발광 소자를 제공한다.

과제 해결 수단

[6] 본 명세서의 일 실시상태에 따르면 하기 화학식 1로 표시되는 화합물을 제공한다.

[7] [화학식 1]

[8]



[9] 상기 화학식 1에 있어서,

[10] X1 및 X2는 서로 같거나 상이하고, 각각 독립적으로 -O-, -S-, -C(R7R8)-, 또는 -N(R9)-이며,

[11] R1 내지 R4 중 적어도 2개는 서로 같거나 상이하고, 각각 독립적으로 하기 화학식 A로 표시되는 기이고,

[12] R1 내지 R4 중 하기 화학식 A가 아닌 기는 서로 같거나 상이하고, 각각 독립적으로 수소; 중수소; 치환 또는 비치환된 알킬기; 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이며,

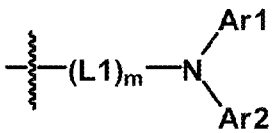
[13] R5 및 R6는 서로 같거나 상이하고, 각각 독립적으로 수소; 치환 또는 비치환된 알킬기; 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이거나, 인접한 치환기는 서로 결합하여 치환 또는 비치환된 고리를 형성하고,

[14] R7 내지 R9는 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 알킬기; 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이고,

[15] a 및 b는 각각 1 내지 4의 정수이며,

[16] 상기 a 및 b가 각각 2 이상인 경우, 2 이상의 괄호 내의 구조는 서로 같거나 상이하고,

[17] [화학식 A]

[18] 

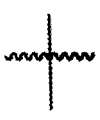
[19] 상기 화학식 A에 있어서,

[20] L1은 직접결합; 치환 또는 비치환된 아릴렌기; 또는 치환 또는 비치환된 헤테로아릴렌기이며,

[21] Ar1 및 Ar2는 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이거나, 서로 결합하여 치환 또는 비치환된 고리를 형성할 수 있고,

[22] m은 1 내지 5의 정수이며,

[23] 상기 m이 2이상인 경우, 2 이상의 L1은 서로 같거나 상이하고,

[24]  는 화학식 1에 결합되는 부위이다.

[25] 또한, 본 명세서의 일 실시상태에 따르면, 제1 전극; 상기 제1 전극에 대향하여 구비된 제2 전극; 및 상기 제1 전극과 제2 전극 사이에 구비된 1층 이상의 유기물층을 포함하는 유기 발광 소자로서, 상기 유기물층 중 1 층 이상은 상기 화학식 1로 표시되는 화합물을 포함하는 것인 유기 발광 소자를 제공한다.

발명의 효과

[26] 본 명세서의 일 실시상태에 따른 화합물은 유기 발광 소자의 유기물층의 재료로서 사용될 수 있고, 이를 사용함으로써 유기 발광 소자에서 효율의 향상, 낮은 구동전압 및/또는 수명 특성의 향상이 가능하다.

도면의 간단한 설명

[27] 도 1은 본 명세서의 일 실시상태에 따르는 유기 발광 소자(10)를 도시한 것이다.

[28] 도 2는 본 명세서의 또 하나의 실시상태에 따르는 유기 발광 소자(11)를 도시한 것이다.

[29] [부호의 설명]

[30] 10, 11: 유기 발광 소자

[31] 20: 기판

[32] 30: 제1 전극

[33] 40: 발광층

[34] 50: 제2 전극

[35] 60: 정공주입층

[36] 70: 정공수송층

[37] 80: 전자수송층

[38] 90: 전자주입층

발명의 실시를 위한 최선의 형태

[39] 이하, 본 명세서에 대하여 더욱 상세하게 설명한다.

[40] 본 명세서는 상기 화학식 1로 표시되는 화합물을 제공한다.

[41] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1로 표시되는 화합물은 3환의 고리 화합물이 축합된 구조로 6환 이상의 구조를 이루고 있으며, 종래의 아릴로만 이루어진 크라이센(4환 고리) 유도체를 이용한 유기 발광 소자에 비해 헤테로 원소가 들어간 유도체를 기본 골격 구조로 이용하므로, 전자 이동이 용이하며, 상기 화학식 1의 R1 및 R2와 같은 특정 위치에 상기 화학식 A로 표시되는 아민기를 치환기로 포함함에 따라, N의 비공유 전자쌍으로 정공의 이동이 용이하여, 정공 및 전자 이동의 균형이 잘 이루어져 이를 포함하는 유기 발광소자는 전압이 낮고, 수명 특성이 향상되며, 효율이 향상될 수 있다.

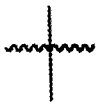
[42] 본 명세서에 있어서, 어떤 부분이 어떤 구성요소를 "포함" 한다고 할 때, 이는 특별히 반대되는 기재가 없는 한 다른 구성요소를 제외하는 것이 아니라 다른 구성 요소를 더 포함할 수 있는 것을 의미한다.

[43] 본 명세서에 있어서, 어떤 부재가 다른 부재 "상에" 위치하고 있다고 할 때, 이는 어떤 부재가 다른 부재에 접해 있는 경우뿐 아니라 두 부재 사이에 또 다른 부재가 존재하는 경우도 포함한다.

[44] 본 명세서에 있어서 치환기의 예시들은 아래에서 설명하나, 이에 한정되는 것은 아니다.

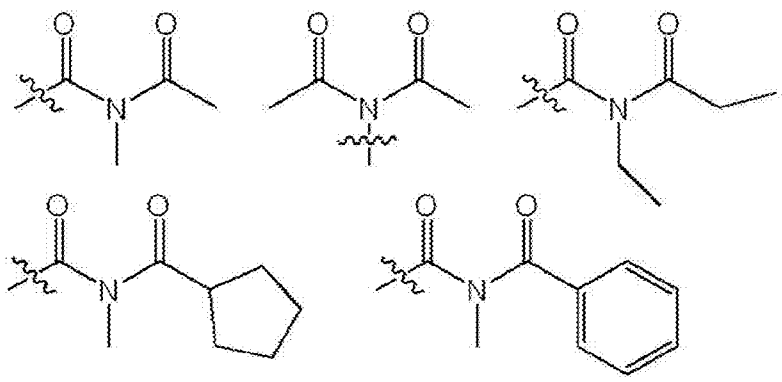
[45] 상기 "치환"이라는 용어는 화합물의 탄소 원자에 결합된 수소 원자가 다른 치환기로 바뀌는 것을 의미하며, 치환되는 위치는 수소 원자가 치환되는 위치 즉, 치환기가 치환 가능한 위치라면 한정하지 않으며, 2 이상 치환되는 경우, 2 이상의 치환기는 서로 동일하거나 상이할 수 있다.

[46] 본 명세서에서 "치환 또는 비치환된" 이라는 용어는 중수소; 할로겐기; 니트릴기; 니트로기; 이미드기; 아미드기; 카르보닐기; 에스테르기; 히드록시기; 치환 또는 비치환된 알킬기; 치환 또는 비치환된 시클로알킬기; 치환 또는 비치환된 알콕시기; 치환 또는 비치환된 아릴옥시기; 치환 또는 비치환된 알킬티옥시기; 치환 또는 비치환된 아릴티옥시기; 치환 또는 비치환된 알킬술폭시기; 치환 또는 비치환된 아릴술폭시기; 치환 또는 비치환된 알케닐기; 치환 또는 비치환된 실릴기; 치환 또는 비치환된 붕소기; 치환 또는 비치환된 아민기; 치환 또는 비치환된 아릴포스핀기; 치환 또는 비치환된 포스핀옥사이드기; 치환 또는 비치환된 아릴기; 및 치환 또는 비치환된 헤테로고리기로 이루어진 군에서 선택된 1 또는 2 이상의 치환기로 치환되었거나 상기 예시된 치환기 중 2 이상의 치환기가 연결된 치환기로 치환되거나, 또는 어떠한 치환기도 갖지 않는 것을 의미한다. 예컨대, "2 이상의 치환기가 연결된 치환기"는 바이페닐기일 수 있다. 즉, 바이페닐기는 아릴기일 수도 있고, 2개의 페닐기가 연결된 치환기로 해석될 수 있다.

[47] 본 명세서에 있어서,  는 다른 치환기 또는 결합부에 결합되는 부위를 의미한다.

[48] 본 명세서에 있어서, 할로겐기는 불소, 염소, 브롬 또는 요오드가 될 수 있다.

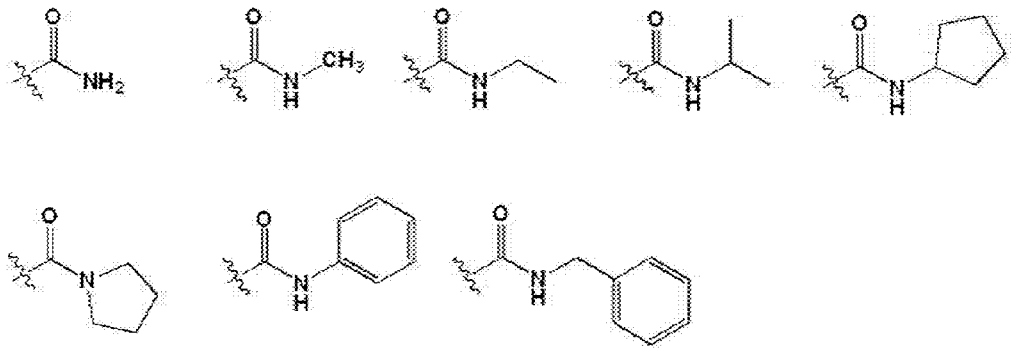
[49] 본 명세서에 있어서, 이미드기의 탄소수는 특별히 한정되지 않으나, 탄소수 1 내지 30인 것이 바람직하다. 구체적으로 하기와 같은 구조의 화합물이 될 수 있으나, 이에 한정되는 것은 아니다.

[50] 

[51] 본 명세서에 있어서, 아미드기는 아미드기의 질소가 수소, 탄소수 1 내지 30의 직쇄, 분지쇄 또는 고리쇄 알킬기 또는 탄소수 6 내지 30의 아릴기로 치환될 수

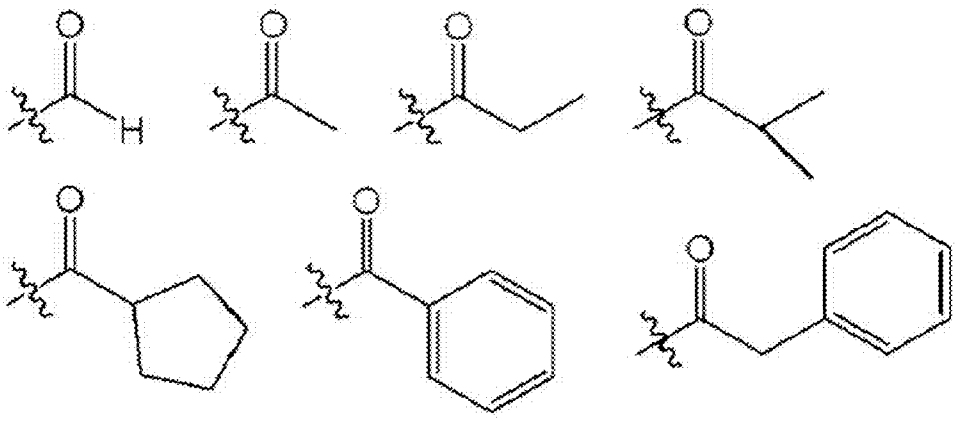
있다. 구체적으로, 하기 구조식의 화합물이 될 수 있으나, 이에 한정되는 것은 아니다.

[52]



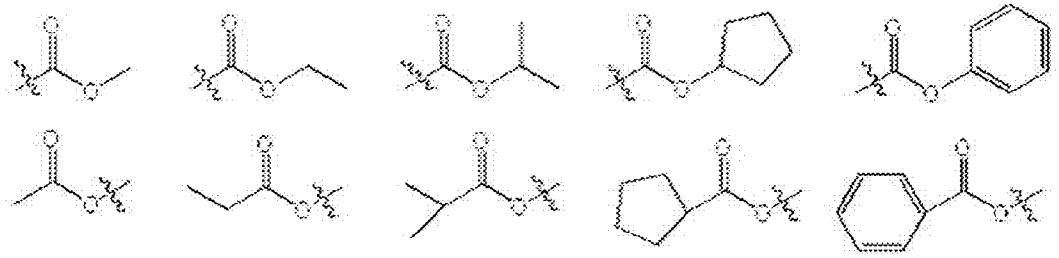
[53] 본 명세서에서 카르보닐기의 탄소수는 특별히 한정되지 않으나, 탄소수 1 내지 30인 것이 바람직하다. 구체적으로 하기와 같은 구조의 화합물이 될 수 있으나, 이에 한정되는 것은 아니다.

[54]



[55] 본 명세서에 있어서, 에스테르기는 에스테르기의 산소가 탄소수 1 내지 25의 직쇄, 분지쇄 또는 고리쇄 알킬기 또는 탄소수 6 내지 30의 아릴기로 치환될 수 있다. 구체적으로, 하기 구조식의 화합물이 될 수 있으나, 이에 한정되는 것은 아니다.

[56]



[57] 본 명세서에 있어서, 상기 알킬기는 직쇄 또는 분지쇄일 수 있고, 탄소수는 특별히 한정되지 않으나 1 내지 30인 것이 바람직하다. 구체적인 예로는 메틸, 에틸, 프로필, n-프로필, 이소프로필, 부틸, n-부틸, 이소부틸, tert-부틸, sec-부틸,

1-메틸-부틸, 1-에틸-부틸, 펜틸, n-펜틸, 이소펜틸, 네오펜틸, tert-펜틸, 헥실, n-헥실, 1-메틸펜틸, 2-메틸펜틸, 4-메틸-2-펜틸, 3,3-디메틸부틸, 2-에틸부틸, 헵틸, n-헵틸, 1-메틸헥실, 시클로펜틸메틸, 시클로헥실메틸, 옥틸, n-옥틸, tert-옥틸, 1-메틸헵틸, 2-에틸헥실, 2-프로필펜틸, n-노닐, 2,2-디메틸헵틸, 1-에틸-프로필, 1,1-디메틸-프로필, 이소헥실, 2-메틸펜틸, 4-메틸헥실, 5-메틸헥실 등이 있으나, 이에 한정되는 것은 아니다.

[58] 본 명세서에 있어서, 시클로알킬기는 특별히 한정되지 않으나, 탄소수 3 내지 30인 것이 바람직하며, 구체적으로 시클로프로필, 시클로부틸, 시클로펜틸, 3-메틸시클로펜틸, 2,3-디메틸시클로펜틸, 시클로헥실, 3-메틸시클로헥실, 4-메틸시클로헥실, 2,3-디메틸시클로헥실, 3,4,5-트리메틸시클로헥실, 4-tert-부틸시클로헥실, 시클로헵틸, 시클로옥틸 등이 있으나, 이에 한정되는 것은 아니다.

[59] 본 명세서에 있어서, 상기 알콕시기는 직쇄, 분지쇄 또는 고리쇄일 수 있다. 알콕시기의 탄소수는 특별히 한정되지 않으나, 탄소수 1 내지 30인 것이 바람직하다. 구체적으로, 메톡시, 에톡시, n-프로폭시, 이소프로폭시, n-부톡시, 이소부톡시, tert-부톡시, sec-부톡시, n-펜틸옥시, 네오펜틸옥시, 이소펜틸옥시, n-헥실옥시, 3,3-디메틸부틸옥시, 2-에틸부틸옥시, n-옥틸옥시, n-노닐옥시, n-데실옥시, 벤질옥시, p-메틸벤질옥시 등이 될 수 있으나, 이에 한정되는 것은 아니다.

[60] 본 명세서에 있어서, 아민기는 $-NH_2$; 알킬아민기; N-알킬아릴아민기; 아릴아민기; N-아릴헤테로아릴아민기; N-알킬헤테로아릴아민기 및 헤테로아릴아민기로 이루어진 군으로부터 선택될 수 있으며, 탄소수는 특별히 한정되지 않으나, 1 내지 30인 것이 바람직하다. 아민기의 구체적인 예로는 메틸아민기, 디메틸아민기, 에틸아민기, 디에틸아민기, 페닐아민기, 나프틸아민기, 바이페닐아민기, 안트라세닐아민기, 9-메틸-안트라세닐아민기, 디페닐아민기, N-페닐나프틸아민기, 디톨릴아민기, N-페닐톨릴아민기, 트리페닐아민기, N-페닐바이페닐아민기, N-페닐나프틸아민기, N-바이페닐나프틸아민기, N-나프틸플루오레닐아민기, N-페닐페난트레닐아민기, N-바이페닐페난트레닐아민기, N-페닐플루오레닐아민기, N-페닐터페닐아민기, N-페난트레닐플루오레닐아민기, N-바이페닐플루오레닐아민기 등이 있으나, 이에 한정되는 것은 아니다.

[61] 본 명세서에 있어서, N-알킬아릴아민기는 아민기의 N에 알킬기 및 아릴기가 치환된 아민기를 의미한다.

[62] 본 명세서에 있어서, N-아릴헤테로아릴아민기는 아민기의 N에 아릴기 및 헤테로아릴기가 치환된 아민기를 의미한다.

[63] 본 명세서에 있어서, N-알킬헤테로아릴아민기는 아민기의 N에 알킬기 및 헤테로아릴기가 치환된 아민기를 의미한다.

[64] 본 명세서에 있어서, 알킬아민기의 예로는 치환 또는 비치환된 모노알킬아민기, 또는 치환 또는 비치환된 디알킬아민기가 있다. 상기 알킬아민기 중의 알킬기는 직쇄 또는 분지쇄의 알킬기일 수 있다. 상기 알킬기가 2 이상을 포함하는 알킬아민기는 직쇄의 알킬기, 분지쇄의 알킬기, 또는 직쇄의 알킬기와 분지쇄의 알킬기를 동시에 포함할 수 있다. 예컨대, 상기 알킬아민기 중의 알킬기는 전술한 알킬기의 예시 중에서 선택될 수 있다.

[65] 본 명세서에 있어서, 알킬아민기, N-아릴알킬아민기, 알킬티옥시기, 알킬술폭시기, N-알킬헤테로아릴아민기 중의 알킬기는 전술한 알킬기의 예시와 같다. 구체적으로 알킬티옥시기로는 메틸티옥시기, 에틸티옥시기, tert-부틸티옥시기, 헥실티옥시기, 옥틸티옥시기 등이 있고, 알킬술폭시기로는 메실, 에틸술폭시기, 프로필술폭시기, 부틸술폭시기 등이 있으나, 이에 한정되는 것은 아니다.

[66] 본 명세서에 있어서, 상기 알케닐기는 직쇄 또는 분지쇄일 수 있고, 탄소수는 특별히 한정되지 않으나, 2 내지 30인 것이 바람직하다. 구체적인 예로는 비닐, 1-프로페닐, 이소프로페닐, 1-부테닐, 2-부테닐, 3-부테닐, 1-펜테닐, 2-펜테닐, 3-펜테닐, 3-메틸-1-부테닐, 1,3-부타디에닐, 알릴, 1-페닐비닐-1-일, 2-페닐비닐-1-일, 2,2-디페닐비닐-1-일, 2-페닐-2-(나프틸-1-일)비닐-1-일, 2,2-비스(디페닐-1-일)비닐-1-일, 스틸베닐기, 스티레닐기 등이 있으나, 이에 한정되는 것은 아니다.

[67] 본 명세서에 있어서, 실릴기는 구체적으로 트리메틸실릴기, 트리에틸실릴기, t-부틸디메틸실릴기, 비닐디메틸실릴기, 프로필디메틸실릴기, 트리페닐실릴기, 디페닐실릴기, 페닐실릴기 등이 있으나, 이에 한정되는 것은 아니다.

[68] 본 명세서에 있어서, 붕소기는 $-BR_{100}R_{101}$일 수 있으며, 상기 R_{100} 및 R_{101}은 같거나 상이하고, 각각 독립적으로 수소; 중수소; 할로겐; 니트릴기; 치환 또는 비치환된 탄소수 3 내지 30의 단환 또는 다환의 시클로알킬기; 치환 또는 비치환된 탄소수 1 내지 30의 직쇄 또는 분지쇄의 알킬기; 치환 또는 비치환된 탄소수 6 내지 30의 단환 또는 다환의 아릴기; 및 치환 또는 비치환된 탄소수 2 내지 30의 단환 또는 다환의 헤테로아릴기로 이루어진 군으로부터 선택될 수 있다.

[69] 본 명세서에 있어서, 포스핀옥사이드기는 구체적으로 디페닐포스핀옥사이드기, 디나프틸포스핀옥사이드기 등이 있으나, 이에 한정되는 것은 아니다.

[70] 본 명세서에 있어서, 아릴기는 특별히 한정되지 않으나, 탄소수 6 내지 30인 것이 바람직하며, 상기 아릴기는 단환식 또는 다환식일 수 있다.

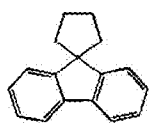
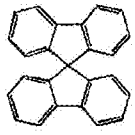
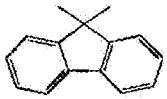
[71] 상기 아릴기가 단환식 아릴기인 경우 탄소수는 특별히 한정되지 않으나, 탄소수 6 내지 30인 것이 바람직하다. 구체적으로 단환식 아릴기로는 페닐기, 바이페닐기, 터페닐기 등이 될 수 있으나, 이에 한정되는 것은 아니다.

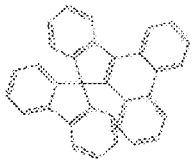
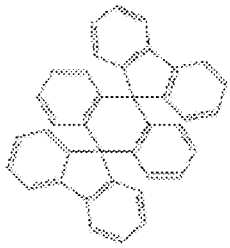
[72] 상기 아릴기가 다환식 아릴기인 경우 탄소수는 특별히 한정되지 않으나.

탄소수 10 내지 30인 것이 바람직하다. 구체적으로 다환식 아릴기로는 나프틸기, 안트라세닐기, 페난트릴기, 트리페닐기, 파이레닐기, 페날레닐기, 페릴레닐기, 크라이세닐기, 플루오레닐기 등이 될 수 있으나, 이에 한정되는 것은 아니다.

[73] 본 명세서에 있어서, 상기 플루오레닐기는 치환될 수 있으며, 인접한 기들이 서로 결합하여 고리를 형성할 수 있다.

[74] 상기 플루오레닐기가 치환되는 경우,


,

,

,

,

,

및

등이 될 수 있다. 다만, 이에 한정되는 것은 아니다.

[75] 본 명세서에 있어서, "인접한" 기는 해당 치환기가 치환된 원자와 직접 연결된 원자에 치환된 치환기, 해당 치환기와 입체구조적으로 가장 가깝게 위치한 치환기, 또는 해당 치환기가 치환된 원자에 치환된 다른 치환기를 의미할 수 있다. 예컨대, 벤젠고리에서 오르토(ortho)위치로 치환된 2개의 치환기 및 지방족 고리에서 동일 탄소에 치환된 2개의 치환기는 서로 "인접한" 기로 해석될 수 있다.

[76] 본 명세서에 있어서, 아릴옥시기, 아릴티옥시기, 아릴술폭시기, N-아릴알킬아민기, N-아릴헤테로아릴아민기 및 아릴포스핀기 중의 아릴기는 전술한 아릴기의 예시와 같다. 구체적으로 아릴옥시기로는 페녹시기, p-토릴옥시기, m-토릴옥시기, 3,5-디메틸-페녹시기, 2,4,6-트리메틸페녹시기, p-tert-부틸페녹시기, 3-바이페닐옥시기, 4-바이페닐옥시기, 1-나프틸옥시기, 2-나프틸옥시기, 4-메틸-1-나프틸옥시기, 5-메틸-2-나프틸옥시기, 1-안트릴옥시기, 2-안트릴옥시기, 9-안트릴옥시기, 1-페난트릴옥시기, 3-페난트릴옥시기, 9-페난트릴옥시기 등이 있고, 아릴티옥시기로는 페닐티옥시기, 2-메틸페닐티옥시기, 4-tert-부틸페닐티옥시기 등이 있으며, 아릴술폭시기로는 벤젠술폭시기, p-톨루엔술폭시기 등이 있으나, 이에 한정되는 것은 아니다.

[77] 본 명세서에 있어서, 아릴아민기의 예로는 치환 또는 비치환된 모노아릴아민기, 또는 치환 또는 비치환된 디아릴아민기가 있다. 상기 아릴아민기 중의 아릴기는 단환식 아릴기일 수 있고, 다환식 아릴기일 수 있다.

상기 아릴기가 2 이상을 포함하는 아릴아민기는 단환식 아릴기, 다환식 아릴기, 또는 단환식 아릴기와 다환식 아릴기를 동시에 포함할 수 있다. 예컨대, 상기 아릴아민기 중의 아릴기는 전술한 아릴기의 예시 중에서 선택될 수 있다.

[78] 본 명세서에 있어서, 헤테로아릴기는 탄소가 아닌 원자, 이종원자를 1 이상 포함하는 것으로서, 구체적으로 상기 이종 원자는 O, N, Se 및 S 등으로 이루어진 군에서 선택되는 원자를 1 이상 포함할 수 있다. 탄소수는 특별히 한정되지 않으나, 탄소수 2 내지 30인 것이 바람직하며, 상기 헤테로아릴기는 단환식 또는 다환식일 수 있다. 헤테로고리기의 예로는 티오펜기, 퓨라닐기, 피롤기, 이미다졸릴기, 티아졸릴기, 옥사졸릴기, 옥사디아졸릴기, 피리딜기, 바이피리딜기, 피리미딜기, 트리아지닐기, 트리아졸릴기, 아크리딜기, 피리다지닐기, 피라지닐기, 퀴놀릴기, 퀴나졸릴기, 퀴녹살릴기, 프탈라지닐기, 피리도 피리미딜기, 피리도 피라지닐기, 피라지노 피라지닐기, 이소퀴놀릴기, 인돌릴기, 카바졸릴기, 벤즈옥사졸릴기, 벤즈이미다졸릴기, 벤조티아졸릴기, 벤조카바졸릴기, 벤조티오펜기, 디벤조티오펜기, 벤조퓨라닐기, 페난쓰롤리닐기(phenanthroline), 이소옥사졸릴기, 티아디아졸릴기, 페노티아지닐기 및 디벤조퓨라닐기 등이 있으나, 이에 한정되는 것은 아니다.

[79] 본 명세서에 있어서, 헤테로아릴아민기의 예로는 치환 또는 비치환된 모노헤테로아릴아민기, 또는 치환 또는 비치환된 디헤테로아릴아민기가 있다. 상기 헤테로아릴기가 2 이상을 포함하는 헤테로아릴아민기는 단환식 헤테로아릴기, 다환식 헤테로아릴기, 또는 단환식 헤테로아릴기와 다환식 헤테로아릴기를 동시에 포함할 수 있다. 예컨대, 상기 헤테로아릴아민기 중의 헤테로아릴기는 전술한 헤테로아릴기의 예시 중에서 선택될 수 있다.

[80] 본 명세서에 있어서, N-아릴헤테로아릴아민기 및 N-알킬헤테로아릴아민기 중의 헤테로아릴기의 예시는 전술한 헤테로아릴기의 예시와 같다.

[81] 본 명세서에 있어서, 아릴렌기는 아릴기에 결합 위치가 두 개 있는 것 즉 2가기를 의미한다. 이들은 각각 2가기인 것을 제외하고는 전술한 아릴기의 설명이 적용될 수 있다.

[82] 본 명세서에 있어서, 헤테로아릴렌기는 헤테로아릴기에 결합 위치가 두 개 있는 것 즉 2가기를 의미한다. 이들은 각각 2가기인 것을 제외하고는 전술한 헤테로아릴기의 설명이 적용될 수 있다.

[83] 본 명세서에 있어서, 인접한 기가 서로 결합하여 형성되는 치환 또는 비치환된 고리에서, "고리"는 치환 또는 비치환된 탄화수소고리; 또는 치환 또는 비치환된 헤테로고리를 의미한다.

[84] 본 명세서에 있어서, 탄화수소고리는 방향족, 지방족 또는 방향족과 지방족의 축합고리일 수 있으며, 상기 1가가 아닌 것을 제외하고 상기 시클로알킬기 또는 아릴기의 예시 중에서 선택될 수 있다.

[85] 본 명세서에 있어서, 방향족고리는 단환 또는 다환일 수 있으며, 1가가 아닌 것을 제외하고 상기 아릴기의 예시 중에서 선택될 수 있다.

[86] 본 명세서에 있어서, 헤테로고리는 탄소가 아닌 원자, 이종원자를 1 이상 포함하는 것으로서, 구체적으로 상기 이종 원자는 O, N, Se 및 S 등으로 이루어진 군에서 선택되는 원자를 1 이상 포함할 수 있다. 상기 헤테로고리는 단환 또는 다환일 수 있으며, 방향족, 지방족 또는 방향족과 지방족의 축합고리일 수 있으며, 1가가 아닌 것을 제외하고 상기 헤테로아릴기 또는 헤테로고리기의 예시 중에서 선택될 수 있다.

[87] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1에 있어서, 인접한 R5는 서로 결합하여 치환 또는 비치환된 고리를 형성한다.

[88] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1에 있어서, 인접한 R5는 서로 결합하여 치환 또는 비치환된 방향족 고리를 형성한다.

[89] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1에 있어서, 인접한 R5는 서로 결합하여 치환 또는 비치환된 벤젠 고리를 형성한다.

[90] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1에 있어서, 인접한 R5는 서로 결합하여 벤젠 고리를 형성한다.

[91] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1에 있어서, 인접한 R6은 서로 결합하여 치환 또는 비치환된 고리를 형성한다.

[92] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1에 있어서, 인접한 R6은 서로 결합하여 치환 또는 비치환된 방향족 고리를 형성한다.

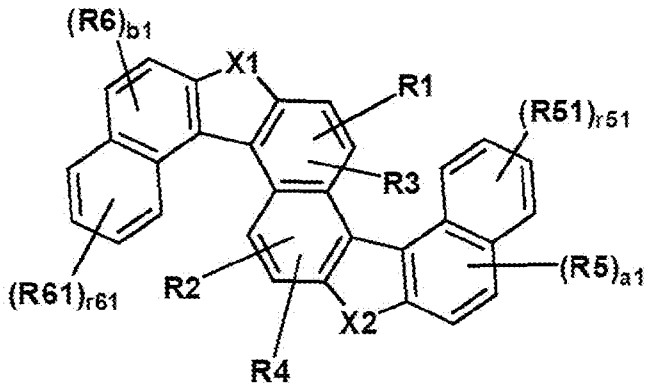
[93] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1에 있어서, 인접한 R6은 서로 결합하여 치환 또는 비치환된 벤젠 고리를 형성한다.

[94] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1에 있어서, 인접한 R6은 서로 결합하여 벤젠 고리를 형성한다.

[95] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1은 하기 화학식 1-1 내지 1-3 중 어느 하나로 표시된다.

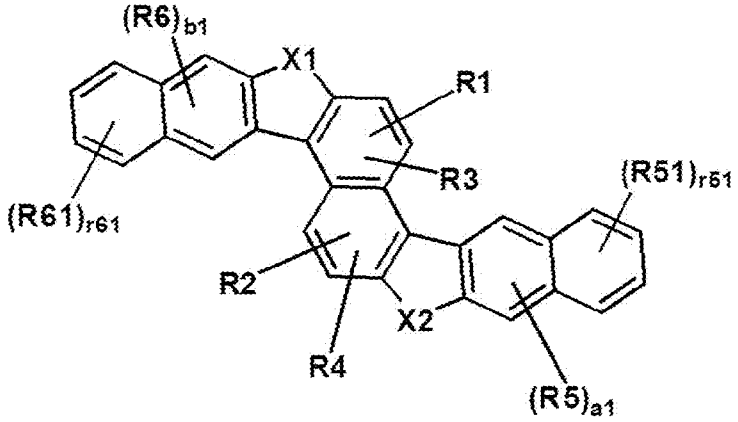
[96] [화학식 1-1]

[97]



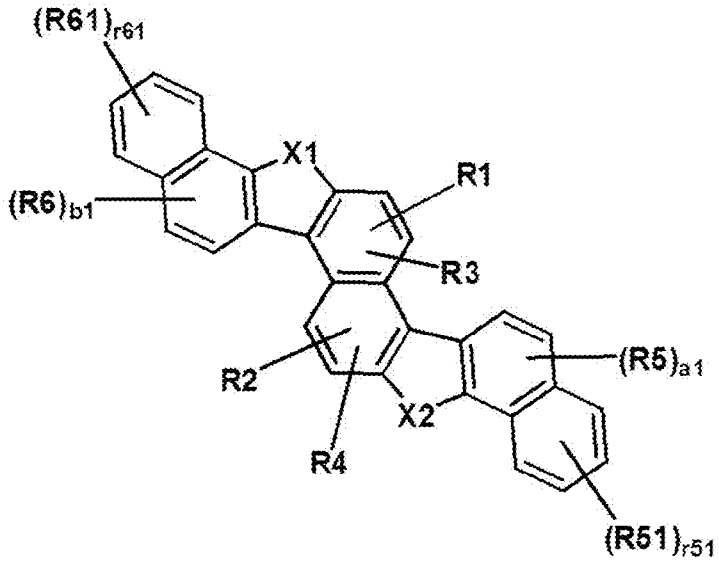
[98] [화학식 1-2]

[99]



[100] [화학식 1-3]

[101]



[102] 상기 화학식 1-1 내지 1-3에 있어서,

[103] X1, X2 및 R1 내지 R4의 정의는 전술한 바와 동일하고,

[104] R5, R6, R51 및 R61은 서로 같거나 상이하고, 각각 독립적으로 수소; 중수소; 치환 또는 비치환된 알킬기; 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이며,

[105] a1 및 b1은 각각 1 또는 2이고,

[106] r51 및 r61은 각각 1 내지 4의 정수이며,

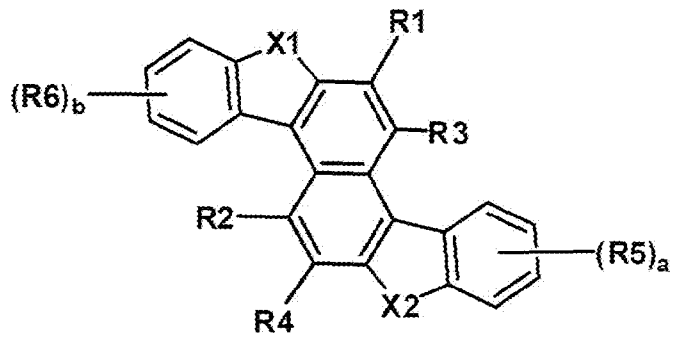
[107] 상기 a1 및 b1가 각각 2 인 경우, 상기 괄호 내의 구조는 서로 같거나 상이하고,

[108] 상기 r51 및 r61이 각각 2 이상인 경우, 2 이상의 괄호 내의 구조는 서로 같거나 상이하다.

[109] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1은 하기 화학식 1-4 내지 1-7 중 어느 하나로 표시된다.

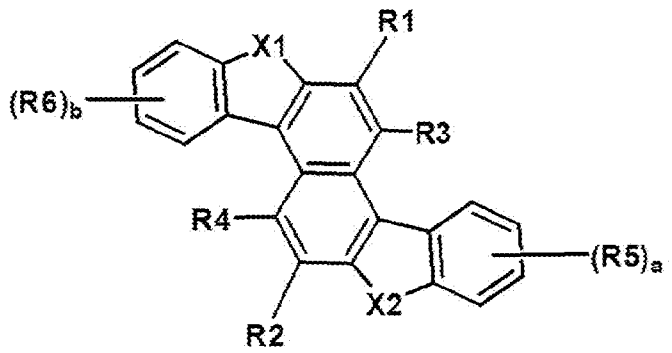
[110] [화학식 1-4]

[111]



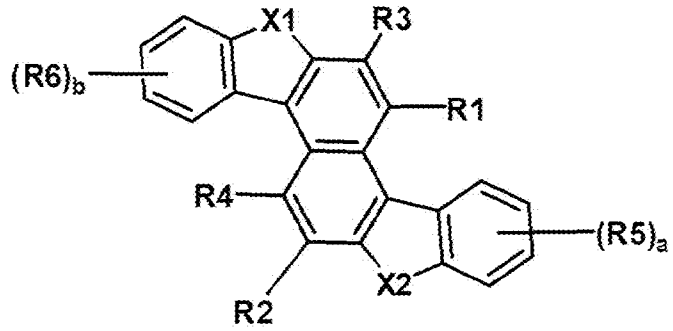
[112] [화학식 1-5]

[113]



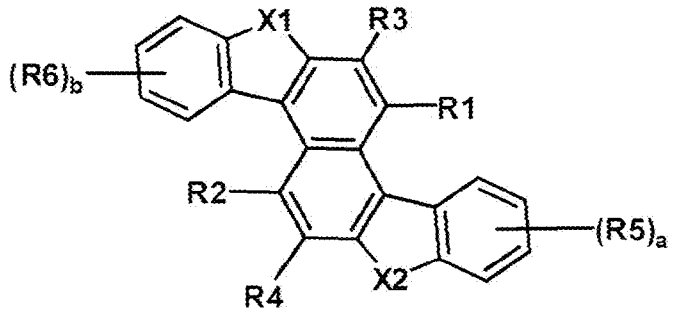
[114] [화학식 1-6]

[115]



[116] [화학식 1-7]

[117]



[118] 상기 화학식 1-4 내지 1-7에 있어서,

[119] X1, X2, R5, R6, a 및 b의 정의는 상기 화학식 1에서 정의한 바와 동일하고,

[120] R1 및 R2는 서로 같거나 상이하고, 각각 독립적으로 상기 화학식 A로 표시되는

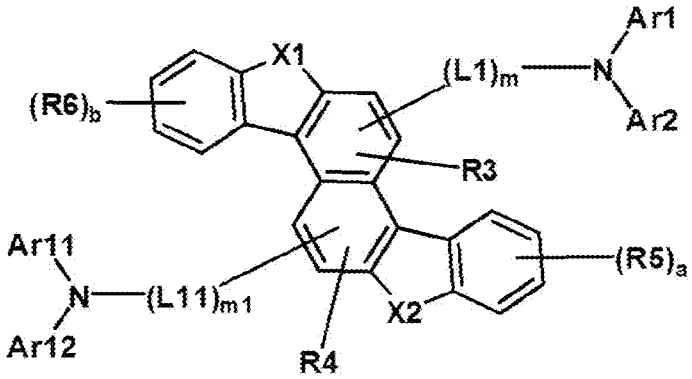
기이고,

[121] R3 및 R4는 서로 같거나 상이하고, 각각 독립적으로 수소; 치환 또는 비치환된 알킬기; 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이다.

[122] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1은 하기 화학식 1-8로 표시된다.

[123] [화학식 1-8]

[124]



[125] 상기 화학식 1-8에 있어서, X1, X2, R5 및 R6, a, b, L1, m, Ar1 및 Ar2의 정의는 전술한 바와 같고,

[126] R3 및 R4는 서로 같거나 상이하고, 각각 독립적으로 수소; 중수소; 치환 또는 비치환된 알킬기; 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이고,

[127] L11은 직접결합; 치환 또는 비치환된 아릴렌기; 또는 치환 또는 비치환된 헤테로아릴렌기이며,

[128] Ar11 및 Ar12는 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이거나, 서로 결합하여 치환 또는 비치환된 고리를 형성할 수 있고,

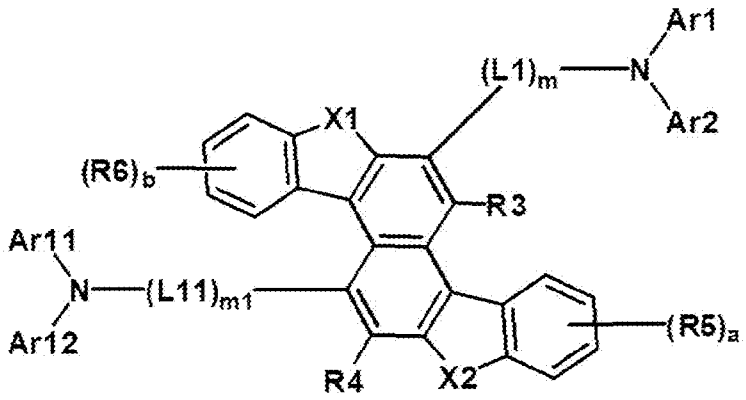
[129] m1은 1 내지 5의 정수이며,

[130] 상기 m1이 2이상인 경우, 2 이상의 L11은 서로 같거나 상이하다.

[131] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1은 하기 화학식 1-9 내지 1-12 중 어느 하나로 표시된다.

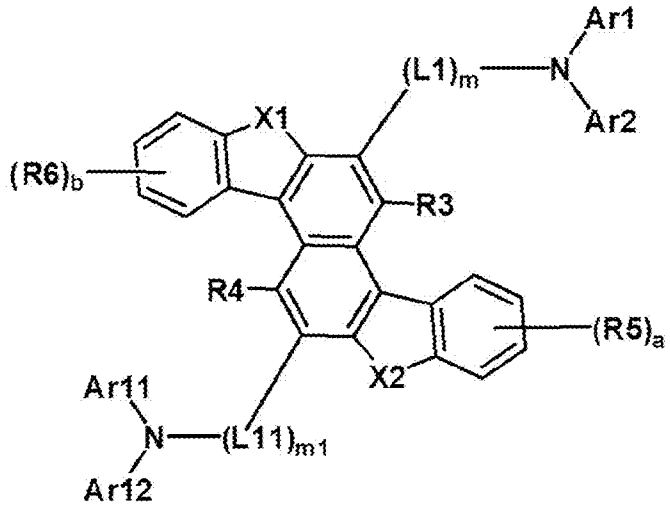
[132] [화학식 1-9]

[133]



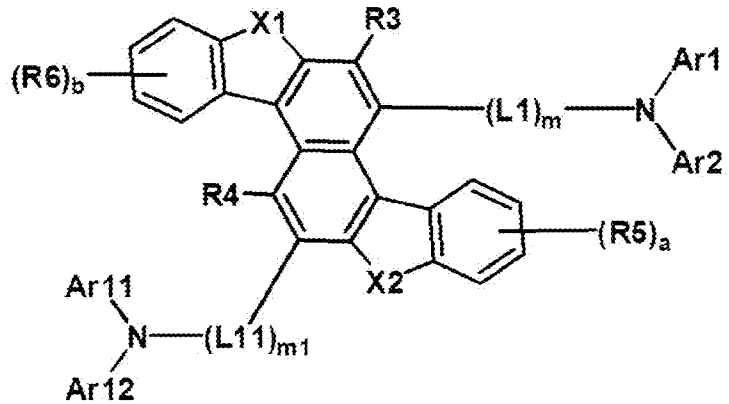
[134] [화학식 1-10]

[135]



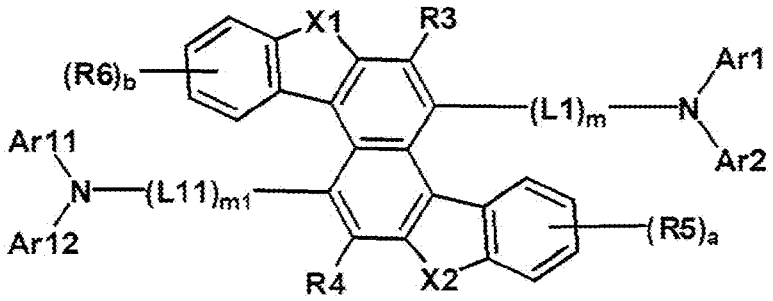
[136] [화학식 1-11]

[137]



[138] [화학식 1-12]

[139]



[140] 상기 화학식 1-9 내지 1-12에 있어서,

[141] X1, X2, R5, R6, a, b, L1, m, Ar1 및 Ar2의 정의는 전술한 바와 동일하며,

[142] R3 및 R4는 서로 같거나 상이하고, 각각 독립적으로 수소; 중수소; 치환 또는 비치환된 알킬기; 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이고,

[143] L11은 직접결합; 치환 또는 비치환된 아릴렌기; 또는 치환 또는 비치환된 헤테로아릴렌기이며,

[144] Ar11 및 Ar12는 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이거나, 서로 결합하여 치환 또는 비치환된 고리를 형성할 수 있고,

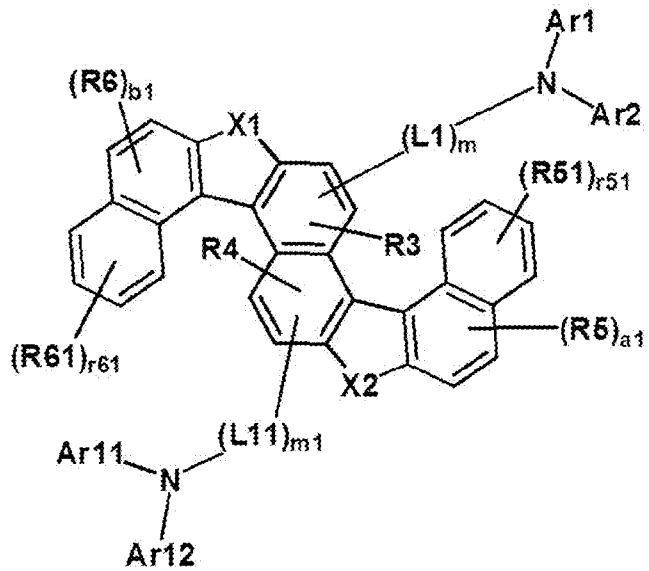
[145] m1은 1 내지 5의 정수이며,

[146] 상기 m1이 2이상인 경우, 2 이상의 L11은 서로 같거나 상이하다.

[147] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1은 하기 화학식 1-13 내지 1-15 중 어느 하나로 표시된다.

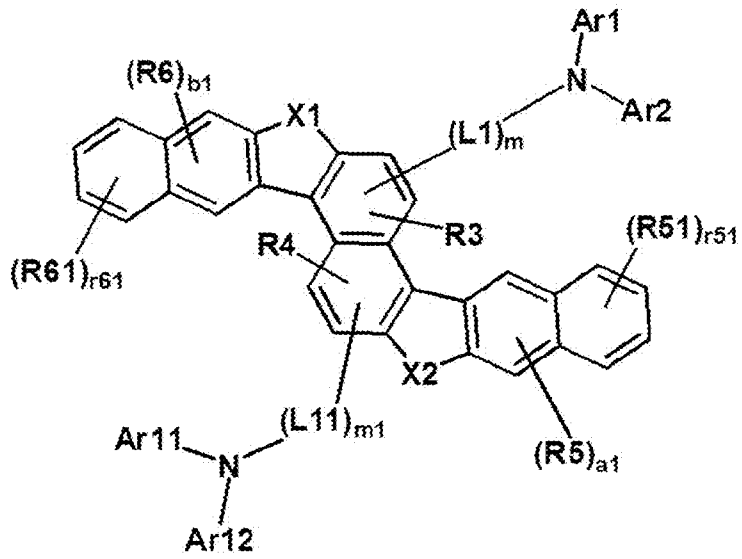
[148] [화학식 1-13]

[149]



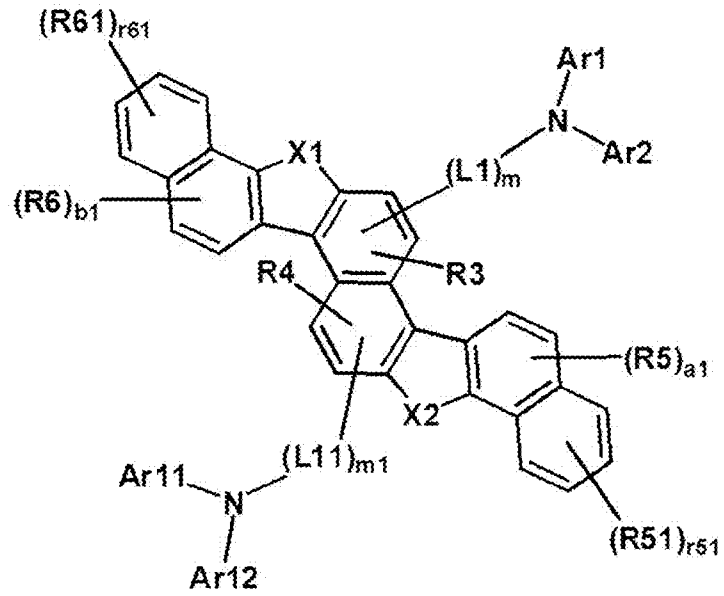
[150] [화학식 1-14]

[151]



[152] [화학식 1-15]

[153]



[154] 상기 화학식 1-13 내지 1-15에 있어서,

[155] X1, X2, R3, R4, L1, m, Ar1 및 Ar2의 정의는 전술한 바와 동일하고,

[156] R5, R6, R51 및 R61은 서로 같거나 상이하고, 각각 독립적으로 수소; 중수소; 치환 또는 비치환된 알킬기; 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이며,

[157] a1 및 b1은 각각 1 또는 2이고,

[158] r51 및 r61은 각각 1 내지 4의 정수이며,

[159] 상기 a1 및 b1가 각각 2 인 경우, 상기 괄호 내의 구조는 서로 같거나 상이하고,

[160] 상기 r51 및 r61이 각각 2 이상인 경우, 2 이상의 괄호 내의 구조는 서로 같거나 상이하며,

[161] L11은 직접결합; 치환 또는 비치환된 아릴렌기; 또는 치환 또는 비치환된

헤테로아릴렌기이며,

[162] Ar11 및 Ar12는 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이거나, 서로 결합하여 치환 또는 비치환된 고리를 형성할 수 있고,

[163] m1은 1 내지 5의 정수이며,

[164] 상기 m1이 2이상인 경우, 2 이상의 L11은 서로 같거나 상이하다.

[165] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1에 있어서, X1은 O이다.

[166] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1에 있어서, X1은 S이다.

[167] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1에 있어서, X1은 -C(R7R8)-이다.

[168] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1에 있어서, X1은 -N(R9)-이다.

[169] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1에 있어서, X2는 O이다.

[170] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1에 있어서, X2는 S이다.

[171] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1에 있어서, X2는 -C(R7R8)-이다.

[172] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1에 있어서, X2는 -N(R9)-이다.

[173] 본 명세서의 일 실시상태에 따르면, 상기 R7 내지 R9는 서로 같거나 상이하고, 각각 독립적으로 알킬기; 또는 아릴기이다.

[174] 본 명세서의 일 실시상태에 따르면, 상기 R7 내지 R9는 서로 같거나 상이하고, 각각 독립적으로 메틸기; 또는 페닐기이다.

[175] 본 명세서의 일 실시상태에 따르면, 상기 R3 내지 R6은 서로 같거나 상이하고, 각각 독립적으로 수소; 알킬기; 또는 아릴기이다.

[176] 본 명세서의 일 실시상태에 따르면, 상기 R3 내지 R6은 서로 같거나 상이하고, 각각 독립적으로 수소; 메틸기; 이소프로필기; t-부틸기; 페닐기; 바이페닐기; 또는 나프틸기이다.

[177] 본 명세서의 일 실시상태에 따르면, 상기 R3은 수소; 알킬기; 또는 아릴기이다.

[178] 본 명세서의 일 실시상태에 따르면, 상기 R3은 수소; 메틸기; 이소프로필기; t-부틸기; 페닐기; 바이페닐기; 또는 나프틸기이다.

[179] 본 명세서의 일 실시상태에 따르면, 상기 R3은 수소; 알킬기; 또는 아릴기이다.

[180] 본 명세서의 일 실시상태에 따르면, 상기 R3은 수소; 메틸기; 이소프로필기; t-부틸기; 페닐기; 바이페닐기; 또는 나프틸기이다.

[181] 본 명세서의 일 실시상태에 따르면, 상기 R4는 수소; 알킬기; 또는 아릴기이다.

[182] 본 명세서의 일 실시상태에 따르면, 상기 R4는 수소; 메틸기; 이소프로필기; t-부틸기; 페닐기; 바이페닐기; 또는 나프틸기이다.

[183] 본 명세서의 일 실시상태에 따르면, 상기 a는 1이다.

[184] 본 명세서의 일 실시상태에 따르면, 상기 a는 2이다.

[185] 본 명세서의 일 실시상태에 따르면, 상기 a는 3이다.

[186] 본 명세서의 일 실시상태에 따르면, 상기 a는 4이다.

[187] 본 명세서의 일 실시상태에 따르면, 상기 b는 1이다.

[188] 본 명세서의 일 실시상태에 따르면, 상기 b는 2이다.

[189] 본 명세서의 일 실시상태에 따르면, 상기 b는 3이다.

[190] 본 명세서의 일 실시상태에 따르면, 상기 b는 4이다.

[191] 본 명세서의 일 실시상태에 따르면, 상기 a는 1이고, 상기 R5는 수소; 알킬기; 또는 아릴기이다.

[192] 본 명세서의 일 실시상태에 따르면, 상기 a는 1이고, 상기 R5는 수소; 메틸기; 이소프로필기; t-부틸기; 페닐기; 바이페닐기; 또는 나프틸기이다.

[193] 본 명세서의 일 실시상태에 따르면, 상기 a는 2이고, 상기 2의 R5는 수소; 알킬기; 또는 아릴기이다.

[194] 본 명세서의 일 실시상태에 따르면, 상기 a는 2이고, 상기 2의 R5는 수소; 메틸기; 이소프로필기; t-부틸기; 페닐기; 바이페닐기; 또는 나프틸기이다.

[195] 본 명세서의 일 실시상태에 따르면, 상기 a는 3이고, 상기 3의 R5는 수소; 알킬기; 또는 아릴기이다.

[196] 본 명세서의 일 실시상태에 따르면, 상기 a는 3이고, 상기 3의 R5는 수소; 메틸기; 이소프로필기; t-부틸기; 페닐기; 바이페닐기; 또는 나프틸기이다.

[197] 본 명세서의 일 실시상태에 따르면, 상기 a는 4이고, 상기 4의 R5는 수소; 알킬기; 또는 아릴기이다.

[198] 본 명세서의 일 실시상태에 따르면, 상기 a는 4이고, 상기 4의 R5는 수소; 메틸기; 이소프로필기; t-부틸기; 페닐기; 바이페닐기; 또는 나프틸기이다.

[199] 본 명세서의 일 실시상태에 따르면, 상기 b는 1이고, 상기 R6은 수소; 알킬기; 또는 아릴기이다.

[200] 본 명세서의 일 실시상태에 따르면, 상기 b는 1이고, 상기 R6은 수소; 메틸기; 이소프로필기; t-부틸기; 페닐기; 바이페닐기; 또는 나프틸기이다.

[201] 본 명세서의 일 실시상태에 따르면, 상기 b는 2이고, 상기 2의 R6은 수소; 알킬기; 또는 아릴기이다.

[202] 본 명세서의 일 실시상태에 따르면, 상기 b는 2이고, 상기 2의 R6은 수소; 메틸기; 이소프로필기; t-부틸기; 페닐기; 바이페닐기; 또는 나프틸기이다.

[203] 본 명세서의 일 실시상태에 따르면, 상기 b는 3이고, 상기 3의 R6은 수소; 알킬기; 또는 아릴기이다.

[204] 본 명세서의 일 실시상태에 따르면, 상기 b는 3이고, 상기 3의 R6은 수소; 메틸기; 이소프로필기; t-부틸기; 페닐기; 바이페닐기; 또는 나프틸기이다.

[205] 본 명세서의 일 실시상태에 따르면, 상기 b는 4이고, 상기 4의 R6은 수소; 알킬기; 또는 아릴기이다.

[206] 본 명세서의 일 실시상태에 따르면, 상기 b는 4이고, 상기 4의 R6은 수소; 메틸기; 이소프로필기; t-부틸기; 페닐기; 바이페닐기; 또는 나프틸기이다.

[207] 본 명세서의 일 실시상태에 따르면, 상기 L1은 직접결합; 또는 아릴렌기이다.

[208] 본 명세서의 일 실시상태에 따르면, 상기 L1은 직접결합; 또는 페닐렌기이다.

[209] 본 명세서의 일 실시상태에 따르면, 상기 m은 1이다.

[210] 본 명세서의 일 실시상태에 따르면, 상기 L11은 직접결합; 또는 아릴렌기이다.

[211] 본 명세서의 일 실시상태에 따르면, 상기 L11은 직접결합; 또는 페닐렌기이다.

[212] 본 명세서의 일 실시상태에 따르면, 상기 m1은 1이다.

[213] 본 명세서의 일 실시상태에 따르면, 상기 Ar1 및 Ar2는 서로 같거나 상이하고, 각각 독립적으로 할로겐기, 알킬기, 또는 아릴기로 치환 또는 비치환된 아릴기; 또는 알킬기, 또는 아릴기로 치환 또는 비치환된 헤테로아릴기이다.

[214] 본 명세서의 일 실시상태에 따르면, 상기 Ar1 및 Ar2는 서로 같거나 상이하고, 각각 독립적으로 할로겐기, 또는 알킬기로 치환 또는 비치환된 페닐기; 알킬기로 치환 또는 비치환된 바이페닐기; 나프틸기; 알킬기로 치환 또는 비치환된 플루오레닐기; 피리딜기; 아릴기로 치환 또는 비치환된 티오펜기; 알킬기로 치환 또는 비치환된 디벤조퓨란기; 또는 알킬기, 또는 아릴기로 치환 또는 비치환된 카바졸릴기이다.

[215] 본 명세서의 일 실시상태에 따르면, 상기 Ar1 및 Ar2는 서로 같거나 상이하고, 각각 독립적으로 F, 메틸기, 또는 t-부틸기로 치환 또는 비치환된 페닐기; 메틸기로 치환 또는 비치환된 바이페닐기; 나프틸기; 메틸기로 치환 또는 비치환된 플루오레닐기; 피리딜기; 페닐기로 치환 또는 비치환된 티오펜기; i-프로필기로 치환 또는 비치환된 디벤조퓨란기; 또는 에틸기, 또는 페닐기로 치환 또는 비치환된 카바졸릴기이다.

[216] 본 명세서의 일 실시상태에 따르면, 상기 Ar1 및 Ar2는 서로 결합하여 치환 또는 비치환된 헤테로고리를 형성한다.

[217] 본 명세서의 일 실시상태에 따르면, 상기 Ar1 및 Ar2는 서로 결합하여 헤테로고리를 형성한다.

[218] 본 명세서의 일 실시상태에 따르면, 상기 Ar1 및 Ar2는 서로 결합하여 카바졸 고리를 형성한다.

[219] 본 명세서의 일 실시상태에 따르면, 상기 Ar11 및 Ar12는 서로 같거나 상이하고, 각각 독립적으로 할로겐기, 알킬기, 또는 아릴기로 치환 또는 비치환된 아릴기; 또는 알킬기, 또는 아릴기로 치환 또는 비치환된 헤테로아릴기이다.

[220] 본 명세서의 일 실시상태에 따르면, 상기 Ar11 및 Ar12는 서로 같거나 상이하고, 각각 독립적으로 할로겐기, 또는 알킬기로 치환 또는 비치환된 페닐기; 알킬기로 치환 또는 비치환된 바이페닐기; 나프틸기; 알킬기로 치환 또는 비치환된 플루오레닐기; 피리딜기; 아릴기로 치환 또는 비치환된 티오펜기; 알킬기로 치환 또는 비치환된 디벤조퓨란기; 또는 알킬기, 또는 아릴기로 치환 또는 비치환된 카바졸릴기이다.

[221] 본 명세서의 일 실시상태에 따르면, 상기 Ar11 및 Ar12는 서로 같거나 상이하고, 각각 독립적으로 F, 메틸기, 또는 t-부틸기로 치환 또는 비치환된 페닐기; 메틸기로 치환 또는 비치환된 바이페닐기; 나프틸기; 메틸기로 치환

또는 비치환된 플루오레닐기; 피리딜기; 페닐기로 치환 또는 비치환된 티오펜기; i-프로필기로 치환 또는 비치환된 디벤조퓨란기; 또는 에틸기, 또는 페닐기로 치환 또는 비치환된 카바졸릴기이다.

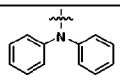
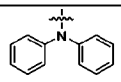
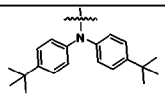
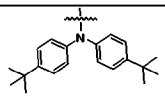
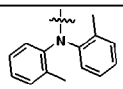
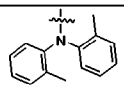
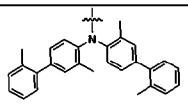
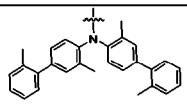
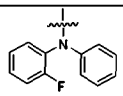
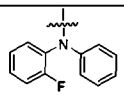
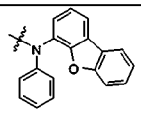
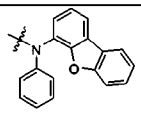
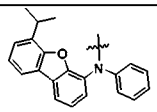
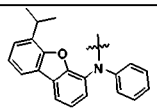
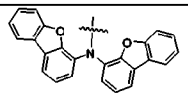
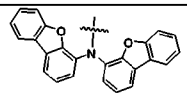
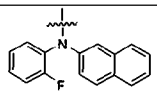
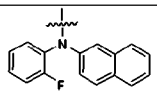
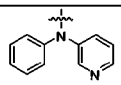
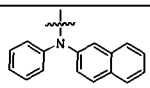
[222] 본 명세서의 일 실시상태에 따르면, 상기 Ar11 및 Ar12는 서로 결합하여 치환 또는 비치환된 헤테로고리를 형성한다.

[223] 본 명세서의 일 실시상태에 따르면, 상기 Ar11 및 Ar12는 서로 결합하여 헤테로고리를 형성한다.

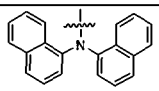
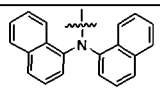
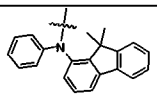
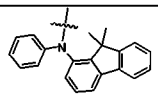
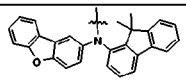
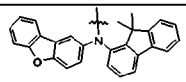
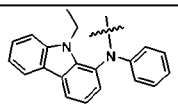
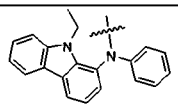
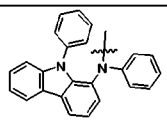
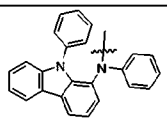
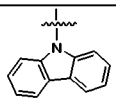
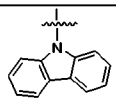
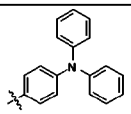
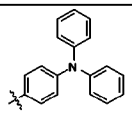
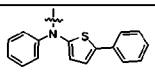
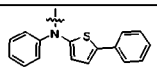
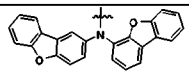
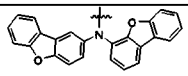
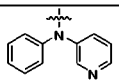
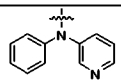
[224] 본 명세서의 일 실시상태에 따르면, 상기 Ar11 및 Ar12는 서로 결합하여 카바졸 고리를 형성한다.

[225] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1은 하기 화합물 중에서 선택된다.

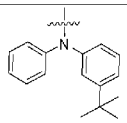
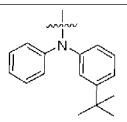
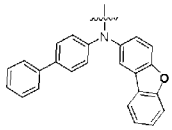
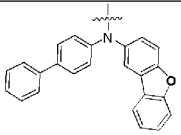
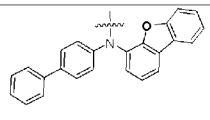
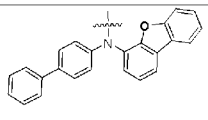
[226]

화합물	X1	X2	R1	R2	R3 내지 R6
1-1	O	O			H
1-2	O	O			H
1-3	O	O			H
1-4	O	O			H
1-5	O	O			H
1-6	O	O			H
1-7	O	O			H
1-8	O	O			H
1-9	O	O			H
1-10	O	O			H

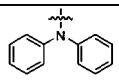
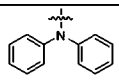
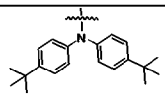
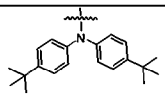
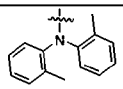
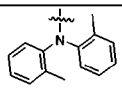
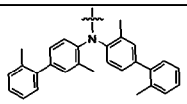
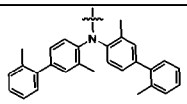
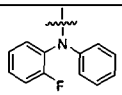
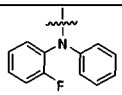
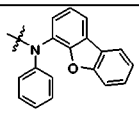
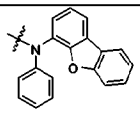
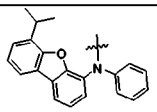
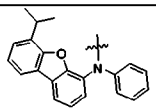
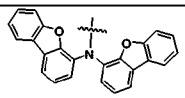
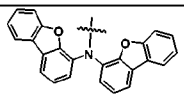
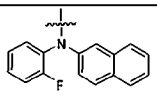
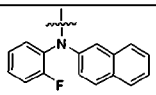
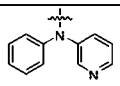
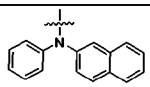
[227]

1-11	O	O			H
1-12	O	O			H
1-13	O	O			H
1-14	O	O			H
1-15	O	O			H
1-16	O	O			H
1-17	O	O			H
1-18	O	O			H
1-19	O	O			H
1-20	O	O			H

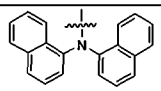
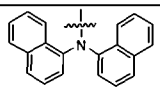
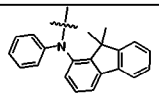
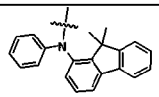
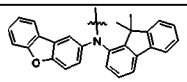
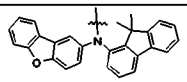
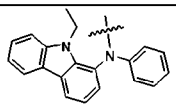
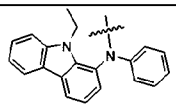
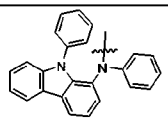
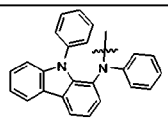
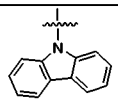
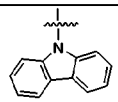
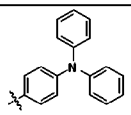
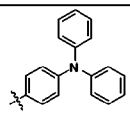
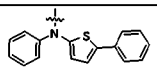
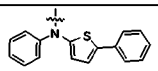
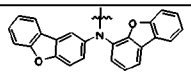
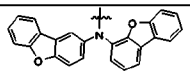
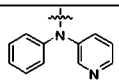
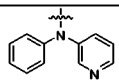
[228]

1-21	O	O			H
1-22	O	O			H
1-23	O	O			H

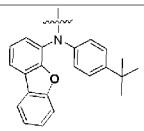
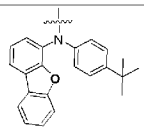
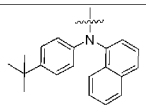
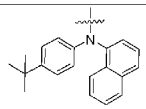
[229]

화합물	X1	X2	R1	R2	R3 내지 R6
2-1	S	S			H
2-2	S	S			H
2-3	S	S			H
2-4	S	S			H
2-5	S	S			H
2-6	S	S			H
2-7	S	S			H
2-8	S	S			H
2-9	S	S			H
2-10	S	S			H

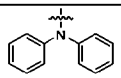
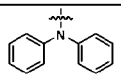
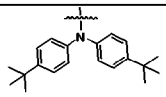
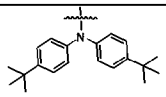
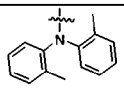
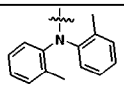
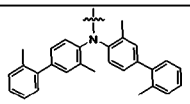
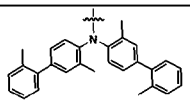
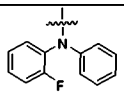
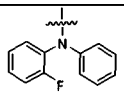
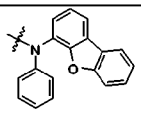
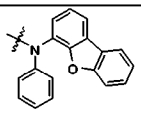
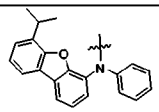
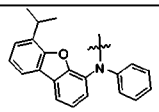
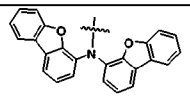
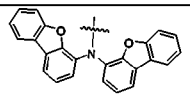
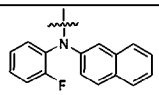
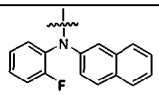
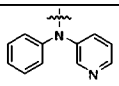
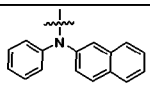
[230]

2-11	S	S			H
2-12	S	S			H
2-13	S	S			H
2-14	S	S			H
2-15	S	S			H
2-16	S	S			H
2-17	S	S			H
2-18	S	S			H
2-19	S	S			H
2-20	S	S			H

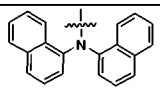
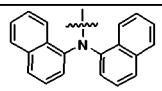
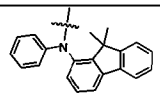
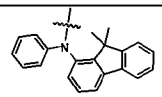
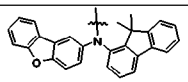
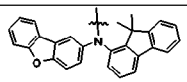
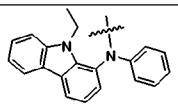
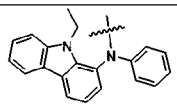
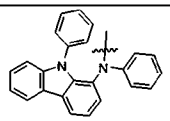
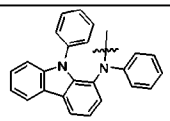
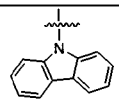
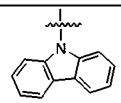
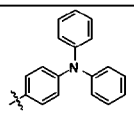
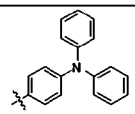
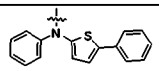
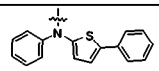
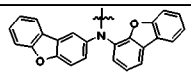
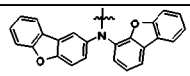
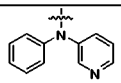
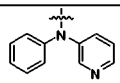
[231]

2-21	S	S			H
2-22	S	S			H

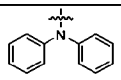
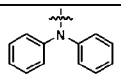
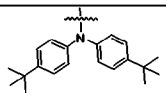
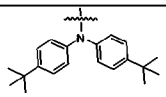
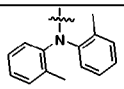
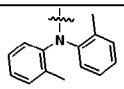
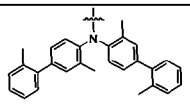
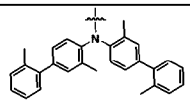
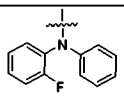
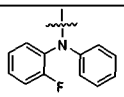
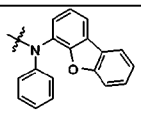
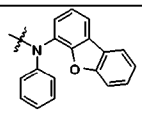
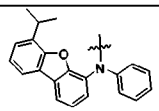
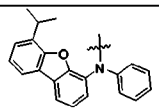
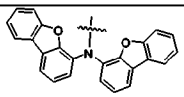
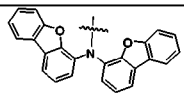
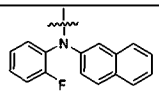
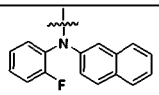
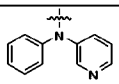
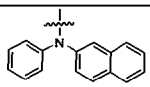
[232]

화합물	X1	X2	R1	R2	R3 내지 R6
3-1	N	N			H
3-2	N	N			H
3-3	N	N			H
3-4	N	N			H
3-5	N	N			H
3-6	N	N			H
3-7	N	N			H
3-8	N	N			H
3-9	N	N			H
3-10	N	N			H

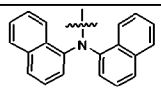
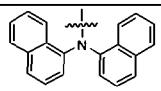
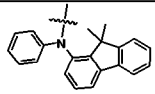
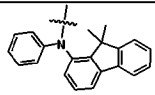
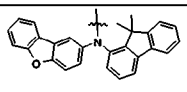
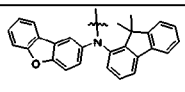
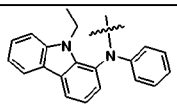
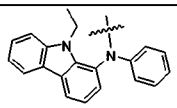
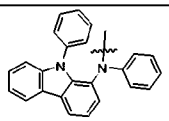
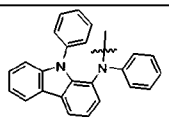
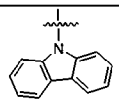
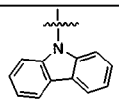
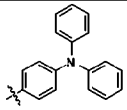
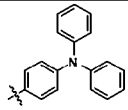
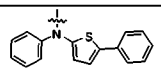
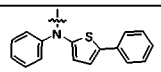
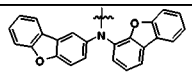
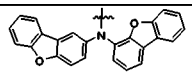
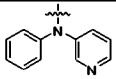
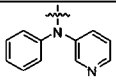
[233]

3-11					H
3-12					H
3-13					H
3-14					H
3-15					H
3-16					H
3-17					H
3-18					H
3-19					H
3-20					H

[234]

화합물	X1	X2	R1	R2	R3 내지 R6
4-1					H
4-2					H
4-3					H
4-4					H
4-5					H
4-6					H
4-7					H
4-8					H
4-9					H
4-10					H

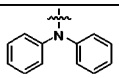
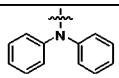
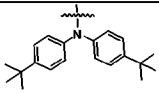
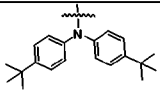
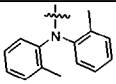
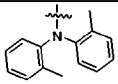
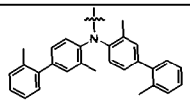
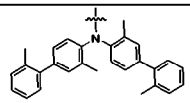
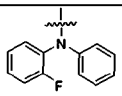
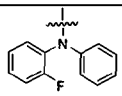
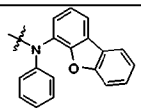
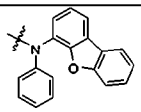
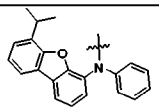
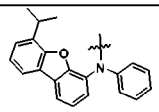
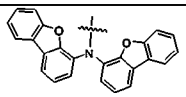
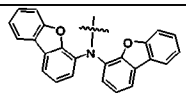
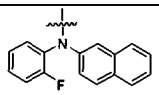
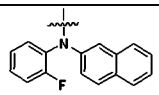
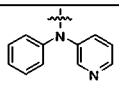
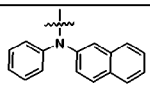
[235]

4-11					H
4-12					H
4-13					H
4-14					H
4-15					H
4-16					H
4-17					H
4-18					H
4-19					H
4-20					H

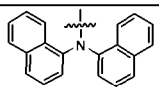
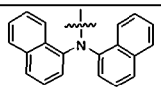
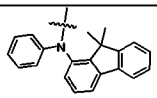
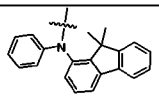
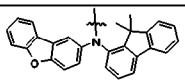
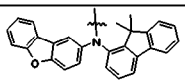
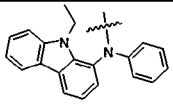
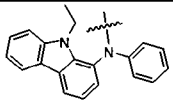
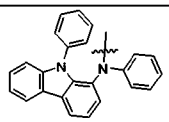
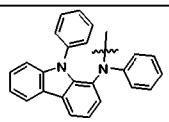
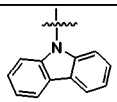
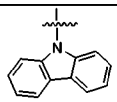
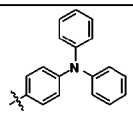
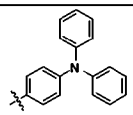
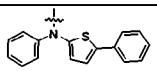
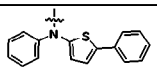
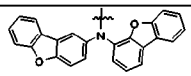
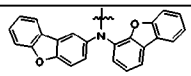
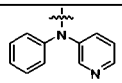
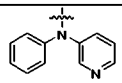
[236]

4-21					H

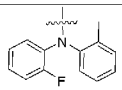
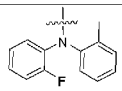
[237]

화합물	X1	X2	R1	R2	R3 내지 R6
5-1	C	C			H
5-2	C	C			H
5-3	C	C			H
5-4	C	C			H
5-5	C	C			H
5-6	C	C			H
5-7	C	C			H
5-8	C	C			H
5-9	C	C			H
5-10	C	C			H

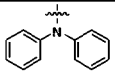
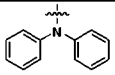
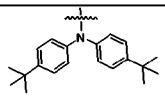
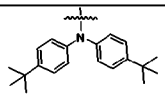
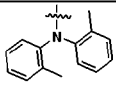
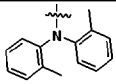
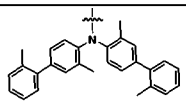
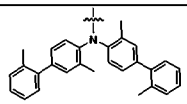
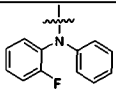
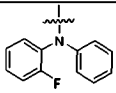
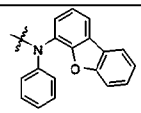
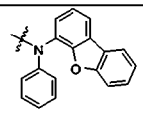
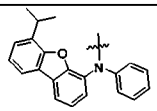
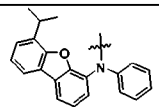
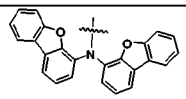
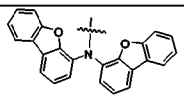
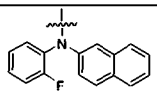
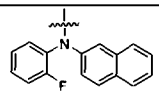
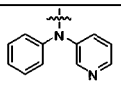
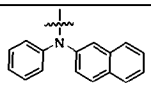
[238]

5-11	C	C			H
5-12	C	C			H
5-13	C	C			H
5-14	C	C			H
5-15	C	C			H
5-16	C	C			H
5-17	C	C			H
5-18	C	C			H
5-19	C	C			H
5-20	C	C			H

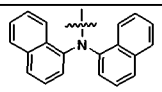
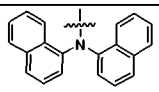
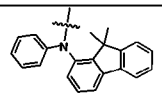
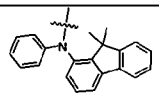
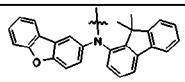
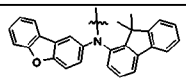
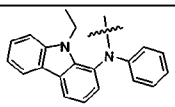
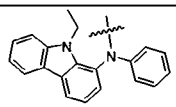
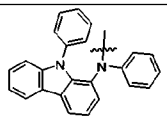
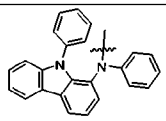
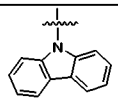
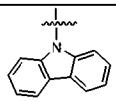
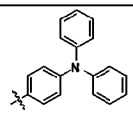
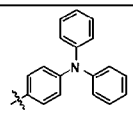
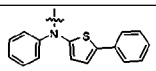
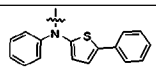
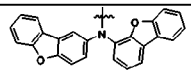
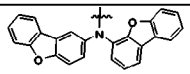
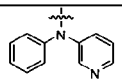
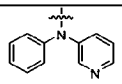
[239]

5-21	C	C			H

[240]

화합물	X1	X2	R1	R2	R3 내지 R6
6-1					H
6-2					H
6-3					H
6-4					H
6-5					H
6-6					H
6-7					H
6-8					H
6-9					H
6-10					H

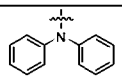
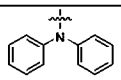
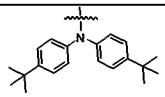
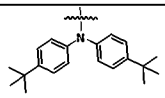
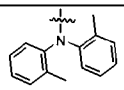
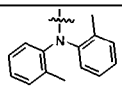
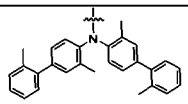
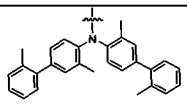
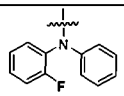
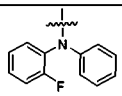
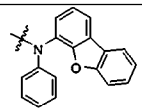
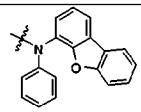
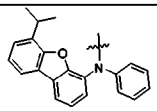
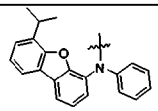
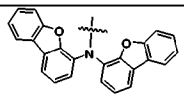
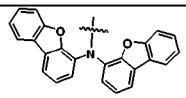
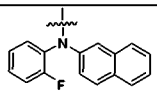
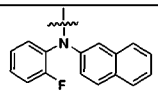
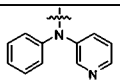
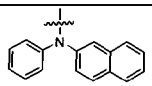
[241]

6-11					H
6-12					H
6-13					H
6-14					H
6-15					H
6-16					H
6-17					H
6-18					H
6-19					H
6-20					H

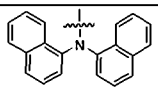
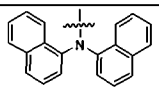
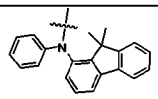
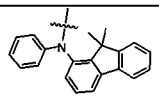
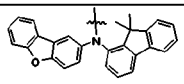
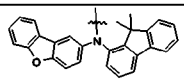
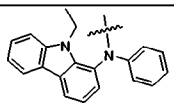
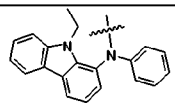
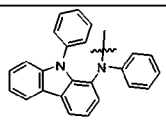
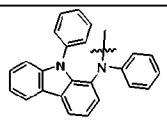
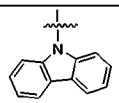
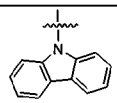
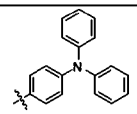
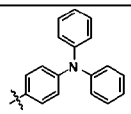
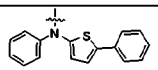
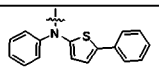
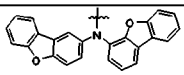
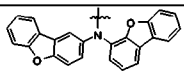
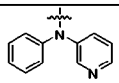
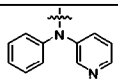
[242]

6-21					H

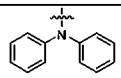
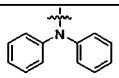
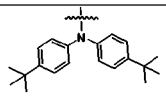
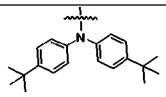
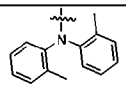
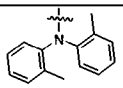
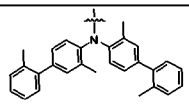
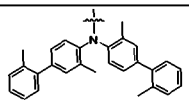
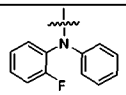
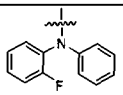
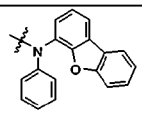
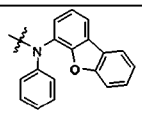
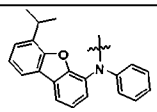
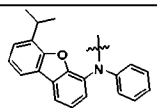
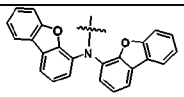
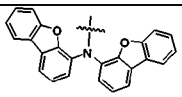
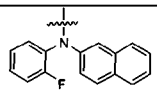
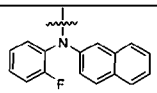
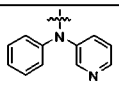
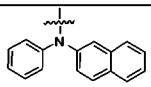
[243]

화합물	X1	X2	R1	R2	R3 내지 R6
7-1	O	S			H
7-2	O	N			H
7-3	O				H
7-4	O	C			H
7-5	O				H
7-6	S	N			H
7-7	S				H
7-8	S	C			H
7-9	S				H
7-10	N				H

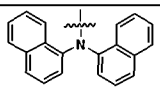
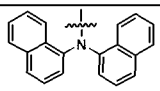
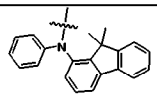
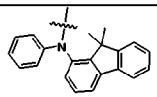
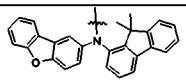
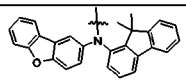
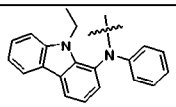
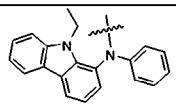
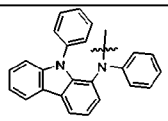
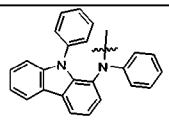
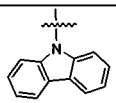
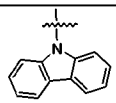
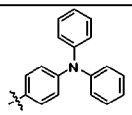
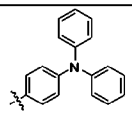
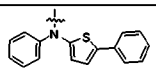
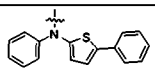
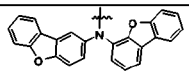
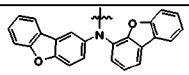
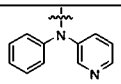
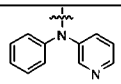
[244]

7-11					H
7-12					H
7-13					H
7-14					H
7-15					H
7-16	O	S			H
7-17	O				H
7-18	O				H
7-19	O				H
7-20	O				H

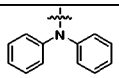
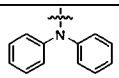
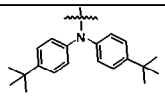
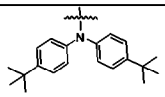
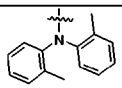
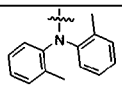
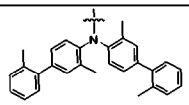
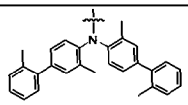
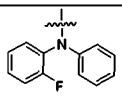
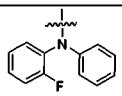
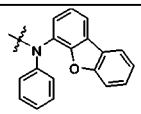
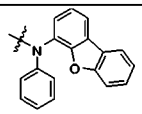
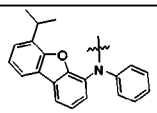
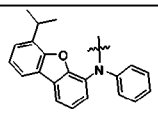
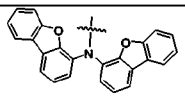
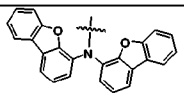
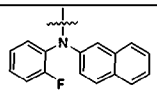
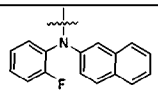
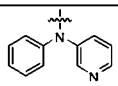
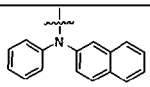
[245]

화합물	X1	X2	R1	R2	R3 내지 R6
8-1	O	O			
8-2	O	O			
8-3	O	O			
8-4	O	O			
8-5	O	O			
8-6	O	O			
8-7	O	O			
8-8	O	O			
8-9	O	O			
8-10	O	O			

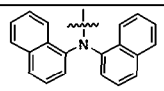
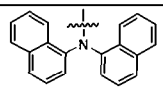
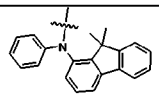
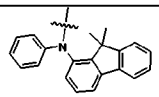
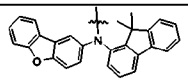
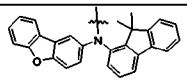
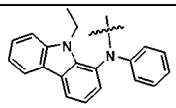
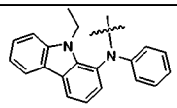
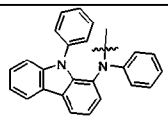
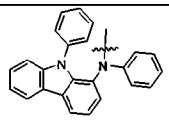
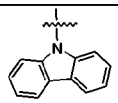
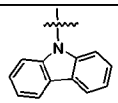
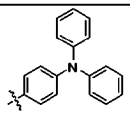
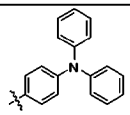
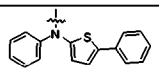
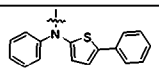
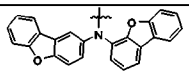
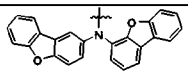
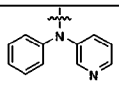
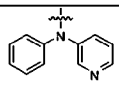
[246]

8-11	O	O			
8-12	O	O			
8-13	O	O			
8-14	O	O			
8-15	O	O			
8-16	O	O			
8-17	O	O			
8-18	O	O			
8-19	O	O			
8-20	O	O			

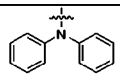
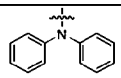
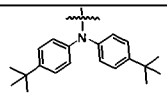
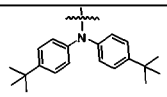
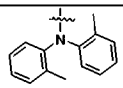
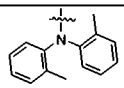
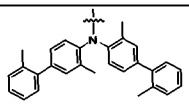
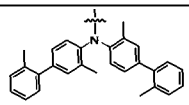
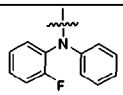
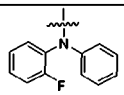
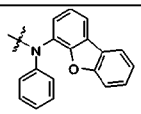
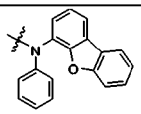
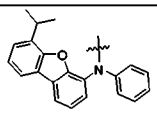
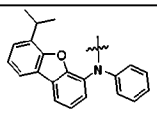
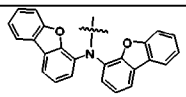
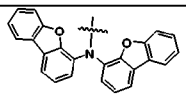
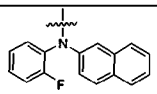
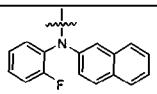
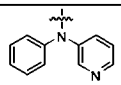
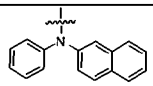
[247]

화합물	X1	X2	R1	R2	R3 내지 R6
9-1	S	S			-CH_3
9-2	S	S			-CH_3
9-3	S	S			-CH_3
9-4	S	S			-CH_3
9-5	S	S			-CH_3
9-6	S	S			-CH_3
9-7	S	S			-CH_3
9-8	S	S			-CH_3
9-9	S	S			-CH_3
9-10	S	S			-CH_3

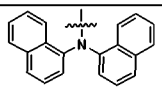
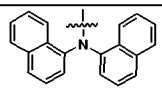
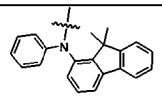
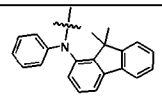
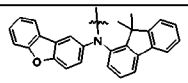
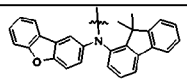
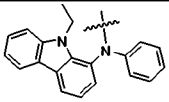
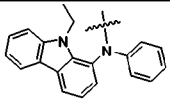
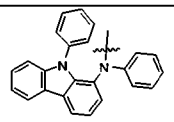
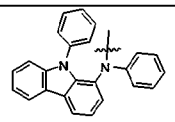
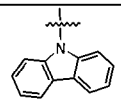
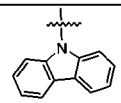
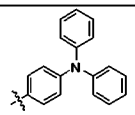
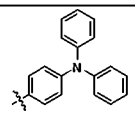
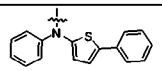
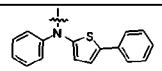
[248]

9-11	S	S			$-CH_3$
9-12	S	S			$-CH_3$
9-13	S	S			$-CH_3$
9-14	S	S			$-CH_3$
9-15	S	S			$-CH_3$
9-16	S	S			$-CH_3$
9-17	S	S			$-CH_3$
9-18	S	S			$-CH_3$
9-19	S	S			$-CH_3$
9-20	S	S			$-CH_3$

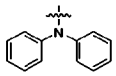
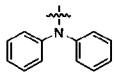
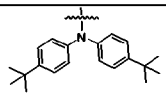
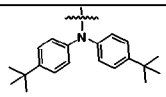
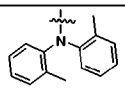
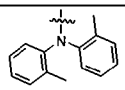
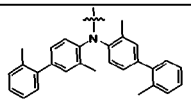
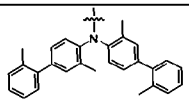
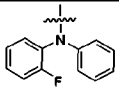
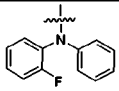
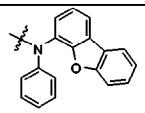
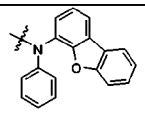
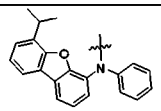
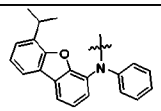
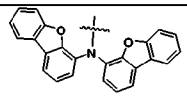
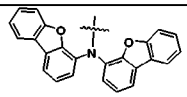
[249]

화합물	X1	X2	R1	R2	R3 내지 R6
10-1	N	N			
10-2	N	N			
10-3	N	N			
10-4	N	N			
10-5	N	N			
10-6	N	N			
10-7	N	N			
10-8	N	N			
10-9	N	N			
10-10	N	N			

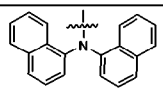
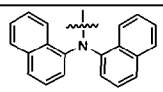
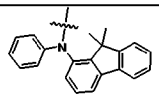
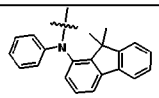
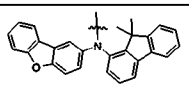
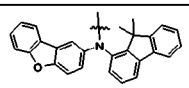
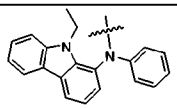
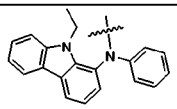
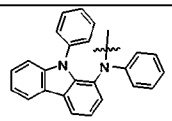
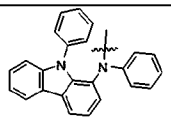
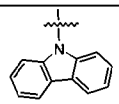
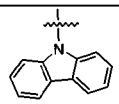
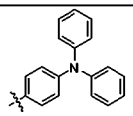
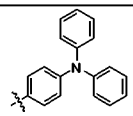
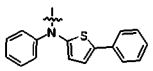
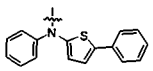
[250]

10-11					
10-12					
10-13					
10-14					
10-15					
10-16					
10-17					
10-18					
10-19					
10-20					

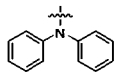
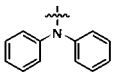
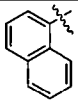
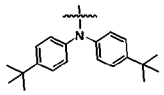
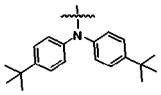
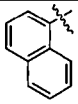
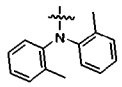
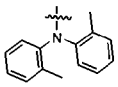
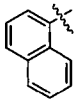
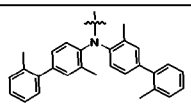
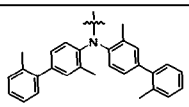
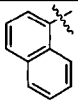
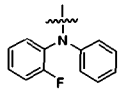
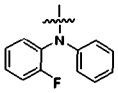
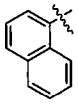
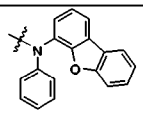
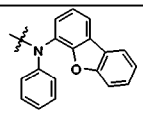
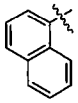
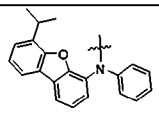
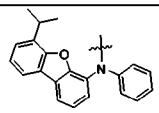
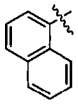
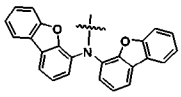
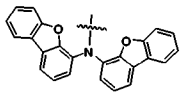
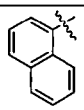
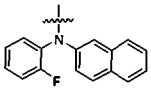
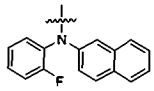
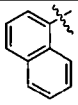
[251]

화합물	X1	X2	R1	R2	R3 내지 R6
11-1					
11-2					
11-3					
11-4					
11-5					
11-6					
11-7					
11-8					
11-9					
11-10					

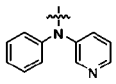
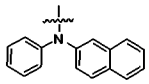
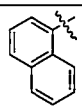
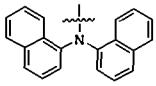
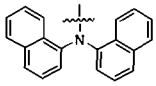
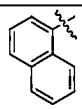
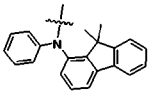
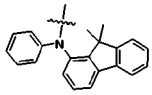
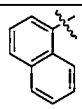
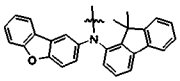
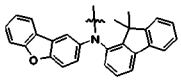
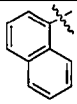
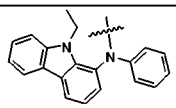
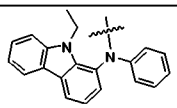
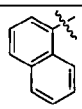
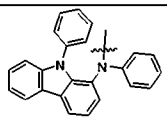
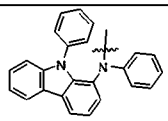
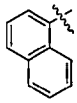
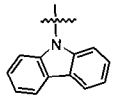
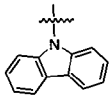
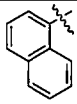
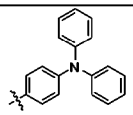
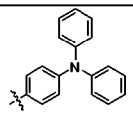
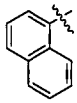
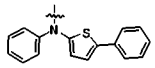
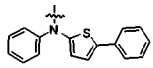
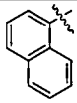
[252]

11-11					
11-12					
11-13					
11-14					
11-15					
11-16					
11-17					
11-18					
11-19					
11-20					

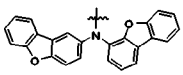
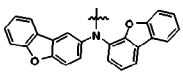
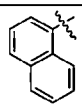
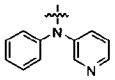
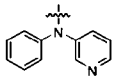
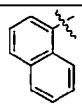
[253]

화합물	X1	X2	R1	R2	R3 내지 R6
12-1	C	C			
12-2	C	C			
12-3	C	C			
12-4	C	C			
12-5	C	C			
12-6	C	C			
12-7	C	C			
12-8	C	C			
12-9	C	C			

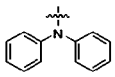
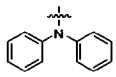
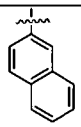
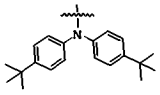
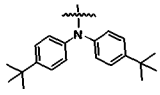
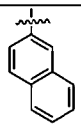
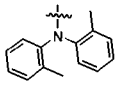
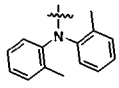
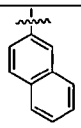
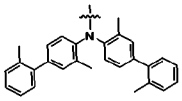
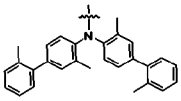
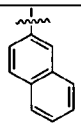
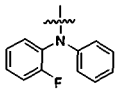
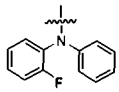
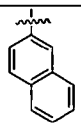
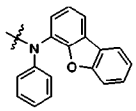
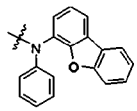
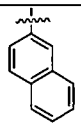
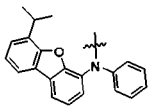
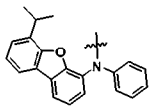
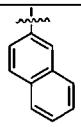
[254]

12-10	C	C			
12-11	C	C			
12-12	C	C			
12-13	C	C			
12-14	C	C			
12-15	C	C			
12-16	C	C			
12-17	C	C			
12-18	C	C			

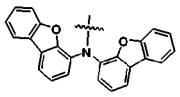
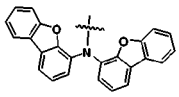
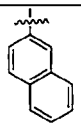
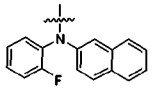
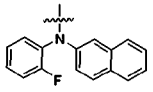
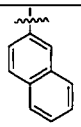
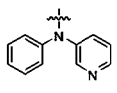
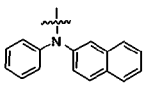
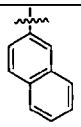
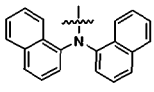
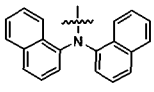
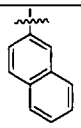
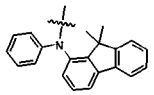
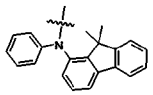
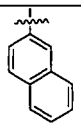
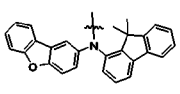
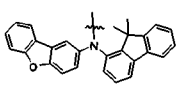
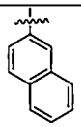
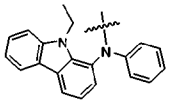
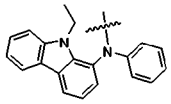
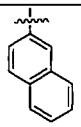
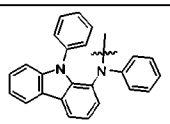
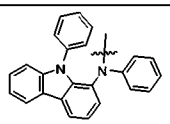
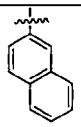
[255]

12-19	C	C			
12-20	C	C			

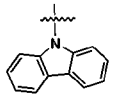
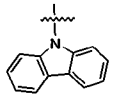
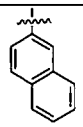
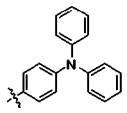
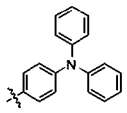
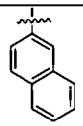
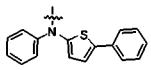
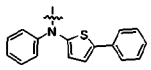
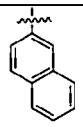
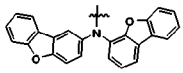
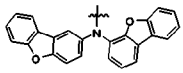
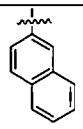
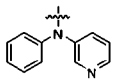
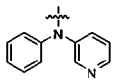
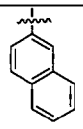
[256]

화합물	X1	X2	R1	R2	R3 내지 R6
13-1					
13-2					
13-3					
13-4					
13-5					
13-6					
13-7					

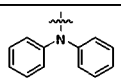
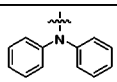
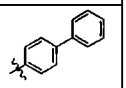
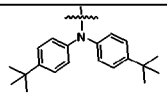
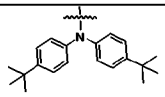
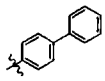
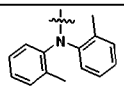
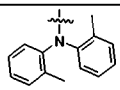
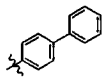
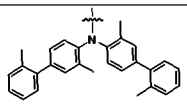
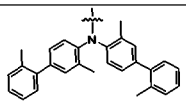
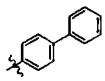
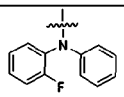
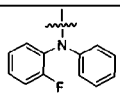
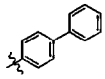
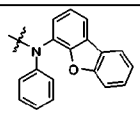
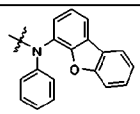
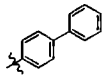
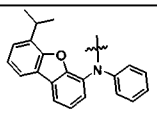
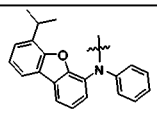
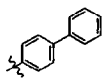
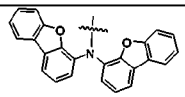
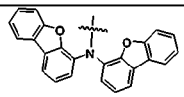
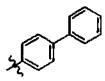
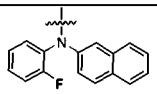
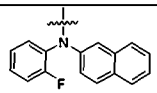
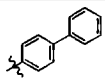
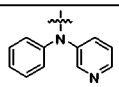
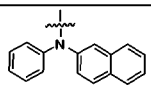
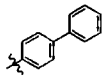
[257]

13-8					
13-9					
13-10					
13-11					
13-12					
13-13					
13-14					
13-15					

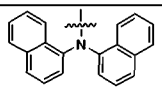
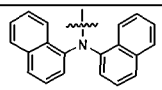
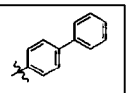
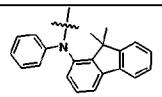
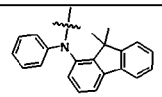
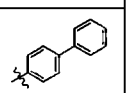
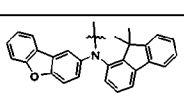
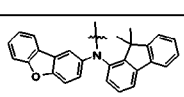
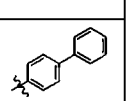
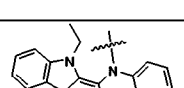
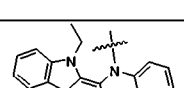
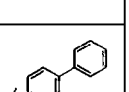
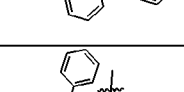
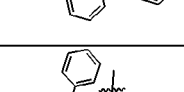
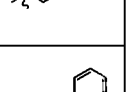
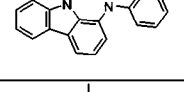
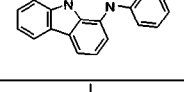
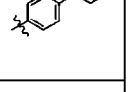
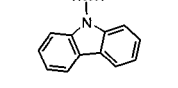
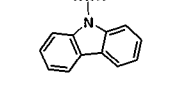
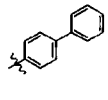
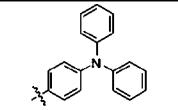
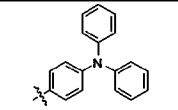
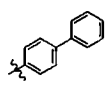
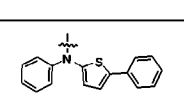
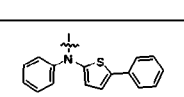
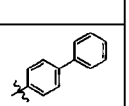
[258]

13-16					
13-17					
13-18					
13-19					
13-20					

[259]

화합물	X1	X2	R1	R2	R3 내지 R6
14-1	O	S			
14-2	O				
14-3	O				
14-4	O				
14-5	O				
14-6	S				
14-7	S				
14-8	S				
14-9	S				
14-10					

[260]

14-11					
14-12					
14-13					
14-14					
14-15					
14-16	O	S			
14-17	O				
14-18	O				
14-19	O				
14-20	O				

[261] 상기 화합물 1-1 내지 1-23, 2-1 내지 2-22, 3-1 내지 3-20, 4-1 내지 4-21, 5-1 내지 5-21, 6-1 내지 6-21, 7-1 내지 7-20, 8-1 내지 8-20, 9-1 내지 9-20, 10-1 내지 10-20, 11-1 내지 11-20, 12-1 내지 12-20, 13-1 내지 13-20 및 14-1 내지 14-20에 있어서, 상기 R5 및 R6이 상기 치환기인 경우, 상기 화학식 1의 a 및 b는 각각 1 내지 4의 정수이다.

[262] 상기 화합물 1-1 내지 1-23, 2-1 내지 2-22, 3-1 내지 3-20, 4-1 내지 4-21, 5-1 내지 5-21, 6-1 내지 6-21, 7-1 내지 7-20, 8-1 내지 8-20, 9-1 내지 9-20, 10-1 내지 10-20, 11-1 내지 11-20, 12-1 내지 12-20, 13-1 내지 13-20 및 14-1 내지 14-20에 있어서, 상기 R5 및 R6이 상기 치환기인 경우, 상기 화학식 1의 a 및 b는 각각 1이다.

[263] 상기 화합물 1-1 내지 1-23, 2-1 내지 2-22, 3-1 내지 3-20, 4-1 내지 4-21, 5-1 내지 5-21, 6-1 내지 6-21, 7-1 내지 7-20, 8-1 내지 8-20, 9-1 내지 9-20, 10-1 내지 10-20, 11-1 내지 11-20, 12-1 내지 12-20, 13-1 내지 13-20 및 14-1 내지 14-20에 있어서, 상기 R5 및 R6이 상기 치환기인 경우, 상기 화학식 1의 a 및 b는 각각 2이다.

[264] 상기 화합물 1-1 내지 1-23, 2-1 내지 2-22, 3-1 내지 3-20, 4-1 내지 4-21, 5-1 내지 5-21, 6-1 내지 6-21, 7-1 내지 7-20, 8-1 내지 8-20, 9-1 내지 9-20, 10-1 내지 10-20, 11-1 내지 11-20, 12-1 내지 12-20, 13-1 내지 13-20 및 14-1 내지 14-20에 있어서, 상기 R5 및 R6이 상기 치환기인 경우, 상기 화학식 1의 a 및 b는 각각 3이다.

[265] 상기 화합물 1-1 내지 1-23, 2-1 내지 2-22, 3-1 내지 3-20, 4-1 내지 4-21, 5-1 내지 5-21, 6-1 내지 6-21, 7-1 내지 7-20, 8-1 내지 8-20, 9-1 내지 9-20, 10-1 내지 10-20, 11-1 내지 11-20, 12-1 내지 12-20, 13-1 내지 13-20 및 14-1 내지 14-20에 있어서, 상기 R5 및 R6이 상기 치환기인 경우, 상기 화학식 1의 a 및 b는 각각 4이다.

[266] 본 명세서의 일 실시상태에 따르면, 제1 전극; 상기 제1 전극에 대향하여 구비된 제2 전극; 및 상기 제1 전극과 제2 전극 사이에 구비된 1층 이상의 유기물층을 포함하는 유기 발광 소자로서, 상기 유기물층 중 1 층 이상은 전술한 화합물을 포함하는 것인 유기 발광 소자를 제공한다.

[267] 본 명세서의 일 실시상태에 따르면, 본 명세서의 유기 발광 소자의 유기물층은 단층 구조로 이루어질 수도 있으나, 2층 이상의 유기물층이 적층된 다층 구조로 이루어질 수 있다. 예컨대, 본 발명의 유기 발광 소자는 유기물층으로서 정공주입층, 정공수송층, 전자차단층, 발광층, 정공차단층, 전자수송층, 전자주입층 등을 포함하는 구조를 가질 수 있다. 그러나 유기 발광 소자의 구조는 이에 한정되지 않고 더 적거나 많은 수의 유기층을 포함할 수 있다.

[268] 예컨대, 본 명세서의 유기 발광 소자의 구조는 도 1 및 도 2에 나타난 것과 같은 구조를 가질 수 있으나 이에만 한정되는 것은 아니다.

[269] 도 1에는 기판(20) 위에 제1 전극(30), 발광층(40) 및 제2 전극(50)이 순차적으로 적층된 유기 발광 소자(10)의 구조가 예시 되어 있다. 상기 도 1은 본 명세서의 일 실시상태에 따른 유기 발광 소자의 예시적인 구조이며, 다른 유기물층을 더 포함할 수 있다.

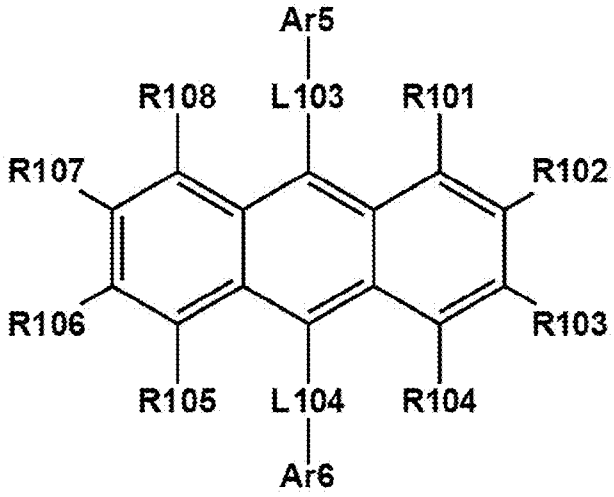
[270] 도 2에는 기판(20) 위에 제1 전극(30), 정공주입층(60), 정공수송층(70), 발광층(40), 전자수송층(80), 전자주입층(90) 및 제2 전극(50)이 순차적으로 적층된 유기 발광 소자의 구조가 예시되어 있다. 상기 도 2는 본 명세서의 실시상태에 따른 예시적인 구조이며, 다른 유기물층을 더 포함할 수 있다.

[271] 본 명세서의 일 실시상태에 따르면, 상기 유기물층은 발광층을 포함하고, 상기 발광층은 상기 화학식 1로 표시되는 화합물을 포함한다.

[272] 본 명세서의 일 실시상태에 따르면, 상기 유기물층은 발광층을 포함하고, 상기 발광층은 상기 화학식 1로 표시되는 화합물을 발광층의 도펀트로서 포함한다.

[273] 본 명세서의 일 실시상태에 따르면, 상기 유기물층은 발광층을 포함하고, 상기 발광층은 하기 화학식 1A로 표시되는 화합물을 포함한다.

[274] [화학식 1A]

[275] 

[276] 상기 화학식 1A에 있어서,

[277] L103 및 L104는 서로 같거나 상이하고, 각각 독립적으로 직접결합; 치환 또는 비치환된 아릴렌기; 또는 치환 또는 비치환된 헤테로아릴렌기이고,

[278] Ar5 및 Ar6은 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이며,

[279] R101 내지 R108은 서로 같거나 상이하고, 각각 독립적으로 수소; 중수소; 할로겐기; 니트릴기; 니트로기; 치환 또는 비치환된 알킬기; 치환 또는 비치환된 시클로알킬기; 치환 또는 비치환된 실릴기; 치환 또는 비치환된 포스핀옥사이드기; 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이다.

[280] 본 명세서의 일 실시상태에 따르면, 상기 L103 및 L104는 직접결합이다.

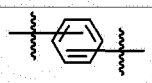
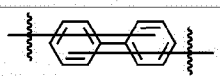
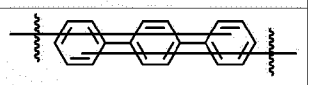
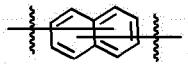
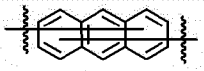
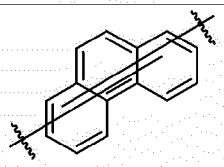
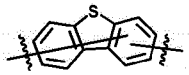
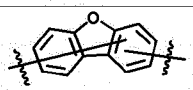
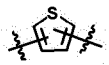
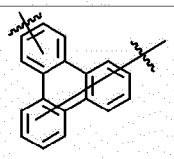
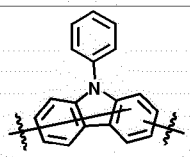
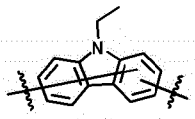
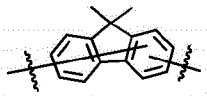
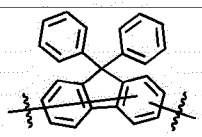
[281] 본 명세서의 일 실시상태에 따르면, 상기 L103 및 L104는 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 탄소수 6 내지 30의 아릴렌기이다.

[282] 본 명세서의 일 실시상태에 따르면, 상기 L103 및 L104는 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 페닐렌기; 치환 또는 비치환된 비페닐릴렌기; 또는 치환 또는 비치환된 나프틸렌기이다.

[283] 본 명세서의 일 실시상태에 따르면, 상기 L103 및 L104는 서로 같거나 상이하고, 각각 독립적으로 페닐렌기; 비페닐릴렌기; 또는 나프틸렌기이다.

[284] 본 명세서의 일 실시상태에 따르면, 상기 L103 및 L104는 서로 같거나 상이하고, 각각 독립적으로 하기 표 1의 치환기 중에서 선택된다.

[285] [표1]

치환기 A1	치환기 A2	치환기 A3
		
치환기 A4	치환기 A5	치환기 A6
		
치환기 A7	치환기 A8	치환기 A9
		
치환기 A10	치환기 A11	치환기 A12
		
치환기 A13	치환기 A14	치환기 A15
		

[286] 본 명세서의 일 실시상태에 따르면, 상기 Ar5 및 Ar6은 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 탄소수 6 내지 30의 아릴기이다.

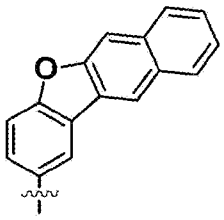
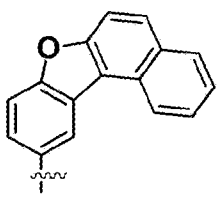
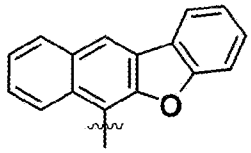
[287] 본 명세서의 일 실시상태에 따르면, 상기 Ar5 및 Ar6은 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 페닐기; 치환 또는 비치환된 비페닐기; 또는 치환 또는 비치환된 나프틸기이다.

[288] 본 명세서의 일 실시상태에 따르면, 상기 Ar5 및 Ar6은 서로 같거나 상이하고, 각각 독립적으로 페닐기; 비페닐기; 또는 나프틸기이다.

[289] 본 명세서의 일 실시상태에 따르면, 상기 Ar5 및 Ar6은 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 탄소수 6 내지 50의 헤테로아릴기이다.

[290] 본 명세서의 일 실시상태에 따르면, 상기 Ar5 및 Ar6은 서로 같거나 상이하고, 각각 독립적으로 축합고리가 형성된 디벤조티오펜기이다.

[291] 본 명세서의 일 실시상태에 따르면, 상기 Ar5 및 Ar6은 서로 같거나 상이하고, 각각 독립적으로

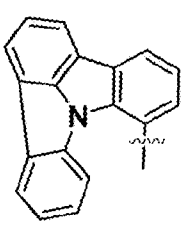
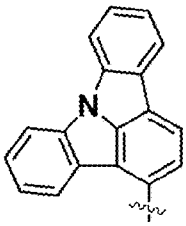
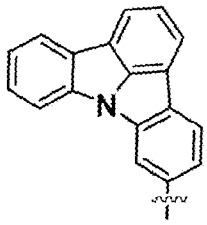
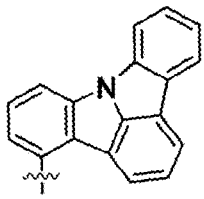
 ;  ; 또는 

이다.

[292] 본 명세서의 일 실시상태에 따르면, 상기 Ar5 및 Ar6은 서로 같거나 상이하고, 각각 독립적으로 축합고리가 형성된 카바졸릴기이다.

[293] 본 명세서의 일 실시상태에 따르면, 상기 Ar5 및 Ar6은 서로 같거나 상이하고, 각각 독립적으로

이다.

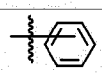
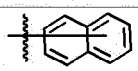
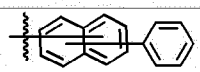
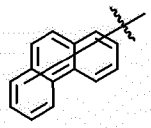
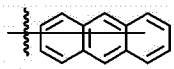
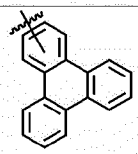
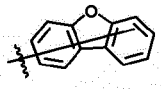
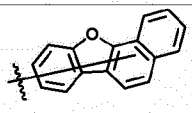
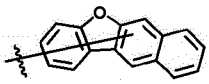
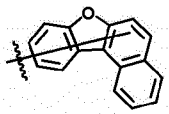
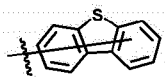
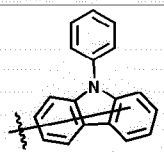
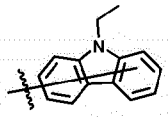
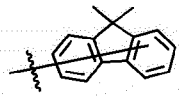
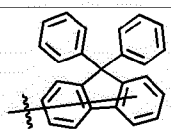
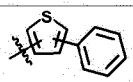
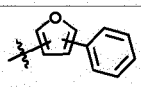
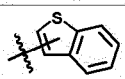
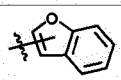

;

;

; 또는


[294] 본 명세서의 일 실시상태에 따르면, 상기 Ar5 및 Ar6은 서로 같거나 상이하고, 각각 독립적으로 아릴기로 치환 또는 비치환된 티오펜기이다.

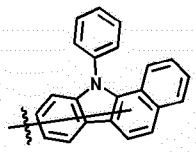
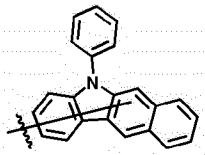
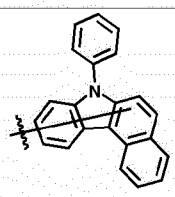
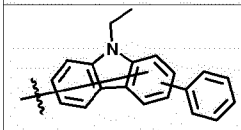
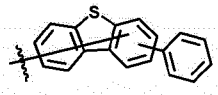
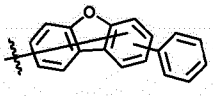
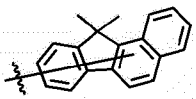
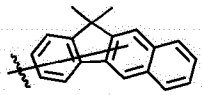
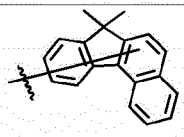
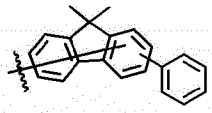
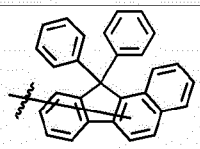
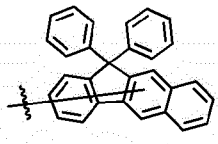
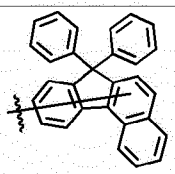
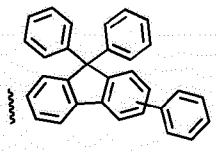
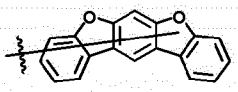
[295] 본 명세서의 일 실시상태에 따르면, 상기 Ar5 및 Ar6은 서로 같거나 상이하고, 각각 독립적으로 페닐기로 치환 또는 비치환된 티오펜기이다.

[296] 본 명세서의 일 실시상태에 따르면, 상기 Ar5 및 Ar6은 서로 같거나 상이하고, 각각 독립적으로 하기 표 2의 치환기 중에서 선택된다.

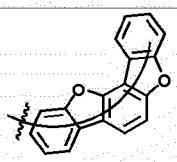
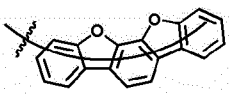
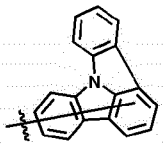
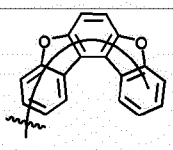
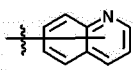
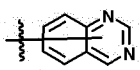
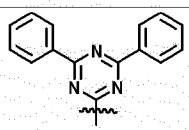
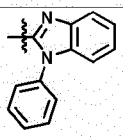
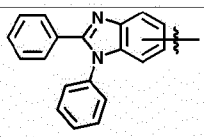
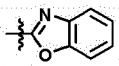
[297] [표2]

치환기 B1	치환기 B2	치환기 B3
		
치환기 B4	치환기 B5	치환기 B6
		
치환기 B7	치환기 B8	치환기 B9
		
치환기 B10	치환기 B11	치환기 B12
		
치환기 B13	치환기 B14	치환기 B15
		
치환기 B16	치환기 B17	치환기 B18
		
치환기 B19	치환기 B20	치환기 B21
		

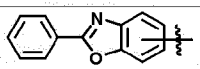
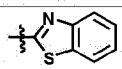
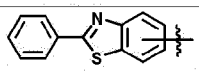
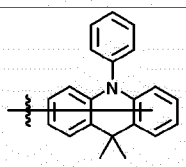
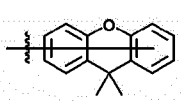
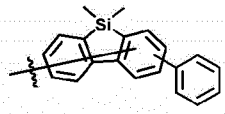
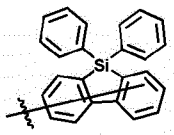
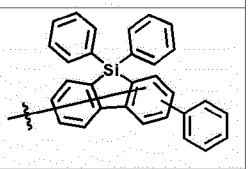
[298]

치환기 B22	치환기 B23	치환기 B24
		
치환기 B25	치환기 B26	치환기 B27
		
치환기 B28	치환기 B29	치환기 B30
		
치환기 B31	치환기 B32	치환기 B33
		
치환기 B34	치환기 B35	치환기 B36
		

[299]

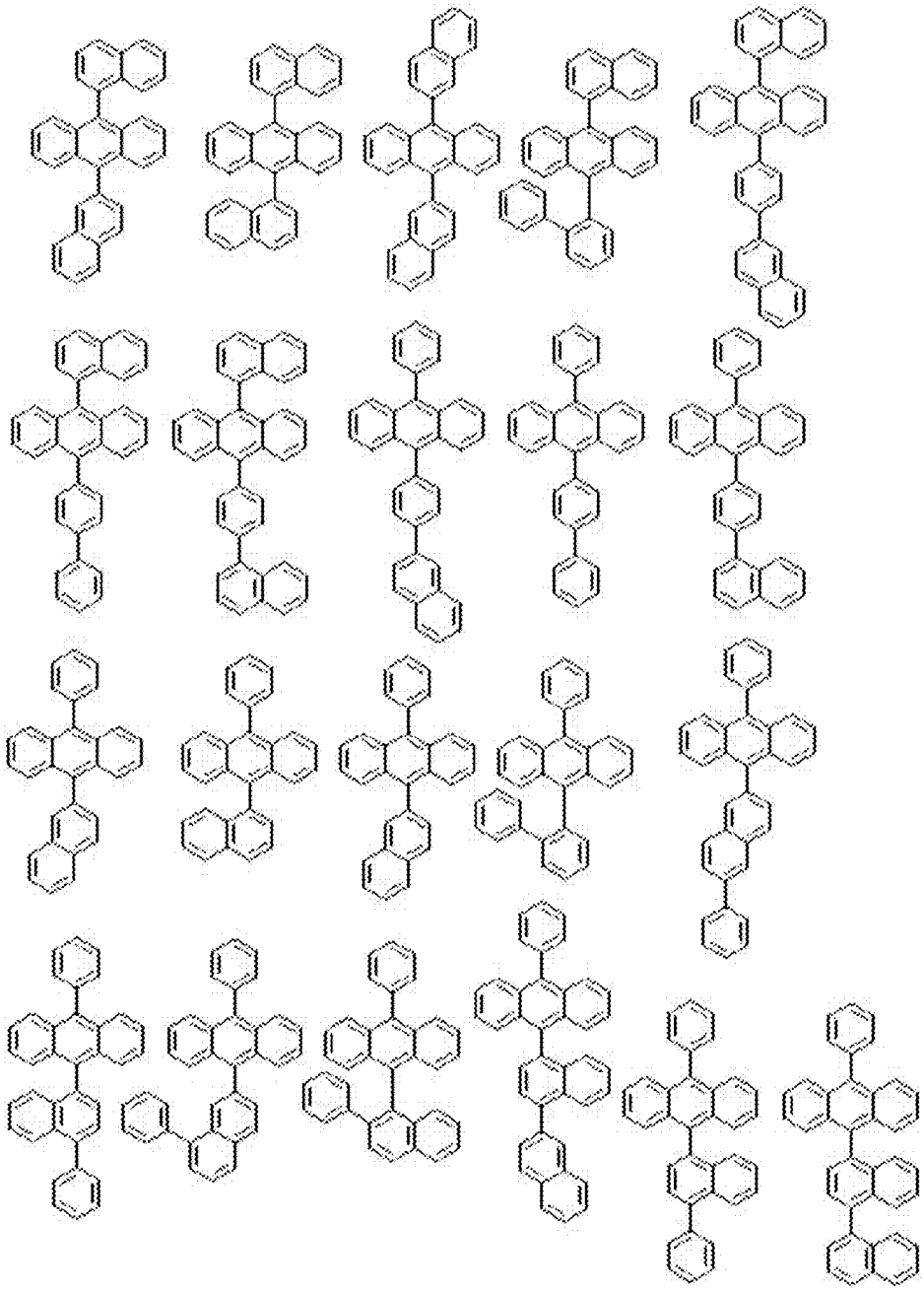
치환기 B37	치환기 B38	치환기 B39
		
치환기 B40	치환기 B41	치환기 B42
		
치환기 B43	치환기 B44	치환기 B45
		
치환기 B46	치환기 B47	치환기 B48
		

[300]

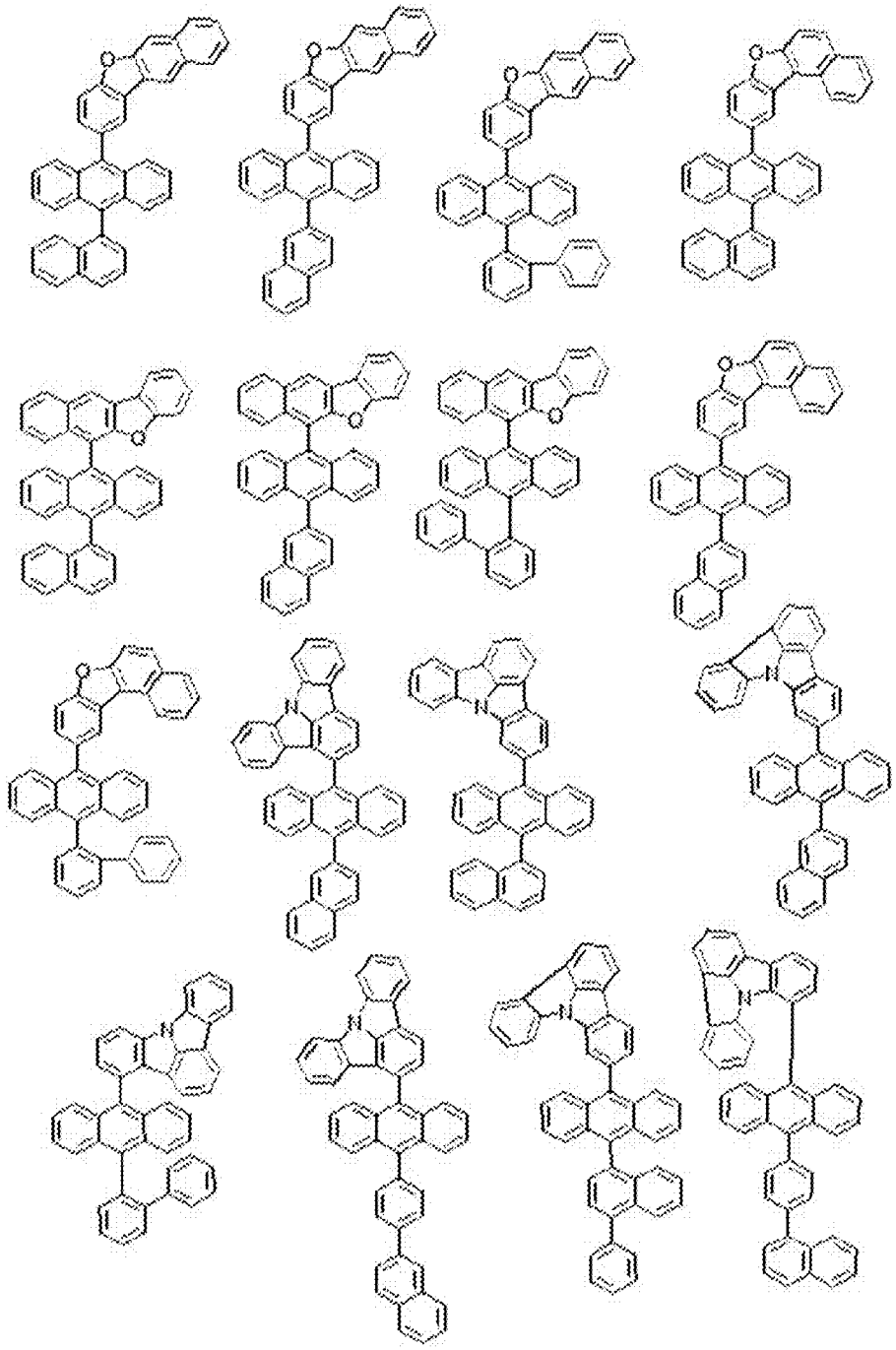
치환기 B49	치환기 B50	치환기 B51
		
치환기 B52	치환기 B53	치환기 B54
		
치환기 B55	치환기 B56	
		

[301] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1A는 하기 화합물 중에서 선택된다.

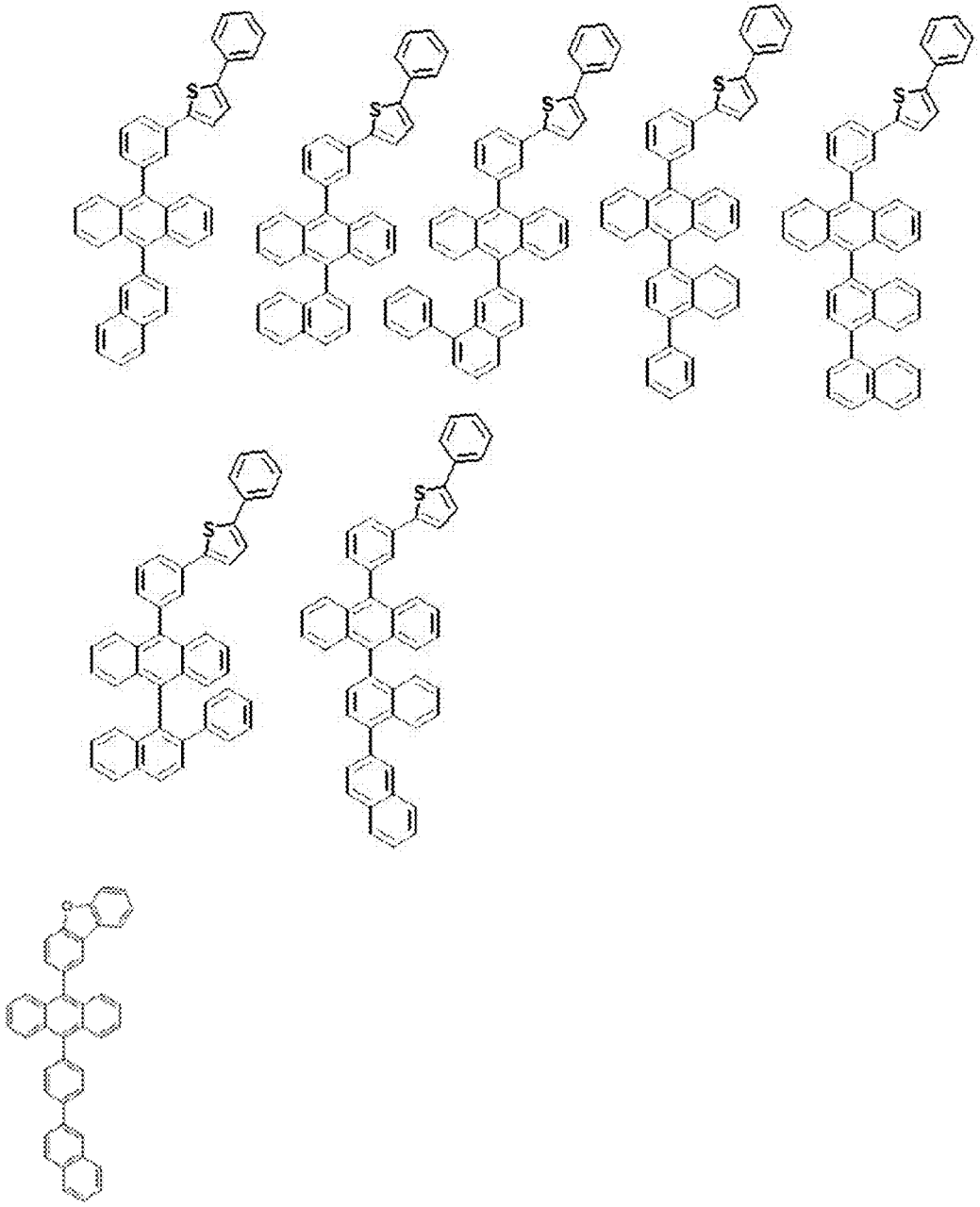
[302]



[303]



[304]

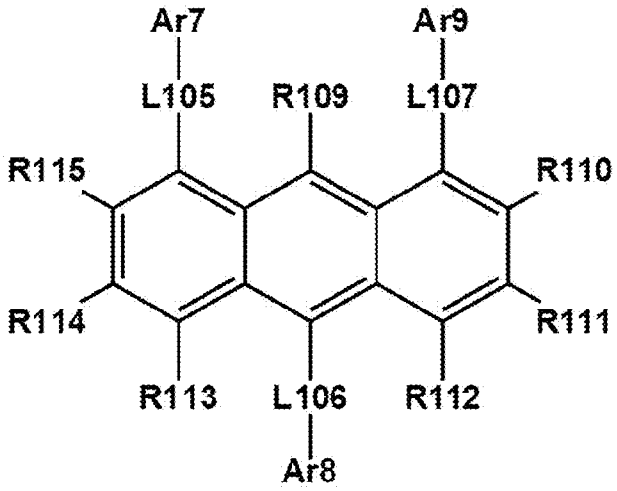


[305] 본 명세서의 일 실시상태에 따르면, 상기 유기물층은 발광층을 포함하고, 상기 발광층은 상기 화학식 1로 표시되는 화합물을 발광층의 도펀트로서 포함하고, 상기 화학식 1A로 표시되는 화합물을 발광층의 호스트로서 포함한다.

[306] 본 명세서의 일 실시상태에 따르면, 상기 발광층은 상기 화학식 1로 표시되는 화합물 및 상기 화학식 1A로 표시되는 화합물을 1:99 내지 10:90의 중량비로 포함한다.

[307] 본 명세서의 일 실시상태에 따르면, 상기 유기물층은 발광층을 포함하고, 상기 발광층은 하기 화학식 1B로 표시되는 화합물을 포함한다.

[308] [화학식 1B]

[309] 

[310] 상기 화학식 1B에 있어서,

[311] L105 내지 L107은 서로 같거나 상이하고, 각각 독립적으로 직접결합; 치환 또는 비치환된 아릴렌기; 또는 치환 또는 비치환된 헤테로아릴렌기이고,

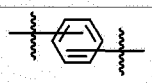
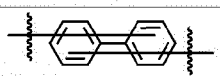
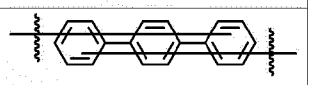
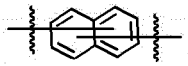
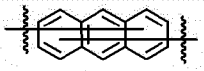
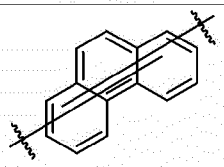
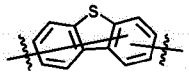
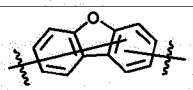
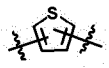
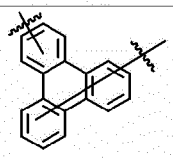
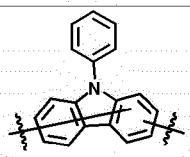
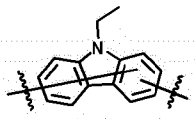
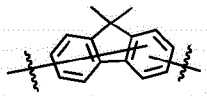
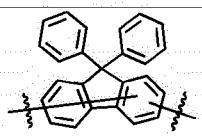
[312] Ar7 내지 Ar9는 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이며,

[313] R109 내지 R115는 서로 같거나 상이하고, 각각 독립적으로 수소; 중수소; 할로겐기; 니트릴기; 니트로기; 치환 또는 비치환된 알킬기; 치환 또는 비치환된 시클로알킬기; 치환 또는 비치환된 실릴기; 치환 또는 비치환된 포스핀옥사이드기; 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이다.

[314] 본 명세서의 일 실시상태에 따르면, 상기 L105 내지 L107는 직접결합이다.

[315] 본 명세서의 일 실시상태에 따르면, 상기 L105 내지 L107는 서로 같거나 상이하고, 각각 독립적으로 하기 표 3의 치환기 중에서 선택된다.

[316] [표3]

치환기 A1	치환기 A2	치환기 A3
		
치환기 A4	치환기 A5	치환기 A6
		
치환기 A7	치환기 A8	치환기 A9
		
치환기 A10	치환기 A11	치환기 A12
		
치환기 A13	치환기 A14	치환기 A15
		

[317] 본 명세서의 일 실시상태에 따르면, 상기 Ar7 내지 Ar9는 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 탄소수 6 내지 30의 아릴기이다.

[318] 본 명세서의 일 실시상태에 따르면, 상기 Ar7 내지 Ar9는 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 페닐기; 치환 또는 비치환된 비페닐기; 치환 또는 비치환된 나프틸기; 또는 치환 또는 비치환된 플루오레닐기이다.

[319] 본 명세서의 일 실시상태에 따르면, 상기 Ar7 내지 Ar9는 서로 같거나 상이하고, 각각 독립적으로 페닐기; 비페닐기; 나프틸기; 또는 플루오레닐기이다.

[320] 본 명세서의 일 실시상태에 따르면, 상기 Ar7 내지 Ar9는 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 탄소수 6 내지 50의 헤테로아릴기이다.

[321] 본 명세서의 일 실시상태에 따르면, 상기 Ar7 내지 Ar9는 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 카바졸릴기이다.

[322] 본 명세서의 일 실시상태에 따르면, 상기 Ar7 내지 Ar9는 서로 같거나 상이하고, 각각 독립적으로 알킬기 또는 아릴기로 치환 또는 비치환된 카바졸기이다.

[323] 본 명세서의 일 실시상태에 따르면, 상기 Ar7 내지 Ar9는 서로 같거나

상이하고, 각각 독립적으로 메틸기 또는 페닐기로 치환 또는 비치환된 카바졸기이다.

[324] 본 명세서의 일 실시상태에 따르면, 상기 Ar7 내지 Ar9는 서로 같거나 상이하고, 각각 독립적으로 축합고리가 형성된 카바졸릴기이다.

[325] 본 명세서의 일 실시상태에 따르면, 상기 Ar7 내지 Ar9는 카바졸릴기이다.

[326] 본 명세서의 일 실시상태에 따르면, 상기 Ar7 내지 Ar9는 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 디벤조티오펜기이다.

[327] 본 명세서의 일 실시상태에 따르면, 상기 Ar7 내지 Ar9는 서로 같거나 상이하고, 각각 독립적으로 축합고리가 형성된 디벤조티오펜기이다.

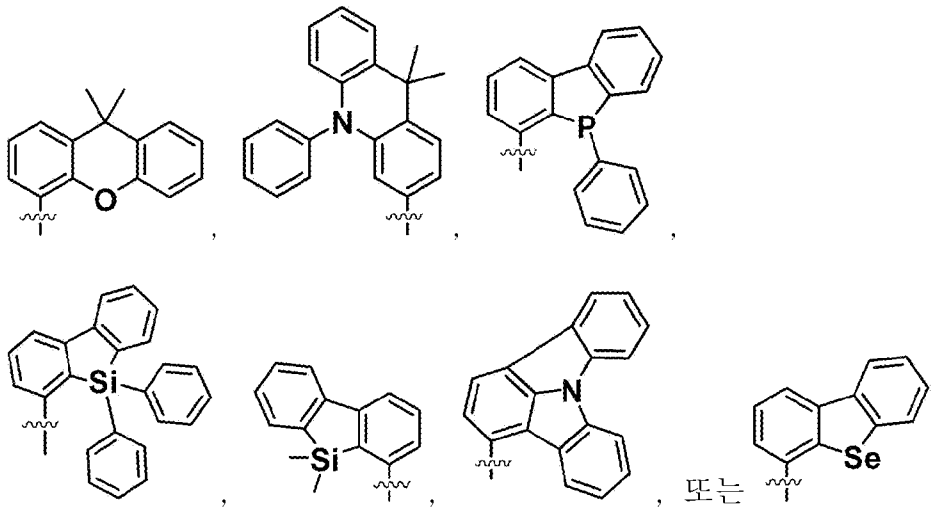
[328] 본 명세서의 일 실시상태에 따르면, 상기 Ar7 내지 Ar9는 디벤조티오펜기이다.

[329] 본 명세서의 일 실시상태에 따르면, 상기 Ar7 내지 Ar9는 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 디벤조퓨란기이다.

[330] 본 명세서의 일 실시상태에 따르면, 상기 Ar7 내지 Ar9는 서로 같거나 상이하고, 각각 독립적으로 축합고리가 형성된 디벤조퓨란기이다.

[331] 본 명세서의 일 실시상태에 따르면, 상기 Ar7 내지 Ar9는 디벤조퓨란기이다.

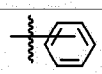
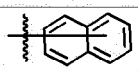
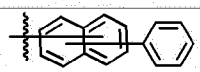
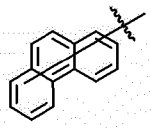
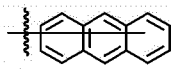
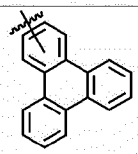
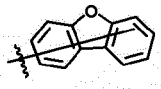
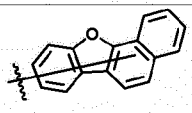
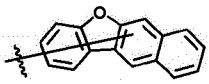
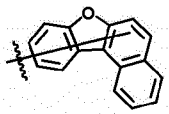
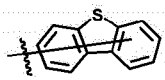
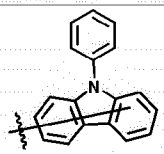
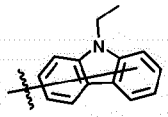
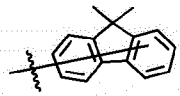
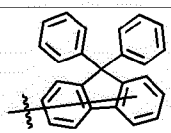
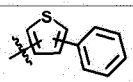
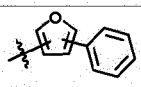
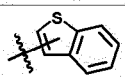
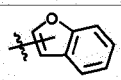
[332] 본 명세서의 일 실시상태에 따르면, 상기 Ar7 내지 Ar9는 서로 같거나 상이하고, 각각 독립적으로



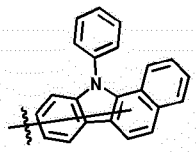
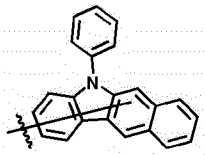
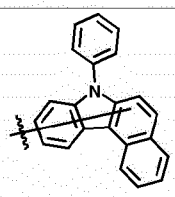
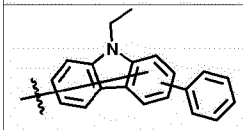
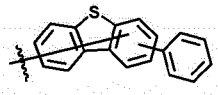
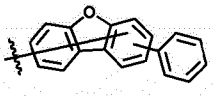
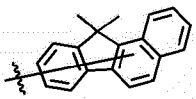
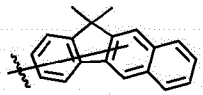
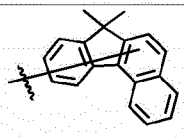
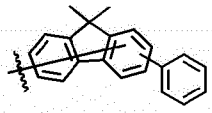
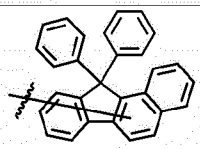
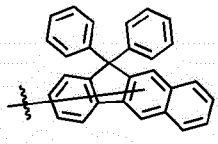
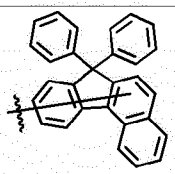
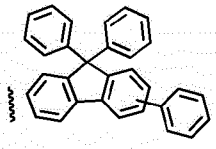
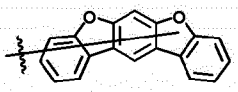
이다.

[333] 본 명세서의 일 실시상태에 따르면, 상기 Ar7 내지 Ar9는 서로 같거나 상이하고, 각각 독립적으로 하기 표 4의 치환기 중에서 선택된다.

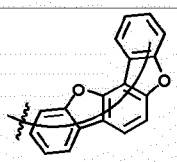
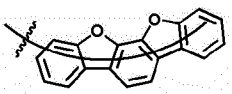
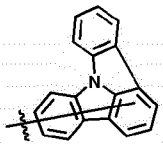
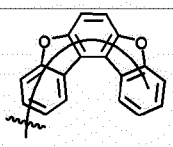
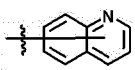
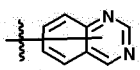
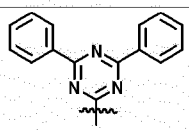
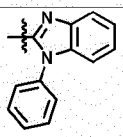
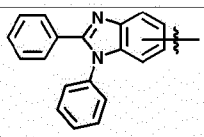
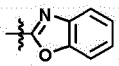
[334] [표4]

치환기 B1	치환기 B2	치환기 B3
		
치환기 B4	치환기 B5	치환기 B6
		
치환기 B7	치환기 B8	치환기 B9
		
치환기 B10	치환기 B11	치환기 B12
		
치환기 B13	치환기 B14	치환기 B15
		
치환기 B16	치환기 B17	치환기 B18
		
치환기 B19	치환기 B20	치환기 B21
		

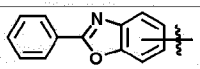
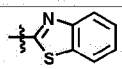
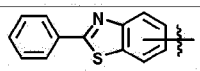
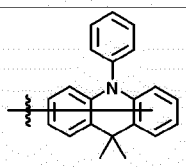
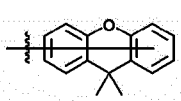
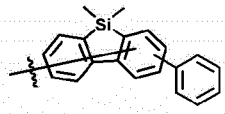
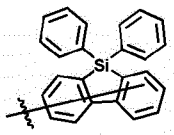
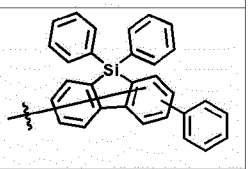
[335]

치환기 B22	치환기 B23	치환기 B24
		
치환기 B25	치환기 B26	치환기 B27
		
치환기 B28	치환기 B29	치환기 B30
		
치환기 B31	치환기 B32	치환기 B33
		
치환기 B34	치환기 B35	치환기 B36
		

[336]

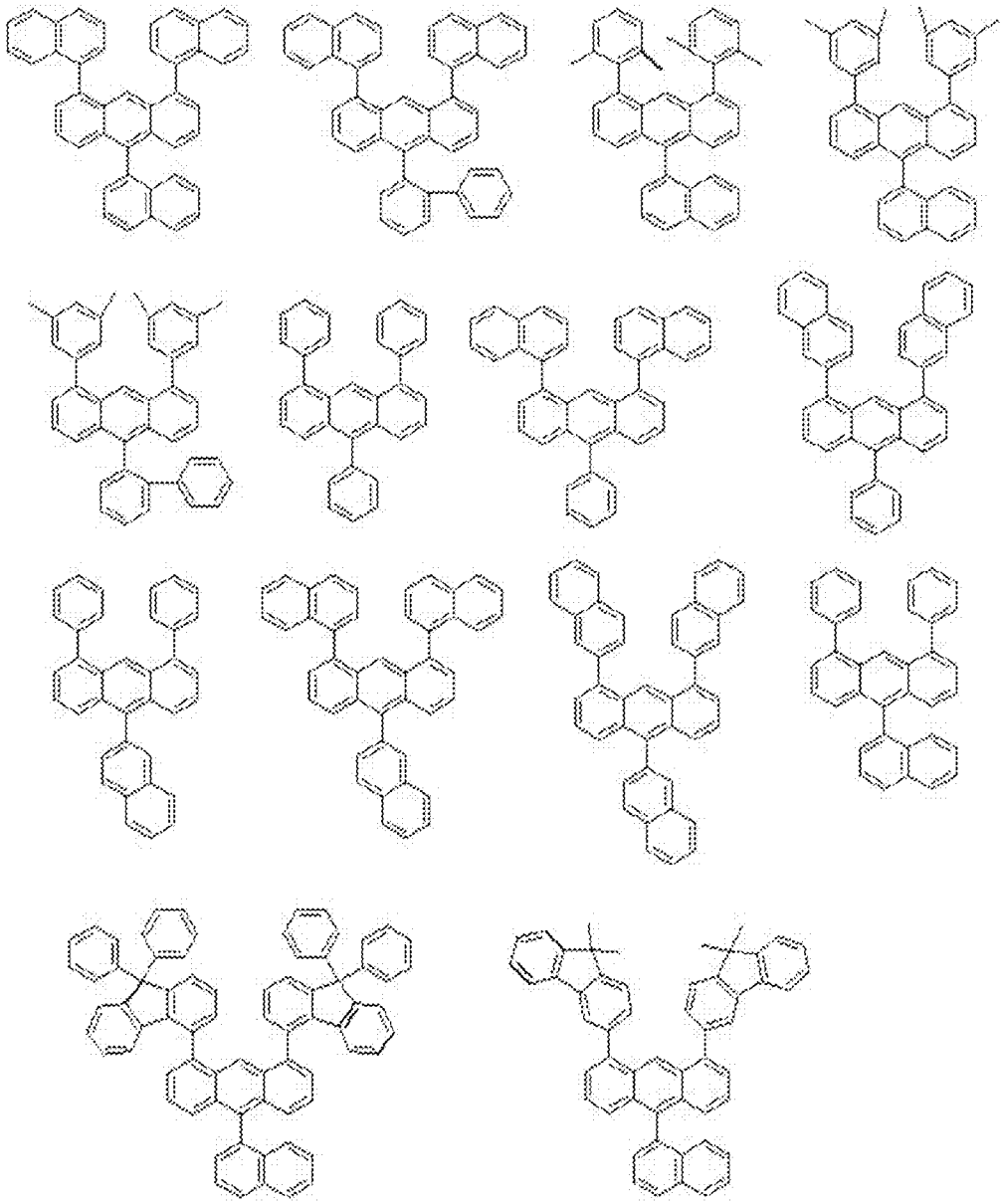
치환기 B37	치환기 B38	치환기 B39
		
치환기 B40	치환기 B41	치환기 B42
		
치환기 B43	치환기 B44	치환기 B45
		
치환기 B46	치환기 B47	치환기 B48
		

[337]

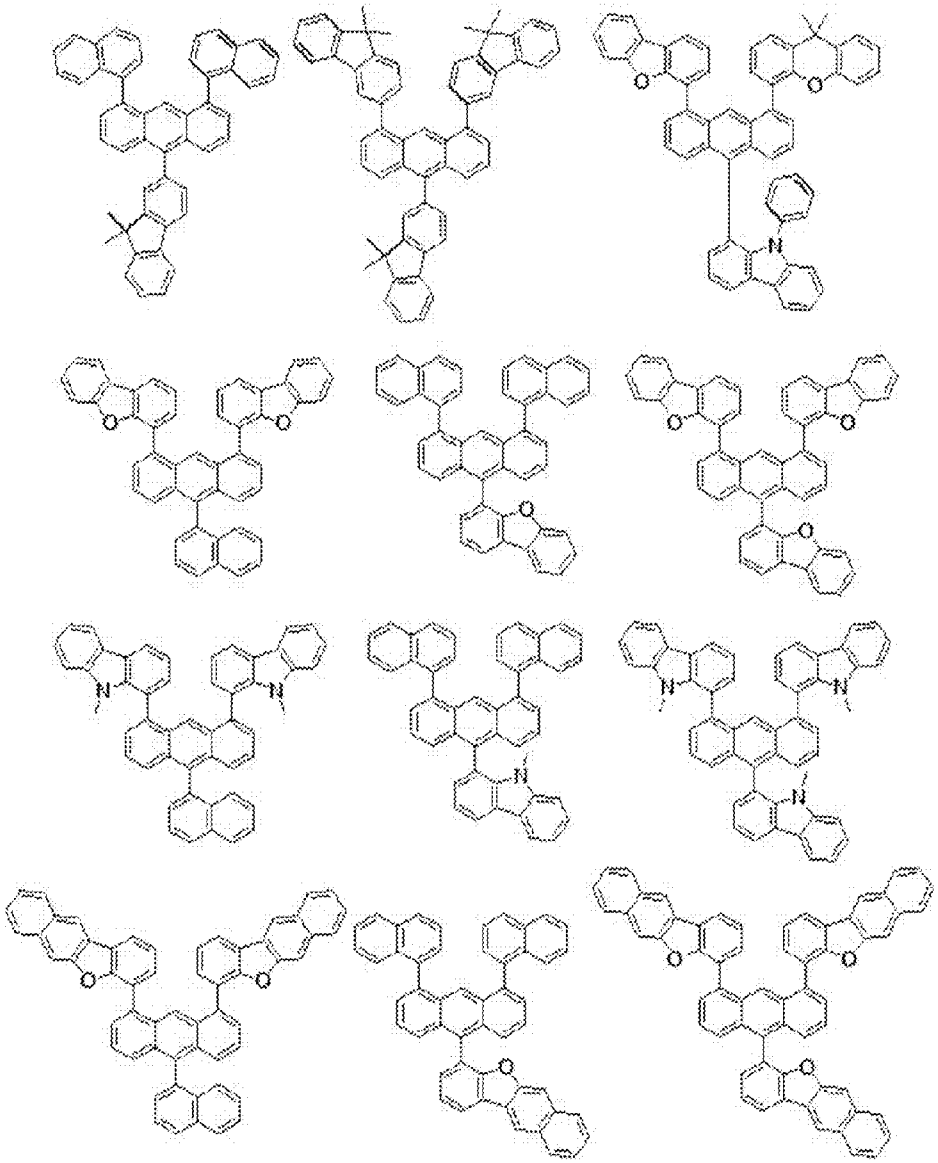
치환기 B49	치환기 B50	치환기 B51
		
치환기 B52	치환기 B53	치환기 B54
		
치환기 B55	치환기 B56	
		

[338] 본 명세서의 일 실시상태에 따르면, 상기 화학식 1B는 하기 화합물 중에서 선택된다.

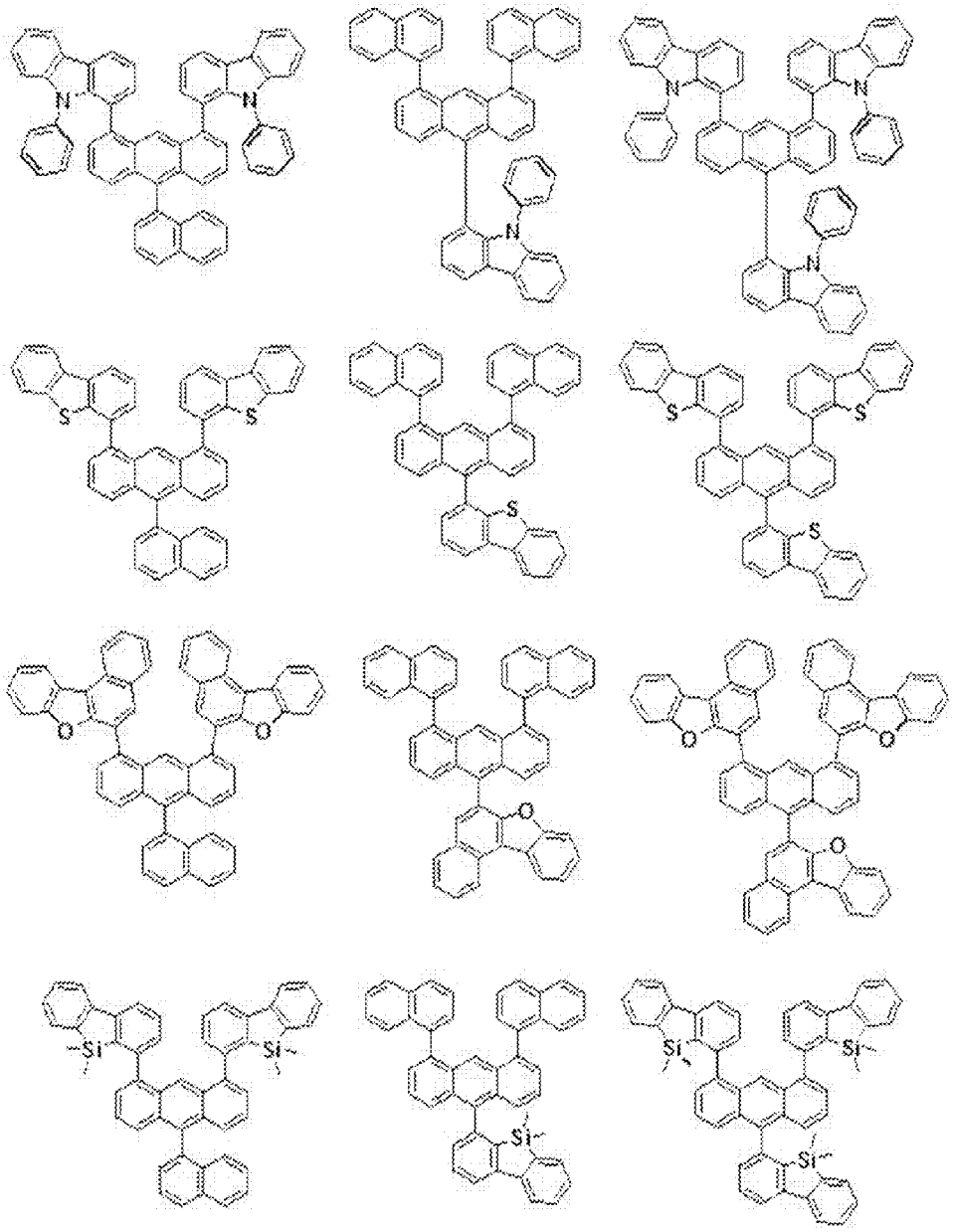
[339]



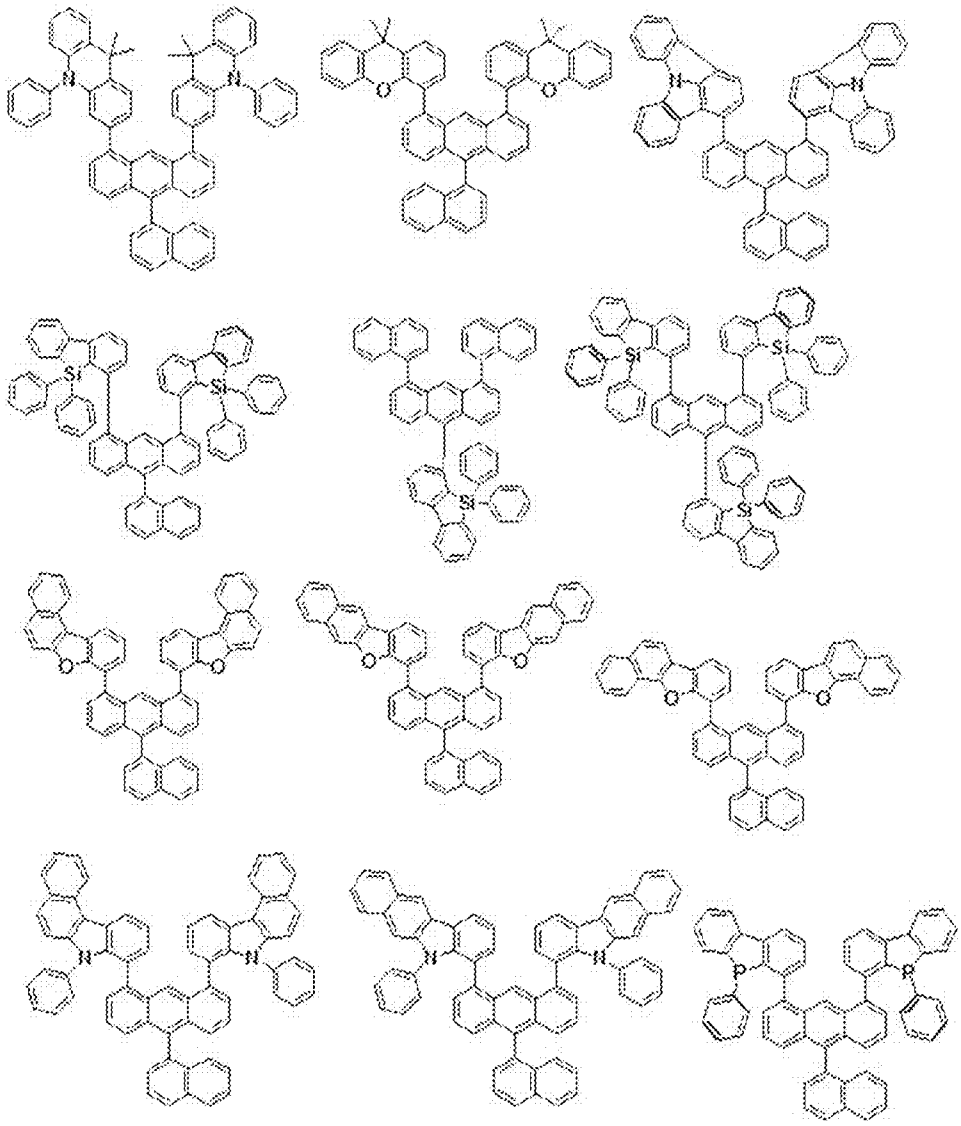
[340]

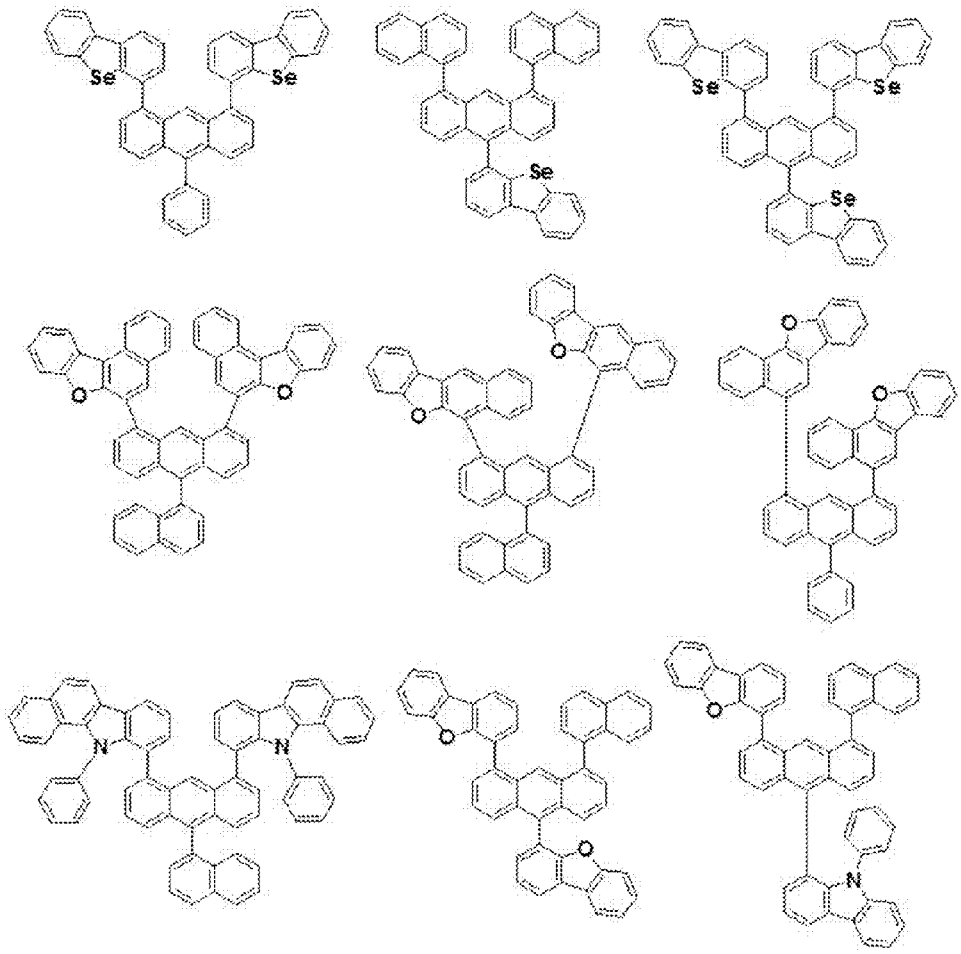


[341]



[342]



[343] 

[344] 본 명세서의 일 실시상태에 따르면, 상기 유기물층은 발광층을 포함하고, 상기 발광층은 상기 화학식 1로 표시되는 화합물을 발광층의 도펀트로서 포함하고, 상기 화학식 1B로 표시되는 화합물을 발광층의 호스트로서 포함한다.

[345] 본 명세서의 일 실시상태에 따르면, 상기 발광층은 상기 화학식 1로 표시되는 화합물 및 상기 화학식 1B로 표시되는 화합물을 1:99 내지 10:90의 중량비로 포함한다.

[346] 본 명세서의 일 실시상태에 따르면, 상기 유기물층은 발광층을 포함하고, 상기 발광층은 상기 화학식 1로 표시되는 화합물을 발광층의 도펀트로서 포함하고, 상기 화학식 1A 및 1B로 표시되는 화합물 중 1 이상을 발광층의 호스트로서 포함한다.

[347] 본 명세서의 일 실시상태에 따르면, 상기 발광층은 상기 화학식 1로 표시되는 화합물 및 상기 화학식 1A 및 1B로 표시되는 화합물 중 1 이상을 1:99 내지 10:90의 중량비로 포함한다.

[348] 본 명세서의 일 실시상태에 따르면, 상기 유기물층은 발광층을 포함하고, 상기 발광층은 상기 화학식 1로 표시되는 화합물을 발광층의 도펀트로서 포함하고, 상기 도펀트는 청색 도펀트이다.

[349] 본 명세서의 일 실시상태에 따르면, 상기 유기 발광 소자는 청색 유기 발광

소자이다.

[350] 본 명세서의 일 실시상태에 따르면, 상기 유기물층은 정공주입층 또는 정공수송층을 포함하고, 상기 정공주입층 또는 정공수송층은 상기 화학식 1로 표시되는 화합물을 포함한다.

[351] 본 명세서의 일 실시상태에 따르면, 상기 유기물층은 전자수송층 또는 전자주입층을 포함하고, 상기 전자수송층 또는 전자주입층은 상기 화학식 1로 표시되는 화합물을 포함한다.

[352] 본 명세서의 일 실시상태에 따르면, 상기 유기물층은 전자차단층 또는 정공차단층을 포함하고, 상기 전자차단층 또는 정공차단층은 상기 화학식 1로 표시되는 화합물을 포함한다.

[353] 본 명세서의 일 실시상태에 따르면, 상기 유기물층은 발광층, 정공주입층, 정공수송층. 전자주입층, 전자수송층, 전자차단층 및 정공차단층으로 이루어진 군으로부터 선택되는 1층 이상을 더 포함할 수 있다.

[354] 본 명세서의 유기 발광 소자는 유기물층 중 1층 이상이 본 명세서의 화합물, 즉, 상기 화학식 1로 표시되는 화합물을 포함하는 것을 제외하고는 당 기술분야에 알려져 있는 재료와 방법으로 제조될 수 있다.

[355] 상기 유기 발광 소자가 복수개의 유기물층을 포함하는 경우, 상기 유기물층은 동일한 물질 또는 다른 물질로 형성될 수 있다.

[356] 예컨대, 본 명세서의 유기 발광 소자는 기판 상에 제1 전극, 유기물층 및 제2 전극을 순차적으로 적층시킴으로써 제조할 수 있다. 이 때 스퍼터링법(sputtering)이나 전자빔 증발법(e-beam evaporation)과 같은 물리 증착 방법(PVD: physical Vapor Deposition)을 이용하여, 기판 상에 금속 또는 전도성을 가지는 금속 산화물 또는 이들의 합금을 증착시켜 제1 전극을 형성하고, 그 위에 정공 주입층, 정공 수송층, 발광층 및 전자 수송층을 포함하는 유기물층을 형성한 후, 그 위에 제2 전극으로 사용할 수 있는 물질을 증착시킴으로써 제조될 수 있다. 이와 같은 방법 외에도, 기판 상에 제2 전극 물질부터 유기물층, 제1 전극 물질을 차례로 증착시켜 유기 발광 소자를 만들 수 있다. 또한, 상기 화학식 1로 표시되는 화합물은 유기 발광 소자의 제조시 진공 증착법 뿐만 아니라 용액 도포법에 의하여 유기물층으로 형성될 수 있다. 여기서, 용액 도포법이라 함은 스핀 코팅, 딥코팅, 닥터 블레이딩, 잉크젯프린팅, 스크린 프린팅, 스프레이법, 롤 코팅 등을 의미하지만, 이들만으로 한정되는 것은 아니다.

[357] 본 명세서의 일 실시상태에 따르면, 상기 제1 전극은 양극이고, 상기 제2 전극은 음극이다.

[358] 본 명세서의 또 하나의 실시상태에 따르면, 상기 제1 전극은 음극이고, 상기 제2 전극은 양극이다.

[359] 상기 양극 물질로는 통상 유기물층으로 정공 주입이 원활할 수 있도록 일함수가 큰 물질이 바람직하다. 본 발명에서 사용될 수 있는 양극 물질의 구체적인 예로는 바나듐, 크롬, 구리, 아연, 금과 같은 금속 또는 이들의 합금;

아연 산화물, 인듐 산화물, 인듐주석 산화물(ITO), 인듐아연 산화물(IZO)과 같은 금속 산화물; ZnO:Al 또는 SnO_2 : Sb와 같은 금속과 산화물의 조합; 폴리(3-메틸티오펜), 폴리[3,4-(에틸렌-1,2-디옥시)티오펜](PEDOT), 폴리피롤 및 폴리아닐린과 같은 전도성 고분자 등이 있으나, 이들에만 한정되는 것은 아니다.

[360] 상기 음극 물질로는 통상 유기물층으로 전자 주입이 용이하도록 일함수가 작은 물질인 것이 바람직하다. 음극 물질의 구체적인 예로는 마그네슘, 칼슘, 나트륨, 칼륨, 티타늄, 인듐, 이트륨, 리튬, 가돌리늄, 알루미늄, 은, 주석 및 납과 같은 금속 또는 이들의 합금; LiF/Al 또는 LiO_2/Al, Mg/Ag과 같은 다층 구조 물질 등이 있으나, 이들에만 한정되는 것은 아니다.

[361] 상기 정공주입층은 정공 주입 물질로는 전극으로부터 정공을 주입하는 층으로, 정공 주입 물질로는 정공을 수송하는 능력을 가져 양극에서의 정공 주입효과, 발광층 또는 발광재료에 대하여 우수한 정공 주입 효과를 갖고, 발광층에서 생성된 여기자의 전자주입층 또는 전자주입재료에의 이동을 방지하며, 또한, 박막 형성 능력이 우수한 화합물이 바람직하다. 정공 주입 물질의 HOMO(highest occupied molecular orbital)가 양극 물질의 일함수와 주변 유기물층의 HOMO 사이인 것이 바람직하다. 정공 주입 물질의 구체적인 예로는 금속 포피린(porphyrin), 올리고티오펜, 아릴아민 계열의 유기물, 헥사니트릴헥사아자트리페닐렌 계열의 유기물, 퀴나크리돈(quinacridone)계열의 유기물, 페릴렌(perylene) 계열의 유기물, 안트라퀴논 및 폴리아닐린과 폴리티오펜 계열의 전도성 고분자 등이 있으나, 이들에만 한정 되는 것은 아니다.

[362] 상기 정공수송층은 정공주입층으로부터 정공을 수취하여 발광층까지 정공을 수송하는 층으로, 정공 수송 물질로는 양극이나 정공 주입층으로부터 정공을 수송받아 발광층으로 옮겨줄 수 있는 물질로 정공에 대한 이동성이 큰 물질이 적합하다. 구체적인 예로는 아릴아민 계열의 유기물, 전도성 고분자, 및 공액 부분과 비공액 부분이 함께 있는 블록 공중합체 등이 있으나, 이들에만 한정되는 것은 아니다.

[363] 상기 전자차단층은 전자 주입층으로부터 주입된 전자가 발광층을 지나 정공 주입층으로 진입하는 것을 방지하여 소자의 수명과 효율을 향상시킬 수 있는 층이고, 필요한 경우에 공지의 재료를 사용하여 발광층과 정공 주입층의 사이에 적절한 부분에 형성될 수 있다.

[364] 상기 발광층이 상기 화학식 1로 표시되는 화합물을 포함하는 발광층 이외의 추가의 발광층을 포함하는 경우, 발광층의 발광 물질로는 정공 수송층과 전자 수송층으로부터 정공과 전자를 각각 수송받아 결합시킴으로써 가시광선 영역의 빛을 낼 수 있는 물질로서, 형광이나 인광에 대한 양자 효율이 좋은 물질이 바람직하다. 구체적인 예로는 8-히드록시-퀴놀린 알루미늄 착물(Alq_3); 카르바졸 계열 화합물; 이량체화 스티릴(dimerized styryl) 화합물; BAlq; 10-히드록시벤조 퀴놀린-금속 화합물; 벤즈옥사졸, 벤조티아졸 및 벤즈이미다졸 계열의 화합물;

폴리(p-페닐렌비닐렌)(PPV) 계열의 고분자; 스피로(spiro) 화합물; 폴리플루오렌, 루브렌 등이 있으나, 이들에만 한정되는 것은 아니다.

[365] 상기 발광층이 상기 화학식 1로 표시되는 화합물을 포함하는 발광층 이외의 추가의 발광층을 포함하는 경우, 발광층은 호스트 재료 및 도펀트 재료를 포함할 수 있다. 호스트 재료는 축합 방향족환 유도체 또는 헤테로 고리 함유 화합물 등이 있다. 구체적으로 축합 방향족환 유도체로는 안트라센 유도체, 피렌 유도체, 나프탈렌 유도체, 펜타센 유도체, 페난트렌 화합물, 플루오란텐 화합물 등이 있고, 헤테로 고리 함유 화합물로는 카바졸 유도체, 디벤조퓨란 유도체, 래더형 퓨란 화합물, 피리미딘 유도체 등이 있으나, 이에 한정되지 않는다.

[366] 상기 발광층이 상기 화학식 1로 표시되는 화합물을 포함하는 발광층 이외의 추가의 발광층을 포함하는 경우, 도펀트 재료로는 방향족 아민 유도체, 스티릴아민 화합물, 붕소 착체, 플루오란텐 화합물, 금속 착체 등이 있다. 구체적으로 방향족 아민 유도체로는 치환 또는 비치환된 아릴아미노기를 갖는 축합 방향족환 유도체로서, 아릴아미노기를 갖는 피렌, 안트라센, 크리센, 페리플란텐 등이 있으며, 스티릴아민 화합물로는 치환 또는 비치환된 아릴아민에 적어도 1개의 아릴비닐기가 치환되어 있는 화합물로, 아릴기, 실릴기, 알킬기, 시클로알킬기 및 아릴아미노기로 이루어진 군에서 1 또는 2 이상 선택되는 치환기가 치환 또는 비치환된다. 구체적으로 스티릴아민, 스티릴디아민, 스티릴트리아민, 스티릴테트라아민 등이 있으나, 이에 한정되지 않는다. 또한, 금속 착체로는 이리듐 착체, 백금 착체 등이 있으나, 이에 한정되지 않는다.

[367] 상기 정공 차단층은 정공 주입층으로부터 주입된 정공이 발광층을 지나 전자 주입층으로 진입하는 것을 방지하여 소자의 수명과 효율을 향상시킬 수 있는 층이고, 필요한 경우에 공지의 재료를 사용하여 발광층과 전자 주입층의 사이에 적절한 부분에 형성될 수 있다.

[368] 상기 전자수송층의 전자 수송 물질로는 전자주입층으로부터 전자를 수취하여 발광층까지 전자를 수송하는 층으로 전자 수송 물질로는 음극으로부터 전자를 잘 주입 받아 발광층으로 옮겨줄 수 있는 물질로서, 전자에 대한 이동성이 큰 물질이 적합하다. 구체적인 예로는 8-히드록시퀴놀린의 Al착물; Alq_3를 포함한 착물; 유기 라디칼 화합물; 히드록시플라본-금속 착물 등이 있으나, 이들에만 한정되는 것은 아니다. 전자 수송층은 종래기술에 따라 사용된 바와 같이 임의의 원하는 캐소드 물질과 함께 사용할 수 있다. 특히, 적절한 캐소드 물질의 예는 낮은 일함수를 가지고 알루미늄층 또는 실버층이 뒤따르는 통상적인 물질이다. 구체적으로 세슘, 바륨, 칼슘, 이테르븀 및 사마륨이고, 각 경우 알루미늄 층 또는 실버층이 뒤따른다.

[369] 상기 전자주입층은 전극으로부터 전자를 주입하는 층으로, 전자를 수송하는 능력을 갖고, 음극으로부터의 전자주입 효과, 발광층 또는 발광 재료에 대하여 우수한 전자주입 효과를 가지며, 발광층에서 생성된 여기자의 정공 주입층에의

이동을 방지하고, 또한, 박막형성능력이 우수한 화합물이 바람직하다.
구체적으로는 플루오레논, 안트라퀴노다이메탄, 다이페노퀴논, 티오피란 다이옥사이드, 옥사졸, 옥사다이아졸, 트리아졸, 이미다졸, 페릴렌테트라카복실산, 프레오레닐리덴 메탄, 안트론 등과 그들의 유도체, 금속 착체 화합물 및 함질소 5원환 유도체 등이 있으나, 이에 한정되지 않는다.

[370] 상기 금속 착체 화합물로서는 8-하이드록시퀴놀리나토 리튬, 비스(8-하이드록시퀴놀리나토)아연, 비스(8-하이드록시퀴놀리나토)구리, 비스(8-하이드록시퀴놀리나토)망간, 트리스(8-하이드록시퀴놀리나토)알루미늄, 트리스(2-메틸-8-하이드록시퀴놀리나토)알루미늄, 트리스(8-하이드록시퀴놀리나토)갈륨, 비스(10-하이드록시벤조[h]퀴놀리나토)베릴륨, 비스(10-하이드록시벤조[h]퀴놀리나토)아연, 비스(2-메틸-8-퀴놀리나토)클로로갈륨, 비스(2-메틸-8-퀴놀리나토)(o-크레졸라토)갈륨, 비스(2-메틸-8-퀴놀리나토)(1-나프톨라토)알루미늄, 비스(2-메틸-8-퀴놀리나토)(2-나프톨라토)갈륨 등이 있으나, 이에 한정되지 않는다.

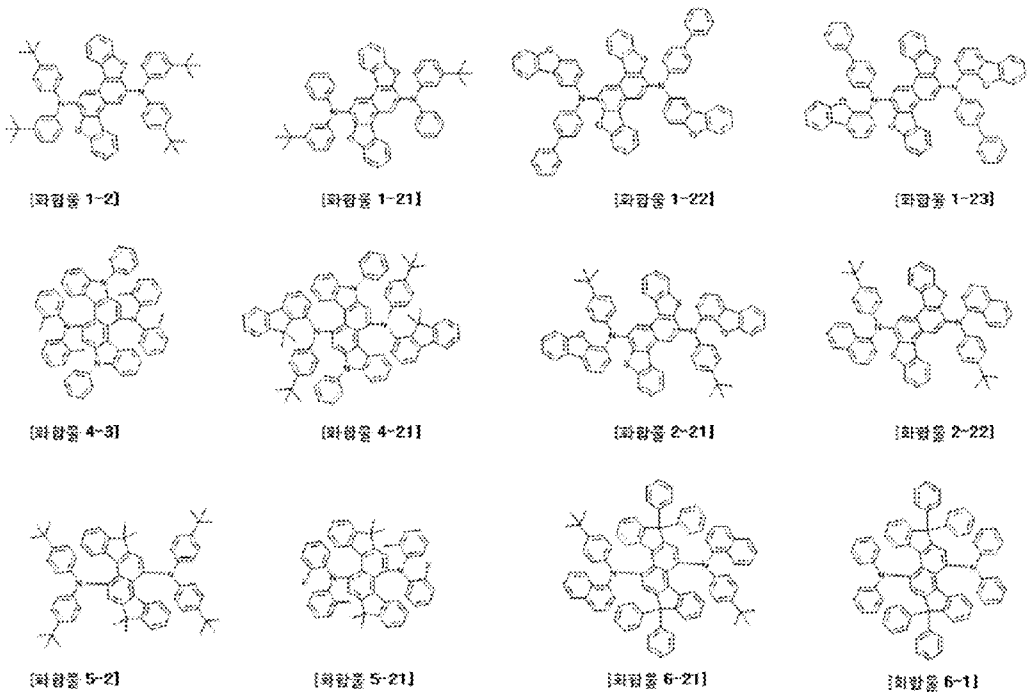
[371] 본 명세서에 따른 유기 발광 소자는 사용되는 재료에 따라 전면 발광형, 후면 발광형 또는 양면 발광형일 수 있다.

발명의 실시를 위한 형태

[372] 이하, 본 명세서를 구체적으로 설명하기 위해 실시예를 들어 상세하게 설명하기로 한다. 그러나, 본 명세서에 따른 실시예들은 여러 가지 다른 형태로 변형될 수 있으며, 본 명세서의 범위가 아래에서 상술하는 실시예들에 한정되는 것으로 해석되지 않는다. 본 명세서의 실시예들은 당업계에서 평균적인 지식을 가진 자에게 본 명세서를 보다 완전하게 설명하기 위해 제공되는 것이다.

[373] 합성예

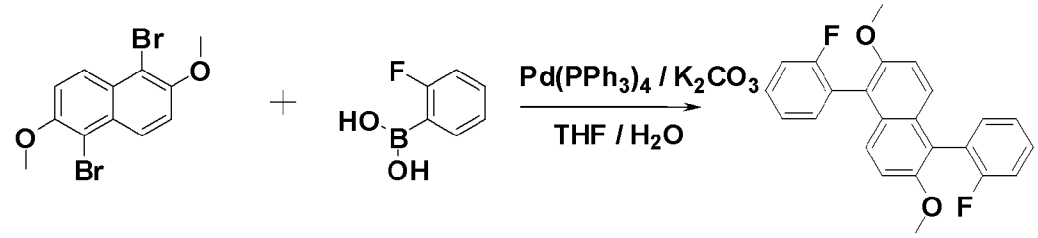
[374]



[375] 합성예 1. 화합물 1-2의 합성

[376] 1) 중간체 1-a의 합성

[377]

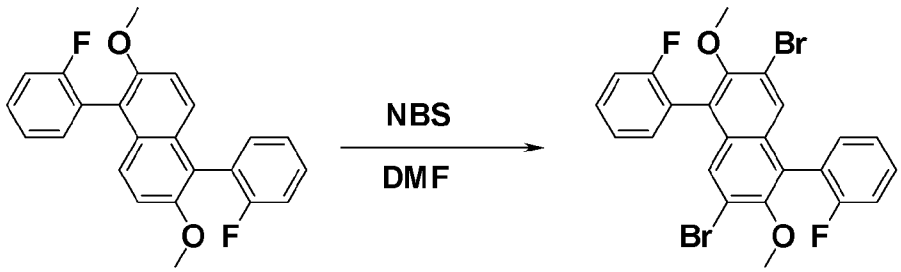


중간체 1-a

[378] 1,5-브로모-2,6-다이하이드록시나프탈렌 (20.0 g, 58 mmol), 2-플로로페닐보로닉산 (20 g, 145 mmol)을 테트라하이드로퓨란 300 mL에 완전히 녹인 후 탄산칼륨 (24.0 g, 174 mmol) 수용액 100 mL을 첨가하고, 테트라키스-(트리페닐포스핀)팔라듐 (3.4 g, 2.9 mmol)을 첨가한 후 24 시간동안 환류하여 교반하였다. 반응 완료 후 상온으로 온도를 낮춘 다음 물과 에틸 아세테이트로 추출하여 유기층을 분리하였다. 유기층은 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 고체는 에틸 아세테이트로 재결정하여 중간체 1-a (19.2 g, 88 %)를 얻었다. MS [M+]= 376.1

[379] 2) 중간체 1-b의 합성

[380]

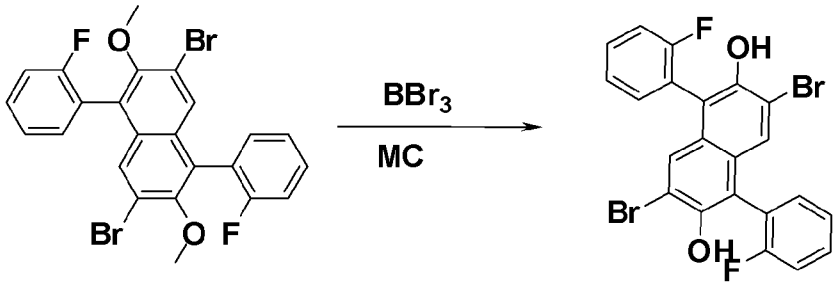


중간체 1-a 중간체 1-b

[381] 중간체 1-a (19.2 g, 51 mmol)을 디메틸포름아마이드 300 mL에 녹인 다음 N-브로모석신이미드 (19.1 g, 107 mmol)를 첨가해 주고 2시간 동안 교반해 주었다. 반응 완료 후 물과 에틸 아세테이트로 추출하여 유기층을 분리하였다. 유기층은 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 고체는 에틸 아세테이트와 헥산으로 재결정하여 중간체 1-b (25 g, 90 %)를 얻었다. MS [M+]= 534.1

[382] 3) 중간체 1-c의 합성

[383]

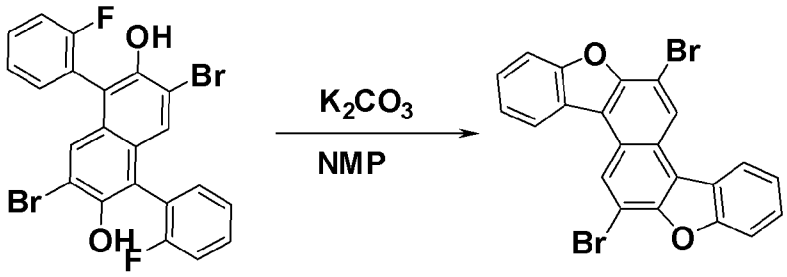


중간체 1-b 중간체 1-c

[384] 중간체 1-b (25 g, 46 mmol), 디클로로메탄 300 mL 를 넣고 1M BBr_3 in CH_2Cl_2 (115 ml, 115 mmol) 을 0℃에서 천천히 적가 후 8시간 교반 하였다. 반응 완료 후 $NaHCO_3$ 로 중성화 시킨 후 물과 CH_2Cl_2로 추출하여 유기층을 분리하였다. 유기층은 무수황산마그네슘으로 처리 후 여과 감압 농축하여 중간체 1-c (19 g, 83 %)를 얻었다. MS [M+]= 506.1

[385] 4) 중간체 1-d의 합성

[386]



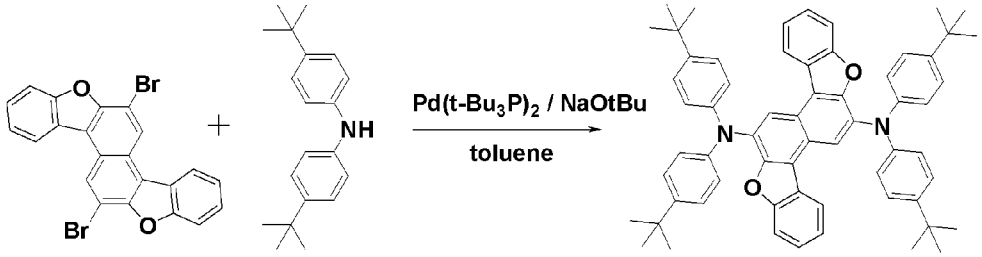
중간체 1-c 중간체 1-d

[387] 중간체 1-c (19 g, 38.2 mmol)와 K_2CO_3 (26.2 g, 191 mmol)를

N-메틸피롤리돈(NMP) 150 mL에 넣고 150℃ 에서 8시간 교반 하였다. 반응 완료 후 500 mL 을 넣고 에틸 아세테이트로 추출하여 유기층을 분리하였다. 유기층은 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 고체는 톨루엔과 헥산으로 재결정하여 중간체 1-d (15.1 g, 83 %)를 얻었다. MS [M+]= 466.1

[388] 5) 화합물 1-2의 합성

[389]



중간체 1-d 화합물 1-2

[390] 질소분위기에서 둥근 바닥 플라스크에 중간체 1-d (6.0 g, 12.9 mmol), 비스(4-터트부틸페닐)아민 (10.9 g, 38.6 mmol), 소듐터트부톡사이드(6.2 g, 64.5 mmol), 비스(트리-터트-부틸포스핀)팔라듐(0) (0.33 g, 0.6 mmol)을 톨루엔 150 mL 에 넣고 환류하여 교반하였다. 반응이 종료되면 상온으로 식힌 다음 톨루엔과 물로 추출하고 물층을 제거하였다. 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 생성물은 컬럼 크로마토그래피로 분리 정제한 후 톨루엔과 헥산으로 재결정하여 화합물 1-2 (7.3 g, 65%)을 얻었다. MS [M+]= 867.1

[391] 합성예 2. 화합물 1-21의 합성

[392] 상기 합성예 1의 5)에서 비스(4-터트부틸페닐)아민 대신 N-4-(터트-부틸)페닐 페닐아민을 사용한 것을 제외하고 동일하게 제조하여 화합물 1-21을 얻었다. MS[M+]=754.9

[393] 합성예 3. 화합물 1-22의 합성

[394] 상기 합성예 1의 5)에서 비스(4-터트부틸페닐)아민 대신 N-바이페닐-4-일-2-디벤조퓨라닐아민을 사용한 것을 제외하고 동일하게 제조하여 화합물 1-22를 얻었다. MS[M+]=975.1

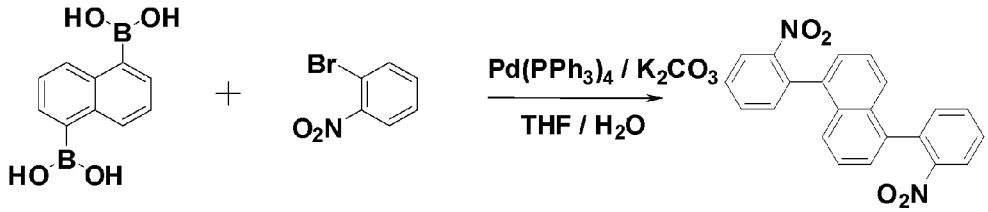
[395] 합성예 4. 화합물 1-23의 합성

[396] 상기 합성예 1의 5)에서 비스(4-터트부틸페닐)아민 대신 N-바이페닐-4-일-4-디벤조퓨라닐아민을 사용한 것을 제외하고 동일하게 제조하여 화합물 1-23을 얻었다. MS[M+]=975.1

[397] 합성예 5. 화합물 4-3의 합성

[398] 1) 중간체 4-a의 합성

[399]

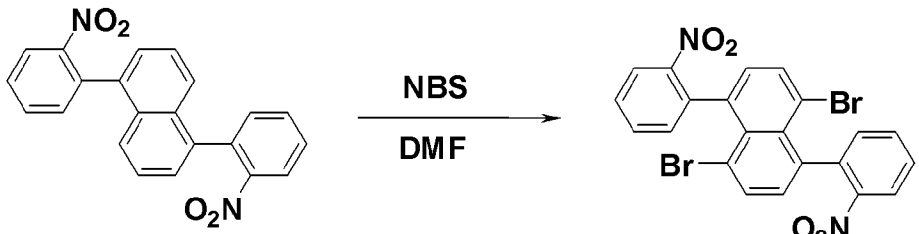


중간체 4-a

[400] 나프탈렌-1,5-디보론산 (20.0 g, 93 mmol), 1-브로모-2-나이트로벤젠 (56.2 g, 278 mmol)을 테트라하이드로퓨란 300 mL에 완전히 녹인 후 탄산칼륨 (38.6 g, 279 mmol) 수용액 100 mL을 첨가하고, 테트라키스-(트리페닐포스핀)팔라듐 (5.4 g, 4.7 mmol)을 첨가한 후 24 시간동안 환류하여 교반하였다. 반응 완료 후 상온으로 온도를 낮춘 다음 물과 에틸 아세테이트로 추출하여 유기층을 분리하였다. 유기층은 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 고체는 에틸 아세테이트로 재결정하여 중간체 4-a (28.9 g, 84 %)를 얻었다. MS [M+]= 370.3

[401] 2) 중간체 4-b의 합성

[402]

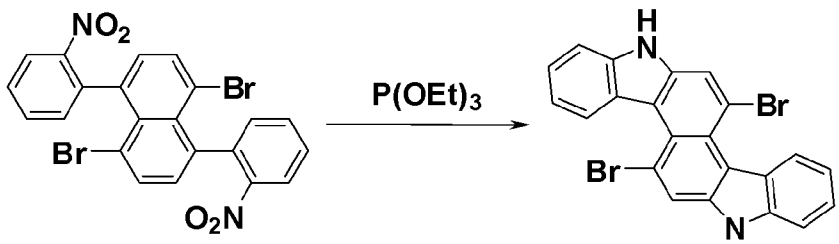


중간체 4-a 중간체 4-b

[403] 중간체 4-a (28.9 g, 78 mmol)을 디메틸포름아마이드 300 mL에 녹인 다음 N-브로모석신이미드 (29.1 g, 164 mmol)를 첨가해 주고 2시간 동안 교반해주었다. 반응 완료 후 물과 에틸 아세테이트로 추출하여 유기층을 분리하였다. 유기층은 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 고체는 에틸 아세테이트와 헥산으로 재결정하여 중간체 4-b (25 g, 60 %)를 얻었다. MS [M+]= 528.1

[404] 3) 중간체 4-c의 합성

[405]



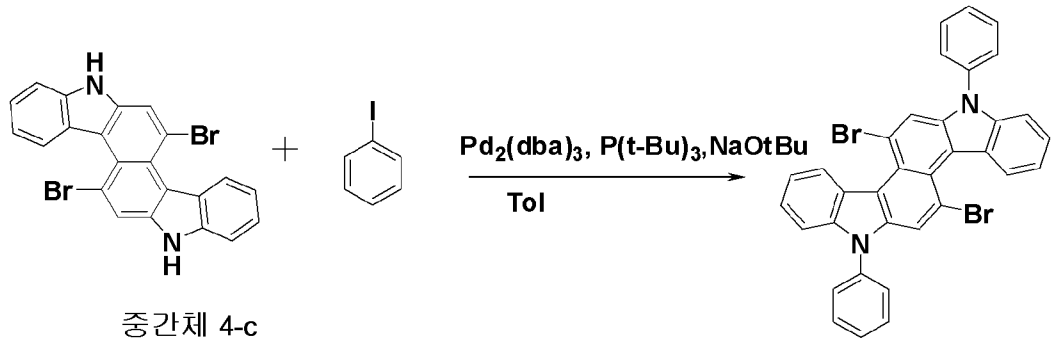
중간체 4-b 중간체 4-c

[406] 중간체 4-b (25.0 g, 37 mmol)을 트리에틸포스파이트 300 mL에 녹인 후, 180 ℃에서 5시간 동안 가열하며 교반 하였다. 반응 완료 후 반응액에 물을 넣어 침전을 시킨 후, 필터 하였다. 이렇게 얻어진 고체를 플래쉬 컬럼

크로마토그래피로 분리 정제하여 중간체 4-c를 (12.2 g, 71 %)을 얻었다. MS [M+]= 464.1

[407] 4) 중간체 4-d의 합성

[408]

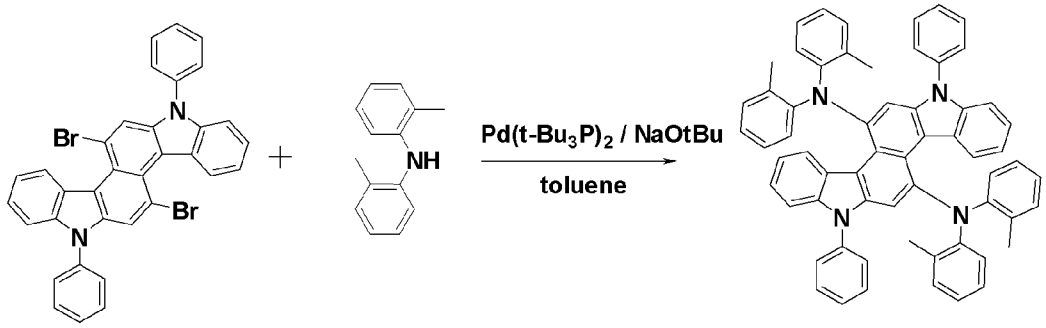


중간체 4-c 중간체 4-d

[409] 중간체 4-c (12 g, 26 mmol)을 톨루엔 300 mL에 녹인 후, 여기에 아이오도벤젠 (16 g, 78 mmol), 트리스(디페닐리덴아세톤)디팔라듐(o)(0.24 g, 0.26 mmol), 트리스-터트 부틸포스핀(0.26 g, 1.3 mmol) 그리고 소듐터트부톡사이드(2.5 g, 26 mmol)을 순차적으로 넣고 100 ℃에서 24시간 동안 가열하며 교반하였다. 반응 완료 후 물과 에틸 아세테이트로 추출하여 유기층을 분리하였다. 유기층은 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 고체는 에틸 아세테이트와 헥산으로 재결정하여 중간체 4-d (10.4 g, 65 %)를 얻었다. MS [M+]= 606.3

[410] 5) 화합물 4-3의 합성

[411]



중간체 4-d 화합물 4-3

[412] 질소분위기에서 둥근 바닥 플라스크에 중간체 4-d (5.0 g, 8.1 mmol), 디올쏘토릴아민 (4.8 g, 24.3 mmol), 소듐터트부톡사이드(3.9 g, 40.5 mmol), 비스(트리-터트-부틸포스핀)팔라듐(0) (0.21 g, 0.4 mmol)을 톨루엔 100 mL 에 넣고 환류하여 교반하였다. 반응이 종료되면 상온으로 식힌 다음 톨루엔과 물로 추출하고 물 층을 제거하였다. 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 생성물은 컬럼 크로마토그래피로 분리 정제한 후 톨루엔과 헥산으로 재결정하여 화합물 4-3 (4.1 g, 60%)을 얻었다. MS [M+]= 849.0

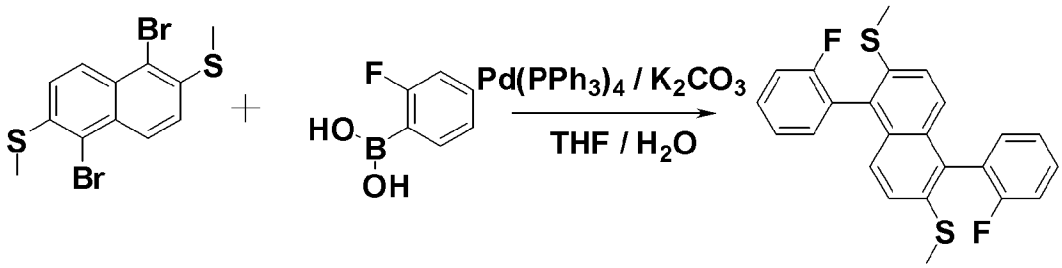
[413] 합성예 6. 화합물 4-21의 합성

[414] 상기 합성예 5의 5)에서 디올쏘토릴아민 대신 N-4-(터트-부틸)페닐-9,9-디메틸-1-플루오레닐아민을 사용한 것을 제외하고 동일하게 제조하여 화합물 4-21를 얻었다. MS[M+]=1137.5

[415] 합성예 7. 화합물 2-21의 합성

[416] 1) 중간체 2-a의 합성

[417]

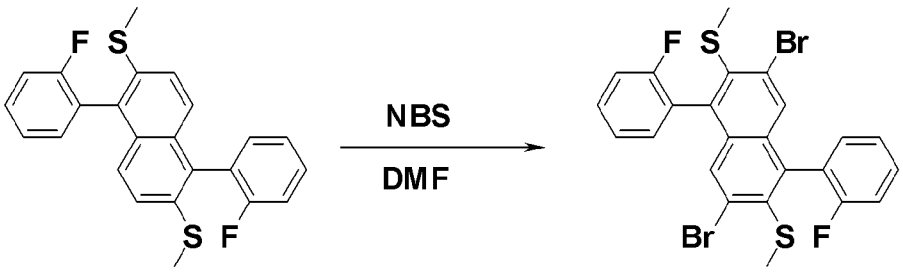


중간체 2-a

[418] 1,5-브로모-2,6-디메틸술폰 (20.0 g, 53 mmol), 2-플로로페닐보로닉산 (18.5 g, 132.5 mmol)을 테트라하이드로퓨란 300 mL에 완전히 녹인 후 탄산칼륨 (22 g, 159 mmol) 수용액 100 mL을 첨가하고, 테트라키스-(트리페닐포스핀)팔라듐 (3.1 g, 2.7 mmol)을 첨가한 후 24 시간동안 환류하여 교반하였다. 반응 완료 후 상온으로 온도를 낮춘 다음 물과 에틸 아세테이트로 추출하여 유기층을 분리하였다. 유기층은 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 고체는 에틸 아세테이트로 재결정하여 중간체 2-a (18.4 g, 85 %)를 얻었다. MS [M+]= 408.5

[419] 2) 중간체 2-b의 합성

[420]

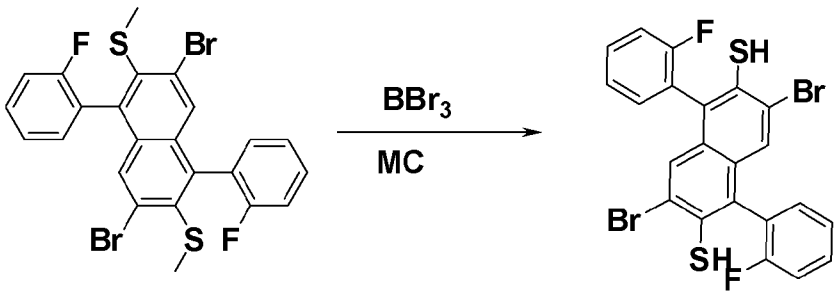


중간체 2-a 중간체 2-b

[421] 중간체 2-a (18 g, 44 mmol)을 디메틸포름아마이드 300 mL에 녹인 다음 N-브로모석신이미드 (16.5 g, 93 mmol)를 첨가해 주고 2시간 동안 교반 해 주었다. 반응 완료 후 물과 에틸 아세테이트로 추출하여 유기층을 분리하였다. 유기층은 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 고체는 에틸 아세테이트와 헥산으로 재결정하여 중간체 2-b (20 g, 80 %)를 얻었다. MS [M+]= 566.3

[422] 3) 중간체 2-c의 합성

[423]

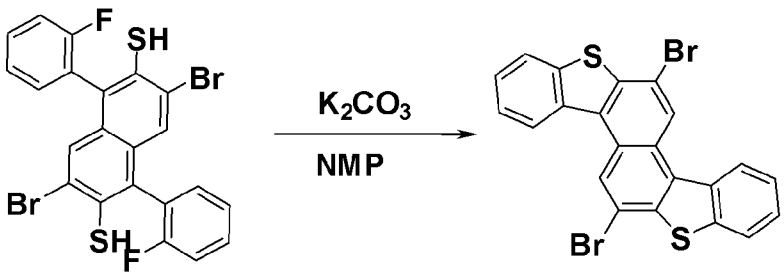


중간체 2-b 중간체 2-c

[424] 중간체 2-b (20 g, 35 mmol), 디크로로메탄 300 mL 를 넣고 1M BBr_3 in CH_2Cl_2 (140 ml, 140 mmol) 을 0℃에서 천천히 적가 후 8시간 교반 하였다. 반응 완료 후 $NaHCO_3$로 중성화 시킨 후 물과 CH_2Cl_2로 추출하여 유기층을 분리하였다. 유기층은 무수황산마그네슘으로 처리 후 여과 감압 농축하여 중간체 2-c (14 g, 75 %)를 얻었다. MS [M+]= 538.2

[425] 4) 중간체 2-d의 합성

[426]

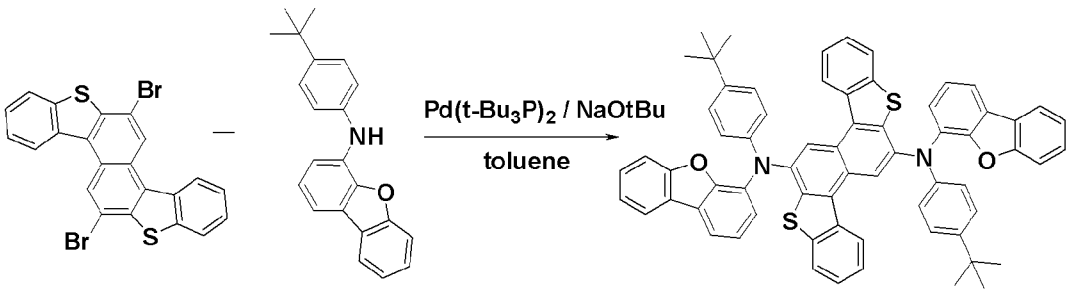


중간체 2-c 중간체 2-d

[427] 중간체 2-c (14 g, 26.3 mmol)와 K_2CO_3 (14.5 g, 105 mmol)를 NMP 150 mL에 넣고 150℃ 에서 8시간 교반 하였다. 반응 완료 후 500 mL 을 넣고 에틸 아세테이트로 추출하여 유기층을 분리하였다. 유기층은 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 고체는 톨루엔과 헥산으로 재결정하여 중간체 2-d (10.9 g, 83 %)를 얻었다. MS [M+]= 498.2

[428] 5) 화합물 2-21의 합성

[429]



중간체 2-d 화합물 2-21

[430] 질소분위기에서 둥근 바닥 플라스크에 중간체 2-d (5.0 g, 10 mmol), 4-터트부틸페닐-4-디벤조퓨라닐아민 (7 g, 22 mmol), 소듐터트부톡사이드(4.8 g,

50 mmol), 비스(트리-터트-부틸포스핀)팔라듐(0) (0.102 g, 0.2 mmol)을 톨루엔 150 mL 에 넣고 환류하여 교반하였다. 반응이 종료되면 상온으로 식힌 다음 톨루엔과 물로 추출하고 물 층을 제거하였다. 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 생성물은 컬럼 크로마토그래피로 분리 정제한 후 톨루엔과 헥산으로 재결정하여 화합물 2-21 (6.8 g, 70%)을 얻었다. MS [M+]= 967.2

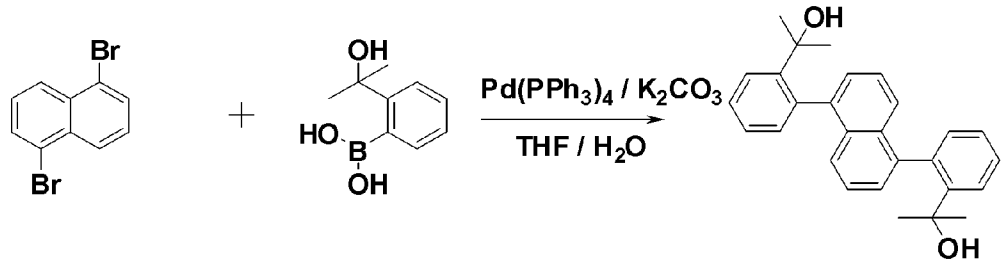
[431] 합성예 8. 화합물 2-22의 합성

[432] 상기 합성예 7의 5)에서 4-터트부틸페닐-4-디벤조퓨라닐아민 대신 N-4-(터트-부틸)페닐-1-나프틸아민을 사용한 것을 제외하고 동일하게 제조하여 화합물 2-22를 얻었다. MS[M+]=887.2

[433] 합성예 9. 화합물 5-2의 합성

[434] 1) 중간체 5-a의 합성

[435]

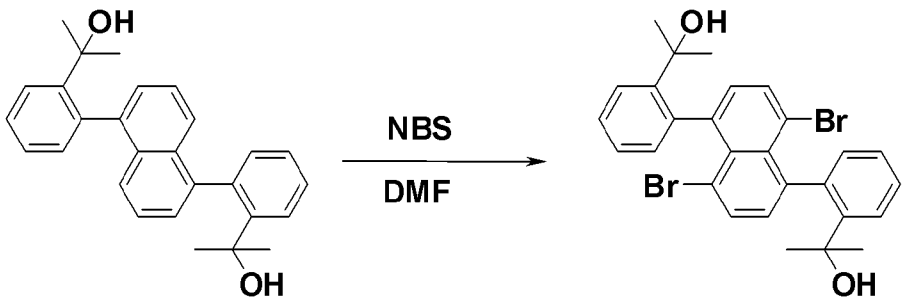


중간체 5-a

[436] 1,5-디브로모나프탈렌 (20.0 g, 70 mmol), 2-하이드록시프로판페닐보로닉산 (27.7 g, 154 mmol)을 테트라하이드로퓨란 400 mL에 완전히 녹인 후 탄산칼륨 (29 g, 210 mmol) 수용액 150 mL을 첨가하고,
테트라키스-(트리페닐포스핀)팔라듐 (4 g, 3.5 mmol)을 첨가한 후 12 시간동안 환류하여 교반하였다. 반응 완료 후 상온으로 온도를 낮춘 다음 물과 에틸 아세테이트로 추출하여 유기층을 분리하였다. 유기층은 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 고체는 에틸 아세테이트로 재결정하여 중간체 5-a (24.4 g, 88 %)를 얻었다. MS [M+]= 396.5

[437] 2) 중간체 5-b의 합성

[438]



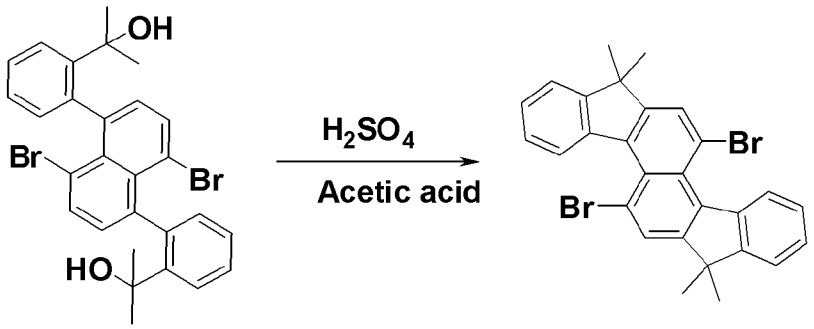
중간체 5-a 중간체 5-b

[439] 중간체 5-a (20 g, 50 mmol)을 디메틸포름아마이드 300 mL에 녹인 다음

N-브로모석신이미드 (18.7 g, 105 mmol)를 첨가해 주고 2시간 동안 교반해주었다. 반응 완료 후 물과 에틸 아세테이트로 추출하여 유기층을 분리하였다. 유기층은 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 고체는 에틸 아세테이트와 헥산으로 재결정하여 중간체 5-b (25 g, 90 %)를 얻었다. MS [M+]= 554.3

[440] 3) 중간체 5-c의 합성

[441]

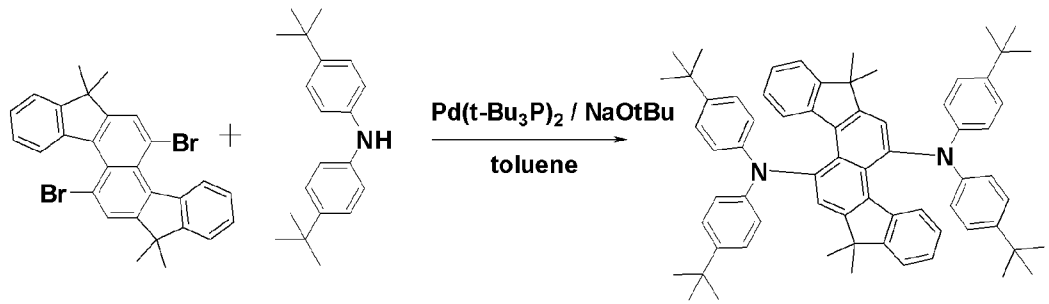


중간체 5-b 중간체 5-c

[442] 중간체 5-b (25 g, 45.1 mmol)를 아세트산 150 mL에 넣고 황산 1~2 방울 넣은 후 상온에서 8시간 교반 하였다. 반응 완료 후 500 mL 물을 넣고 에틸 아세테이트로 추출하여 유기층을 분리하였다. 유기층은 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 고체는 톨루엔으로 재결정하여 중간체 5-c (21.7 g, 93 %)를 얻었다. MS [M+]= 518.2

[443] 4) 화합물 5-2의 합성

[444]



중간체 5-c 중간체 5-2

[445] 질소분위기에서 둥근 바닥 플라스크에 중간체 5-c (10 g, 19 mmol), 4-비스터트부틸페닐아민 (13.3 g, 47.5 mmol), 소듐터트부톡사이드(7.3 g, 76 mmol), 비스(트리-터트-부틸포스핀)팔라듐(0) (0.485 g, 0.95 mmol)을 톨루엔 150 mL 에 넣고 환류하여 교반하였다. 반응이 종료되면 상온으로 식힌 다음 톨루엔과 물로 추출하고 물 층을 제거하였다. 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 생성물은 컬럼 크로마토그래피로 분리 정제한 후 톨루엔과 헥산으로 재결정하여 화합물 5-2 (11.3 g, 65%)을 얻었다. MS [M+]= 919.3

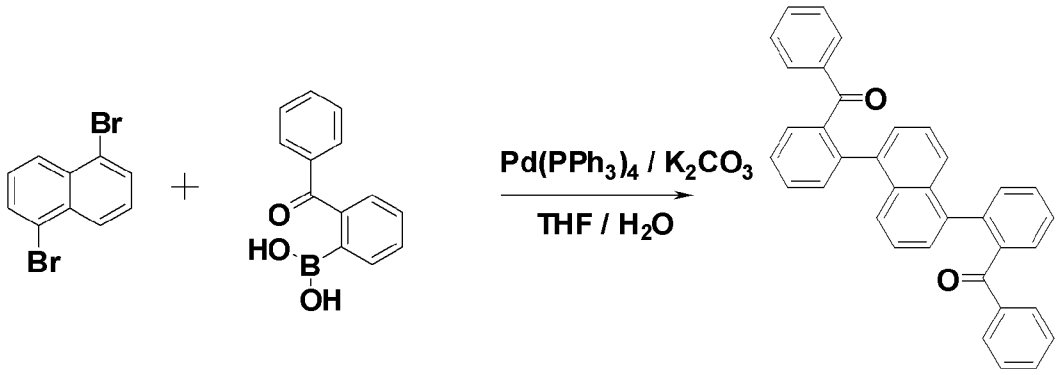
[446] 합성예 10. 화합물 5-21의 합성

[447] 상기 합성예 9의 4)에서 4-비스터트부틸페닐아민 대신 2-프루오로-o-톨루일아민을 사용한 것을 제외하고 동일하게 제조하여 화합물 5-21을 얻었다. MS[M+]=758.9

[448] 합성예 11. 화합물 6-21의 합성

[449] 1) 중간체 6-a의 합성

[450]

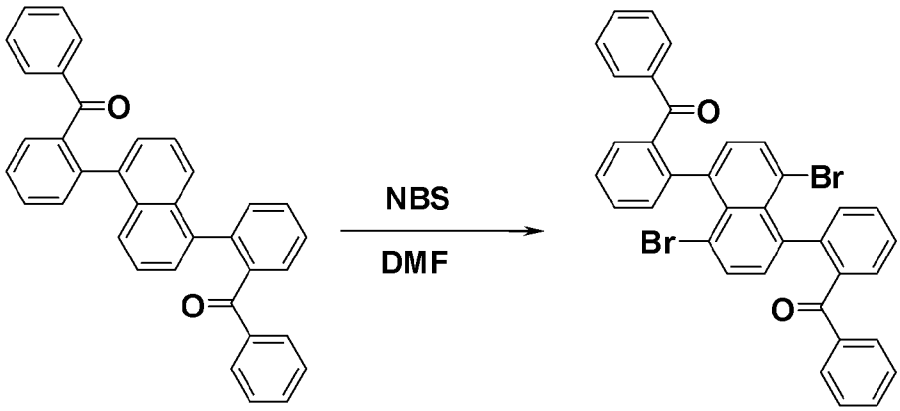


중간체 6-a

[451] 1,5-디브로모나프탈렌 (20.0 g, 70 mmol), 2-벤조페닐보로닉산 (35 g, 154 mmol)을 테트라하이드로퓨란 400 mL에 완전히 녹인 후 탄산칼륨 (29 g, 210 mmol) 수용액 150 mL을 첨가하고, 테트라키스-(트리페닐포스핀)팔라듐 (4 g, 3.5 mmol)을 첨가한 후 12 시간동안 환류하여 교반하였다. 반응 완료 후 상온으로 온도를 낮춘 다음 물과 에틸 아세테이트로 추출하여 유기층을 분리하였다. 유기층은 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 고체는 에틸 아세테이트로 재결정하여 중간체 6-a (28.7 g, 84 %)를 얻었다. MS [M+]= 488.5

[452] 2) 중간체 6-b의 합성

[453]



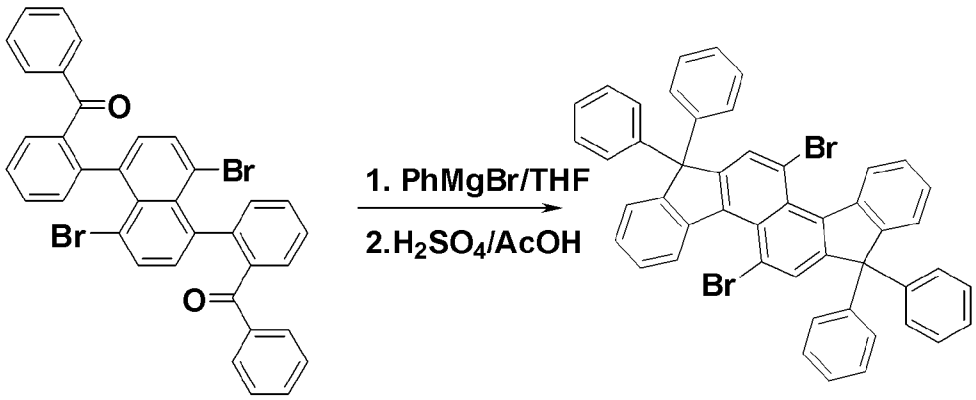
중간체 6-a 중간체 6-b

[454] 중간체 6-a (24.4 g, 50 mmol)을 디메틸포름아마이드 300 mL에 녹인 다음 N-브로모석신이미드 (18.7 g, 105 mmol)를 첨가해 주고 2시간 동안 교반 해 주었다. 반응 완료 후 물과 에틸 아세테이트로 추출하여 유기층을 분리하였다.

유기층은 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 고체는 에틸 아세테이트와 헥산으로 재결정하여 중간체 6-b (27.5 g, 85 %)를 얻었다. MS [M+]= 646.3

[455] 3) 중간체 6-c의 합성

[456]

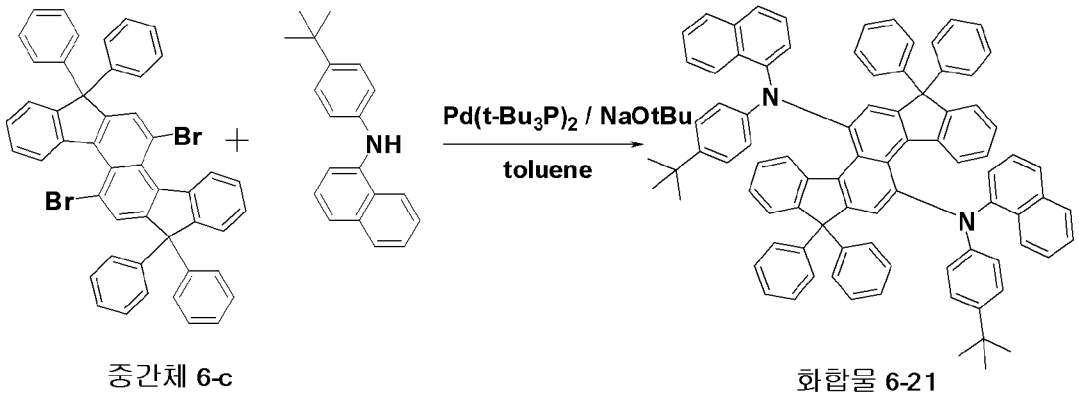


중간체 6-b 중간체 6-c

[457] 질소 분위기 하에서 중간체 6-b (20 g, 38 mmol)을 무수 THF 300 mL에 녹인 다음 0℃에서 페닐마그네슘브로마이드 (41 ml, 41.8 mmol)를 첨가해 주고 2시간 동안 상온교만 한다. 다시 0℃로 내린 후 페닐마그네슘브로마이드 (41 ml, 41.8 mmol)를 첨가해 주고 2시간 동안 상온교만 해 주었다. 반응 완료 후 물과 에틸 아세테이트로 추출하여 유기층을 분리하였다. 유기층은 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 별도의 정제 없이 acetic acid 150 mL에 넣고 황산 1~2 방울 넣은 후 상온에서 8시간 교반 하였다. 반응 완료 후 500 mL 물을 넣고 에틸 아세테이트로 추출하여 유기층을 분리하였다. 유기층은 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 고체는 톨루엔으로 재결정하여 중간체 6-c (21.7 g, 75 %)를 얻었다. MS [M+]= 766.5

[458] 4) 화합물 6-21의 합성

[459]



중간체 6-c 화합물 6-21

[460] 질소분위기에서 둥근 바닥 플라스크에 중간체 6-c (14.5 g, 19 mmol), 4-터트부틸-1-나프틸아민 (13.1 g, 47.5 mmol), 소듐터트부톡사이드(7.3 g, 76 mmol), 비스(트리-터트-부틸포스핀)팔라듐(0) (0.485 g, 0.95 mmol)을 톨루엔 150

mL 에 넣고 환류하여 교반하였다. 반응이 종료되면 상온으로 식힌 다음 톨루엔과 물로 추출하고 물 층을 제거하였다. 무수황산마그네슘으로 처리 후 여과 감압 농축하였다. 생성물은 컬럼 크로마토그래피로 분리 정제한 후 톨루엔과 헥산으로 재결정하여 화합물 6-21 (13.2 g, 60%)을 얻었다. MS [M+]= 1155.5

[461] 합성예 12. 화합물 6-1의 합성

[462] 상기 합성예 11의 4)에서 4-터트부틸-1-나프틸아민 대신 디페닐아민을 사용한 것을 제외하고 동일하게 제조하여 화합물 6-1을 얻었다. MS[M+]=943.2

[463] 유기 발광 소자의 제조

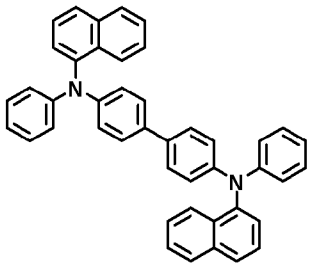
[464] 실시예 1

[465] ITO(인듐 주석 산화물)가 1,000Å 두께로 박막 코팅된 유리 기판(corning 7059 glass)을, 분산제를 녹인 증류수 에 넣고 초음파로 세척하였다. 세제는 Fischer Co.의 제품을 사용하였으며, 증류수는 Millipore Co. 제품의 필터(Filter)로 2차 걸러진 증류수를 사용하였다. ITO를 30분간 세척한 후, 증류수로 2회 반복하여 초음파 세척을 10분간 진행하였다. 증류수 세척이 끝난 후 이소프로필알콜, 아세톤, 메탄올 용제 순서로 초음파 세척을 하고 건조시켰다.

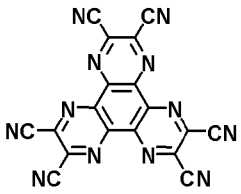
[466] 이렇게 준비된 ITO 투명 전극 위에 하기 HAT를 50Å의 두께로 열 진공 증착하여 정공주입층을 형성하였다. 그 위에 정공수송층으로 하기 HT-A 1000Å을 진공 증착하고, 하기 HT-B 100 Å을 증착하였다. 발광층으로 호스트로 하기 H-A에 도펀트로 상기 합성예 1의 화합물 1-2를 4%을 도핑하여 200Å두께로 진공 증착하였다. 그 다음에 하기 ET-A와 하기 Liq를 1:1 비율로 300Å을 증착하였고 이 위에 순차적으로 150Å 두께의 은(Ag) 10% 도핑된 마그네슘(Mg) 그리고 1,000Å 두께의 알루미늄을 증착하여 음극을 형성하여, 유기 발광 소자를 제조하였다.

[467] 상기의 과정에서 유기물의 증착속도는 1 Å/sec를 유지하였고, LiF는 0.2 Å/sec, 알루미늄은 3Å/sec 내지 7Å/sec의 증착속도를 유지하였다.

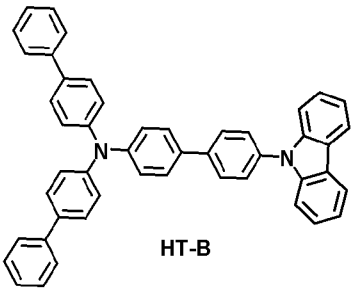
[468]



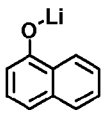
HT-A



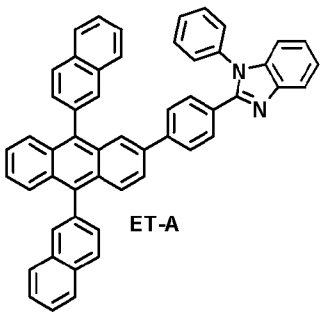
HAT



HT-B

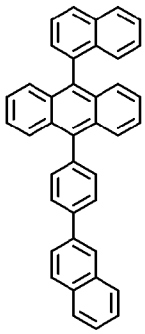


Liq

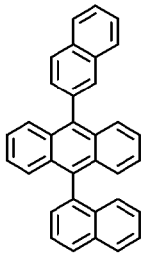


ET-A

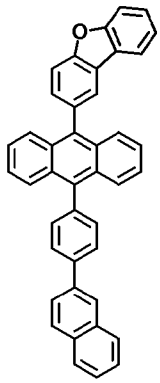
[469]



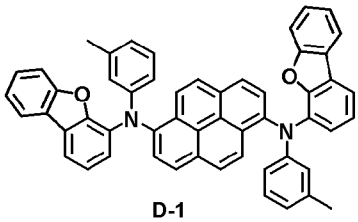
H-A



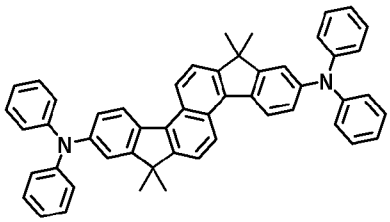
H-B



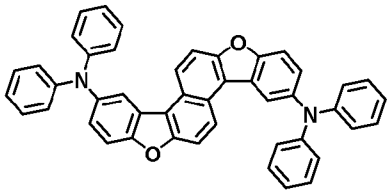
H-C



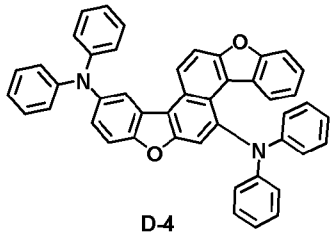
D-1



D-2



D-3



D-4

[470] 실시예 2 내지 36 및 비교예 1 내지 12

[471] 상기 실시예 1에서 발광층의 호스트로 상기 H-A 대신 하기 표 5 내지 7의 호스트를 사용하고, 발광층의 도펀트로 상기 화합물 1-2 대신 하기 표 5 내지 7의 도펀트를 사용한 것을 제외하고는 실시예 1과 동일하게 유기 발광 소자를 제조하였다.

[472] 상기 실시예 1 내지 36 및 비교예 1 내지 비교예 12의 유기 발광 소자를 10mA/cm^{2}의 전류밀도에서 구동전압과 발광 효율을 측정하였고, 20mA/cm^{2}의 전류밀도에서 초기 휘도 대비 95%가 되는 시간(LT95)을 측정하였다. 그 결과를 하기 표 5 내지 7에 나타내었다.

[473] [표5]

	호스트	도펀트	@ 10 mA/cm^2			T 95
			전압(V)	효율(cd/A)	color	수명(hr)
실시예 1	H-A	화합물 1-2	4.22	7.28	blue	100
실시예 2	H-A	화합물 1-21	4.21	6.84	blue	130
실시예 3	H-A	화합물 1-22	4.32	6.96	blue	125
실시예 4	H-A	화합물 1-23	4.32	6.61	blue	125
실시예 5	H-A	화합물 4-3	4.30	6.51	blue	110
실시예 6	H-A	화합물 4-21	4.20	6.66	blue	115
실시예 7	H-A	화합물 2-21	4.18	6.89	blue	110
실시예 8	H-A	화합물 2-22	4.26	6.82	blue	120
실시예 9	H-A	화합물 5-2	4.14	6.91	blue	105
실시예 10	H-A	화합물 5-21	4.08	6.72	blue	105
실시예 11	H-A	화합물 6-21	4.14	6.87	blue	115
실시예 12	H-A	화합물 6-1	4.16	6.42	blue	120
비교예 1	H-A	D-1	4.39	5.13	blue	75
비교예 2	H-A	D-2	4.42	3.50	blue	50
비교예 3	H-A	D-3	4.40	5.12	blue	85
비교예 4	H-A	D-4	4.54	4.88	blue	55

[474] [표6]

	호스트	도펀트	@ 10 mA/cm^2			T 95
			전압(V)	효율(cd/A)	color	수명(hr)
실시예 13	H-B	화합물 1-2	4.35	7.21	blue	120
실시예 14	H-B	화합물 1-21	4.34	6.77	blue	140
실시예 15	H-B	화합물 1-22	4.45	6.89	blue	135
실시예 16	H-B	화합물 1-23	4.45	6.54	blue	125
실시예 17	H-B	화합물 4-3	4.43	6.44	blue	115
실시예 18	H-B	화합물 4-21	4.33	6.79	blue	115
실시예 19	H-B	화합물 2-21	4.31	6.82	blue	135
실시예 20	H-B	화합물 2-22	4.39	6.75	blue	130
실시예 21	H-B	화합물 5-2	4.26	6.84	blue	120
실시예 22	H-B	화합물 5-21	4.20	6.35	blue	120
실시예 23	H-B	화합물 6-21	4.26	6.80	blue	120
실시예 24	H-B	화합물 6-1	4.28	6.56	blue	125
비교예 5	H-B	D-1	4.56	5.18	blue	80
비교예 6	H-B	D-2	4.54	4.50	blue	60
비교예 7	H-B	D-3	4.55	5.32	blue	95
비교예 8	H-B	D-4	4.60	5.58	blue	70

[475] [표7]

	호스트	도펀트	@ 10 mA/cm^2			T 95
			전압(V)	효율(cd/A)	color	수명(hr)
실시예 25	H-C	화합물 1-2	4.14	6.28	blue	120
실시예 26	H-C	화합물 1-21	4.13	6.54	blue	120
실시예 27	H-C	화합물 1-22	4.23	6.66	blue	115
실시예 28	H-C	화합물 1-23	4.23	6.30	blue	125
실시예 29	H-C	화합물 4-3	4.21	6.10	blue	120
실시예 30	H-C	화합물 4-21	4.12	6.06	blue	115
실시예 31	H-C	화합물 2-21	4.10	6.09	blue	120
실시예 32	H-C	화합물 2-22	4.17	6.42	blue	130
실시예 33	H-C	화합물 5-2	4.06	6.42	blue	115
실시예 34	H-C	화합물 5-21	4.00	6.22	blue	125
실시예 35	H-C	화합물 6-21	4.06	6.16	blue	115
실시예 36	H-C	화합물 6-1	4.08	6.22	blue	125
비교예 9	H-C	D-1	4.32	4.86	blue	70
비교예10	H-C	D-2	4.33	4.50	blue	60
비교예 11	H-C	D-3	4.40	4.88	blue	75
비교예 12	H-C	D-4	4.40	4.24	blue	50

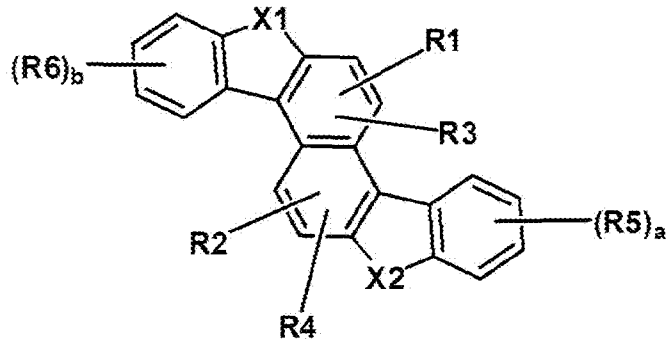
[476] 상기 표 5 내지 7에 따르면, 본 명세서의 일 실시상태에 따른 화학식 1은 상기 R1 내지 R4 위치 중 적어도 두 개에 아민기(상기 화학식 A)를 포함하고, 이를

발광층의 도펀트로서 포함하는 실시예 1 내지 36의 유기 발광 소자는 본 명세서의 화학식 1과 코어가 상이한 비교예 1, 5 및 9의 유기 발광 소자, 상기 R5 및 R6위치에 아민기를 포함하는 비교예 2, 3, 6, 7, 10 및 11의 유기 발광 소자, 및 상기 R4 및 R6(또는 R2 및 R6)위치에 아민기를 포함하는 비교예 4, 8 및 12의 유기 발광 소자 보다 수명이 구동전압이 낮고, 효율이 우수하며, 장수명의 특징이 있다. 특히 수명면에서 상기 실시예 1 내지 36의 유기 발광 소자는 비교예 1 내지 12의 유기 발광 소자 보다 110% 내지 270% 우수함을 알 수 있다.

청구범위

[청구항 1] 하기 화학식 1로 표시되는 화합물:

[화학식 1]



상기 화학식 1에 있어서,

X1 및 X2는 서로 같거나 상이하고, 각각 독립적으로 -O-, -S-, -C(R7R8)-, 또는 -N(R9)-이며,

R1 내지 R4 중 적어도 2개는 서로 같거나 상이하고, 각각 독립적으로 하기 화학식 A로 표시되는 기이고,

R1 내지 R4 중 하기 화학식 A가 아닌 기는 서로 같거나 상이하고, 각각 독립적으로 수소; 중수소; 치환 또는 비치환된 알킬기; 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이며,

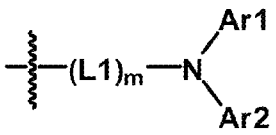
R5 및 R6는 서로 같거나 상이하고, 각각 독립적으로 수소; 중수소; 치환 또는 비치환된 알킬기; 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이거나, 인접한 치환기는 서로 결합하여 치환 또는 비치환된 고리를 형성하고,

R7 내지 R9는 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 알킬기; 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이고,

a 및 b는 각각 1 내지 4의 정수이며,

상기 a 및 b가 각각 2 이상인 경우, 2 이상의 괄호 내의 구조는 서로 같거나 상이하고,

[화학식 A]



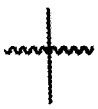
상기 화학식 A에 있어서,

L1은 직접결합; 치환 또는 비치환된 아릴렌기; 또는 치환 또는 비치환된 헤테로아릴렌기이며,

Ar1 및 Ar2는 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이거나, 서로 결합하여 치환 또는 비치환된 고리를 형성할 수 있고,

m은 1 내지 5의 정수이며,

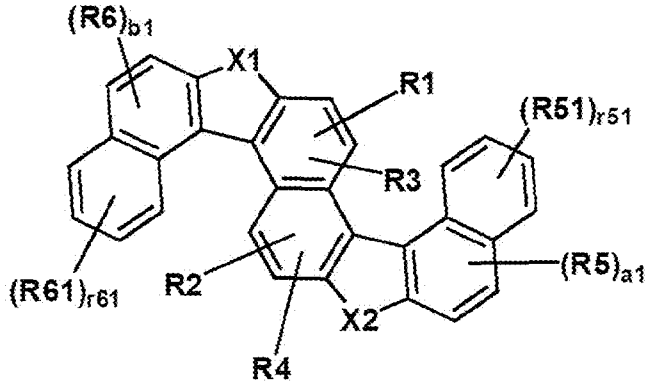
상기 m이 2이상인 경우, 2 이상의 L1은 서로 같거나 상이하고,



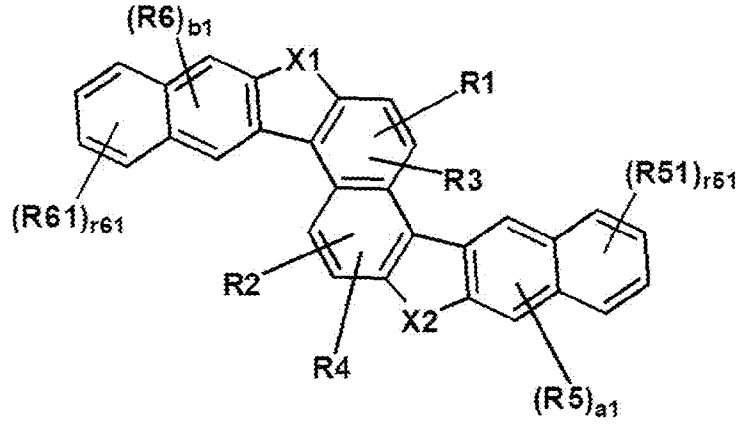
는 화학식 1에 결합되는 부위이다.

[청구항 2] 청구항 1에 있어서, 상기 화학식 1은 하기 화학식 1-1 내지 1-3 중 어느 하나로 표시되는 것인 화합물:

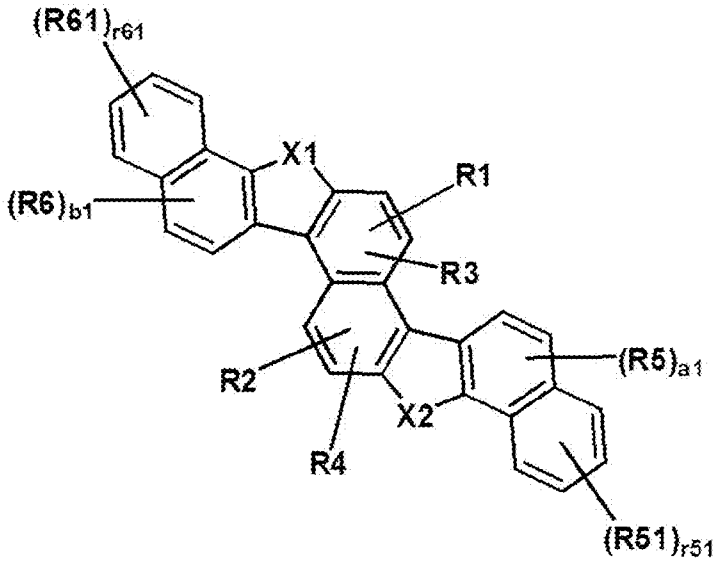
[화학식 1-1]



[화학식 1-2]



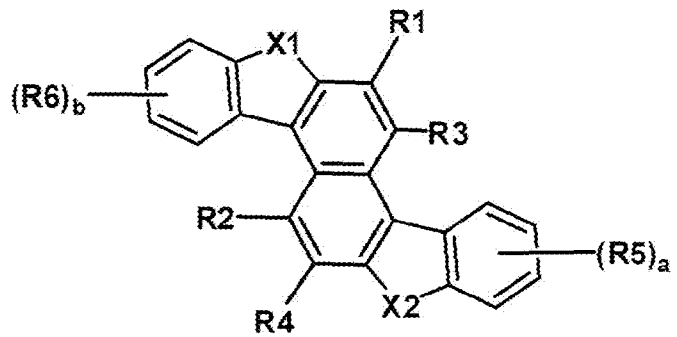
[화학식 1-3]



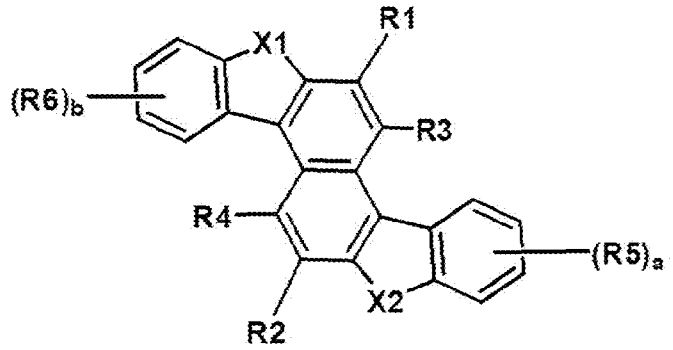
상기 화학식 1-1 내지 1-3에 있어서,
X1, X2 및 R1 내지 R4의 정의는 상기 화학식 1에서 정의한 바와 동일하고,
R5, R6, R51 및 R61은 서로 같거나 상이하고, 각각 독립적으로 수소; 중수소; 치환 또는 비치환된 알킬기; 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이며,
a1 및 b1은 각각 1 또는 2이고,
r51 및 r61은 각각 1 내지 4의 정수이며,
상기 a1 및 b1가 각각 2 인 경우, 상기 괄호 내의 구조는 서로 같거나 상이하고,
상기 r51 및 r61이 각각 2 이상인 경우, 2 이상의 괄호 내의 구조는 서로 같거나 상이하다.

[청구항 3] 청구항 1에 있어서, 상기 화학식 1은 하기 화학식 1-4 내지 1-7 중 어느 하나로 표시되는 것인 화합물:

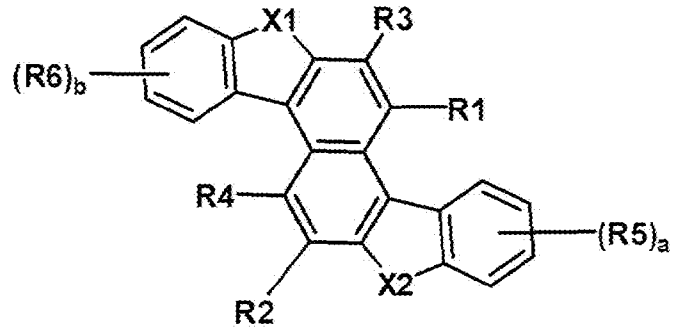
[화학식 1-4]



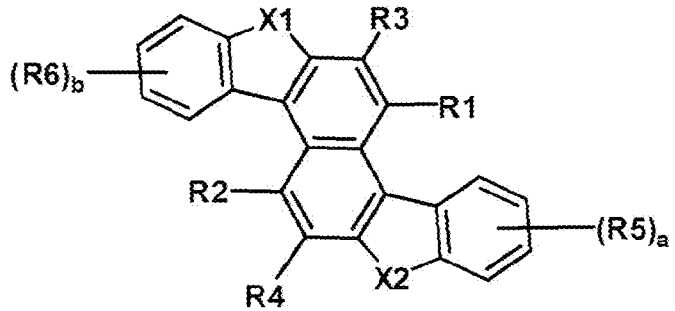
[화학식 1-5]



[화학식 1-6]



[화학식 1-7]



상기 화학식 1-4 내지 1-7에 있어서,

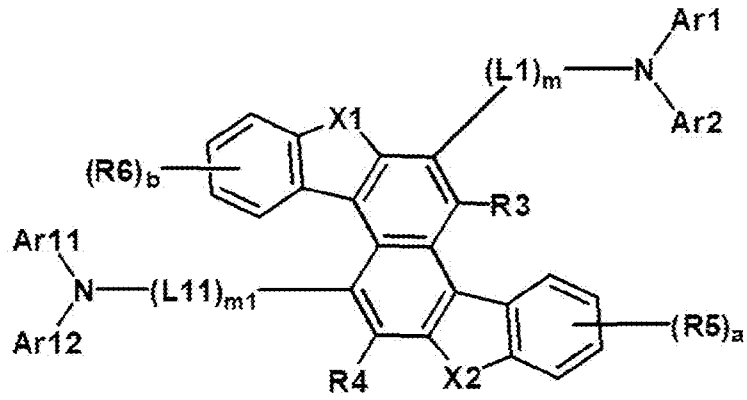
X1, X2, R5, R6, a 및 b의 정의는 상기 화학식 1에서 정의한 바와 동일하고,

R1 및 R2는 서로 같거나 상이하고, 각각 독립적으로 상기 화학식 A로 표시되는 기이고,

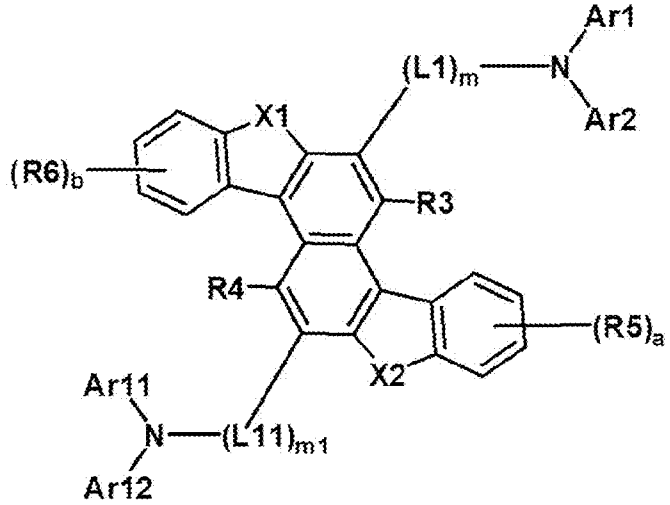
R3 및 R4는 서로 같거나 상이하고, 각각 독립적으로 수소; 중수소; 치환 또는 비치환된 알킬기; 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이다.

[청구항 4] 청구항 1에 있어서, 상기 화학식 1은 하기 화학식 1-9 내지 1-12 중 어느 하나로 표시되는 것인 화합물:

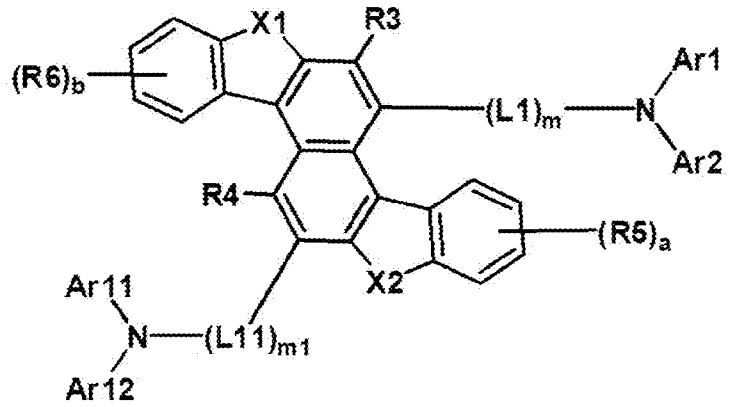
[화학식 1-9]



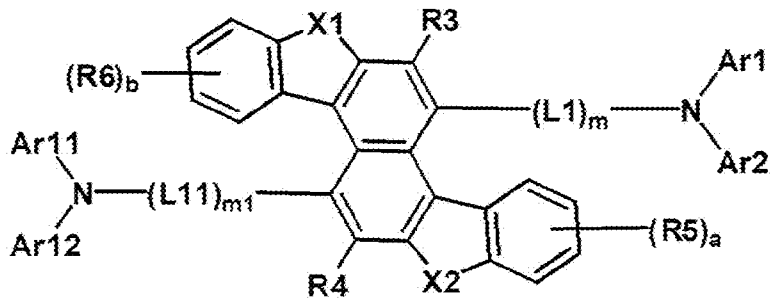
[화학식 1-10]



[화학식 1-11]



[화학식 1-12]



상기 화학식 1-9 내지 1-12에 있어서,

X1, X2, R5 및 R6, a 및 b의 정의는 상기 화학식 1에서 정의한 바와 동일하며,

L1, m, Ar1 및 Ar2의 정의는 상기 화학식 A에서 정의한 바와 동일하고,

R3 및 R4는 서로 같거나 상이하고, 각각 독립적으로 수소; 중수소; 치환 또는 비치환된 알킬기; 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이고,

L11은 직접결합; 치환 또는 비치환된 아릴렌기; 또는 치환 또는 비치환된 헤테로아릴렌기이며,

Ar11 및 Ar12는 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이거나, 서로 결합하여 치환 또는 비치환된 고리를 형성할 수 있고,

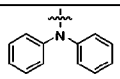
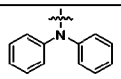
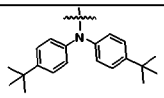
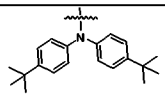
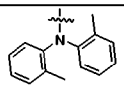
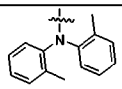
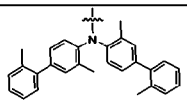
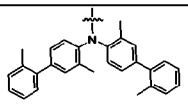
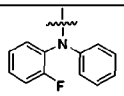
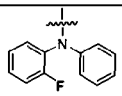
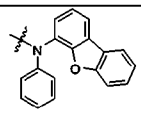
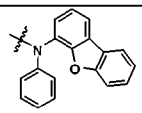
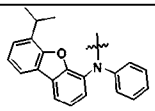
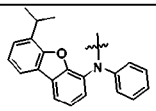
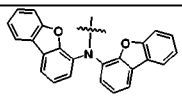
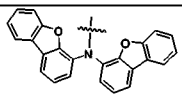
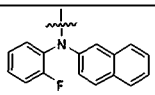
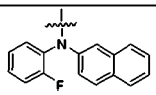
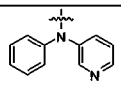
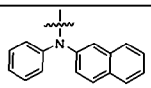
m1은 1 내지 5의 정수이며,

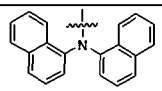
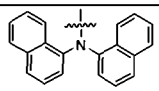
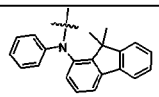
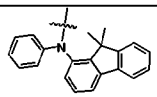
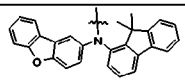
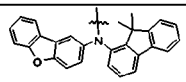
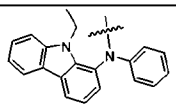
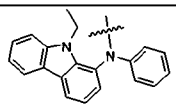
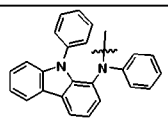
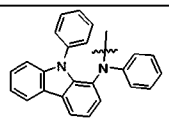
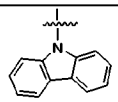
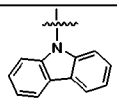
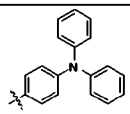
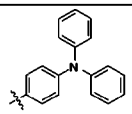
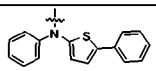
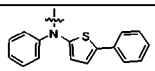
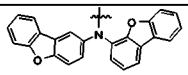
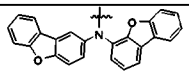
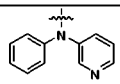
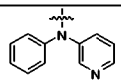
상기 m1이 2이상인 경우, 2 이상의 L11은 서로 같거나 상이하다.

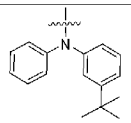
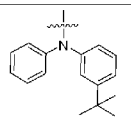
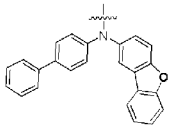
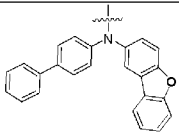
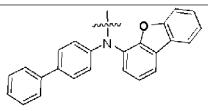
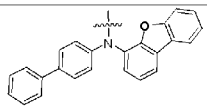
[청구항 5] 청구항 1에 있어서, 상기 L1은 직접결합; 또는 아릴렌기인 것인 화합물.

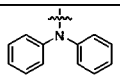
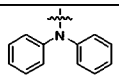
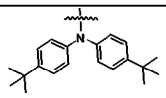
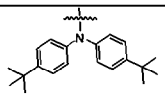
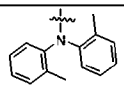
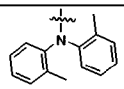
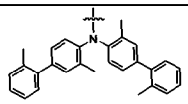
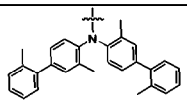
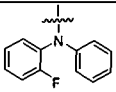
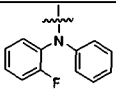
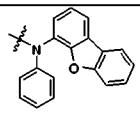
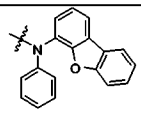
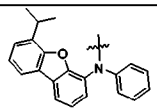
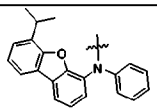
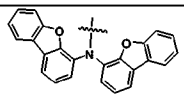
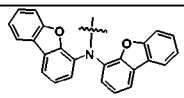
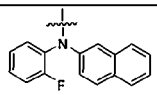
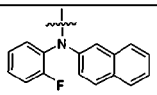
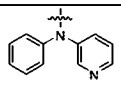
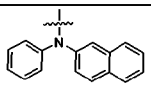
[청구항 6] 청구항 1에 있어서, 상기 Ar1 및 Ar2는 서로 같거나 상이하고, 각각 독립적으로 할로겐기, 알킬기, 또는 아릴기로 치환 또는 비치환된 아릴기; 또는 알킬기, 또는 아릴기로 치환 또는 비치환된 헤테로아릴기인 것인 화합물.

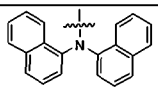
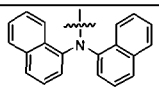
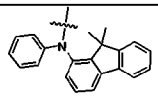
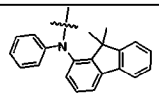
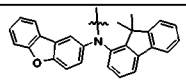
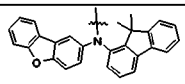
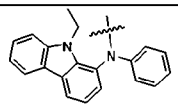
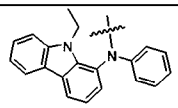
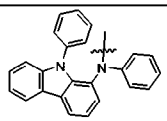
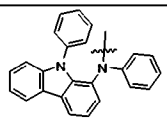
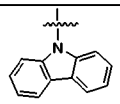
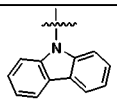
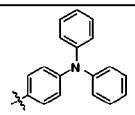
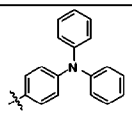
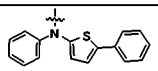
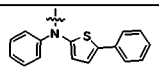
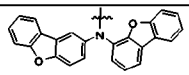
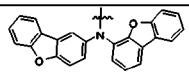
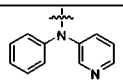
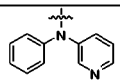
[청구항 7] 청구항 1에 있어서, 상기 화학식 1은 하기 화합물 중에서 선택되는 것인 화합물:

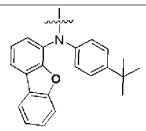
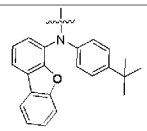
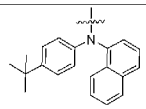
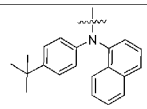
화합물	X1	X2	R1	R2	R3 내지 R6
1-1	O	O			H
1-2	O	O			H
1-3	O	O			H
1-4	O	O			H
1-5	O	O			H
1-6	O	O			H
1-7	O	O			H
1-8	O	O			H
1-9	O	O			H
1-10	O	O			H

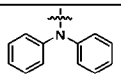
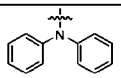
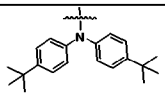
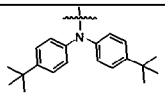
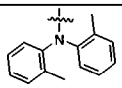
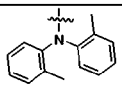
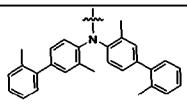
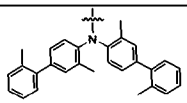
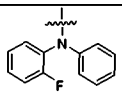
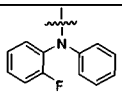
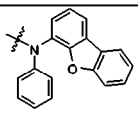
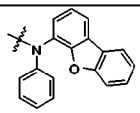
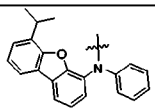
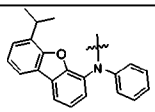
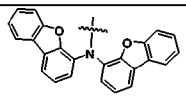
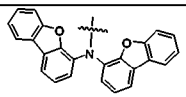
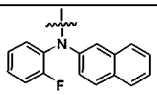
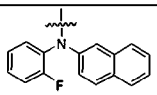
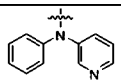
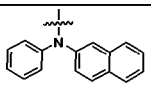
1-11	O	O			H
1-12	O	O			H
1-13	O	O			H
1-14	O	O			H
1-15	O	O			H
1-16	O	O			H
1-17	O	O			H
1-18	O	O			H
1-19	O	O			H
1-20	O	O			H

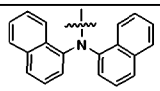
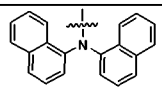
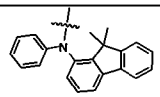
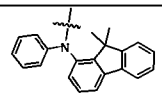
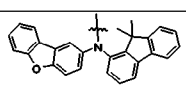
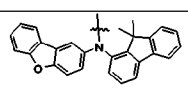
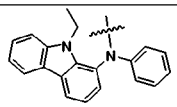
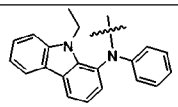
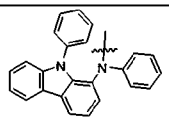
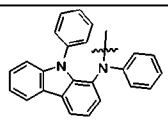
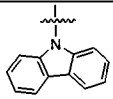
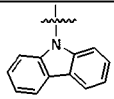
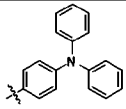
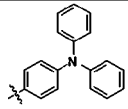
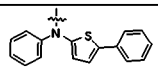
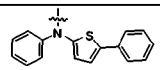
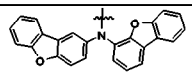
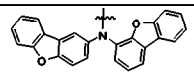
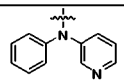
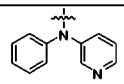
1-21	O	O			H
1-22	O	O			H
1-23	O	O			H

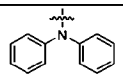
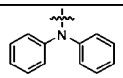
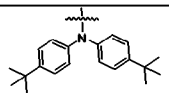
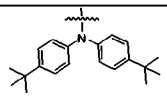
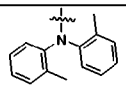
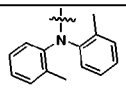
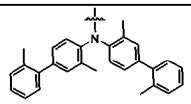
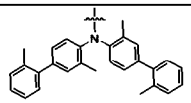
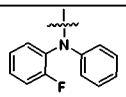
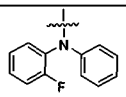
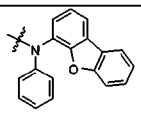
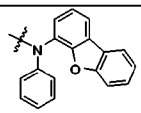
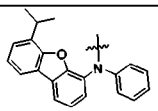
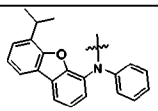
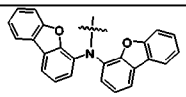
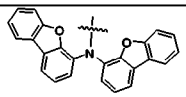
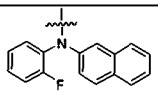
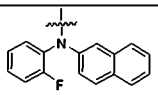
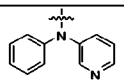
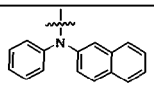
화합물	X1	X2	R1	R2	R3 내지 R6
2-1	S	S			H
2-2	S	S			H
2-3	S	S			H
2-4	S	S			H
2-5	S	S			H
2-6	S	S			H
2-7	S	S			H
2-8	S	S			H
2-9	S	S			H
2-10	S	S			H

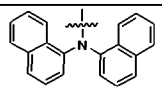
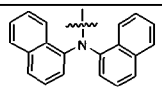
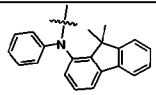
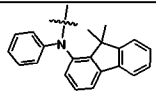
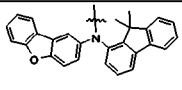
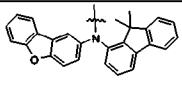
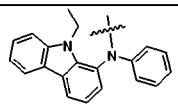
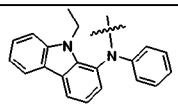
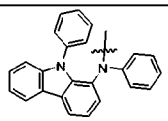
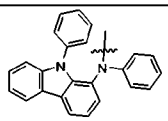
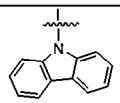
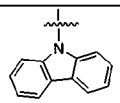
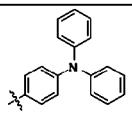
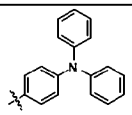
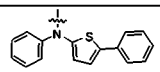
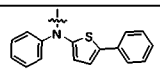
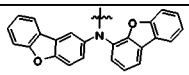
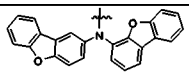
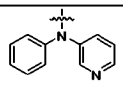
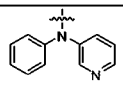
2-11	**S**	**S**			**H**
2-12	**S**	**S**			**H**
2-13	**S**	**S**			**H**
2-14	**S**	**S**			**H**
2-15	**S**	**S**			**H**
2-16	**S**	**S**			**H**
2-17	**S**	**S**			**H**
2-18	**S**	**S**			**H**
2-19	**S**	**S**			**H**
2-20	**S**	**S**			**H**

2-21	S	S			H
2-22	S	S			H

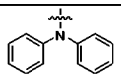
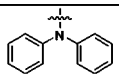
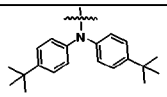
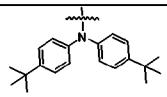
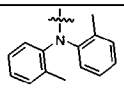
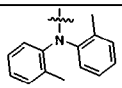
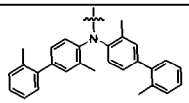
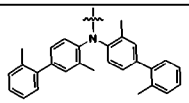
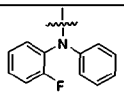
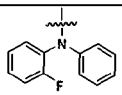
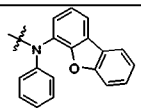
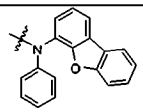
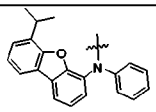
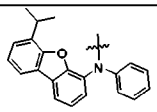
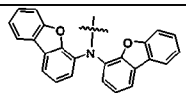
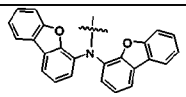
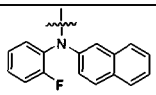
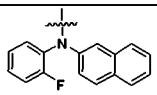
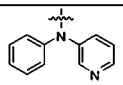
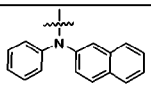
화합물	X1	X2	R1	R2	R3 내지 R6
3-1	N	N			H
3-2	N	N			H
3-3	N	N			H
3-4	N	N			H
3-5	N	N			H
3-6	N	N			H
3-7	N	N			H
3-8	N	N			H
3-9	N	N			H
3-10	N	N			H

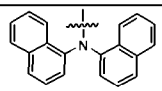
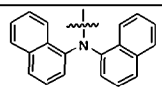
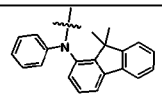
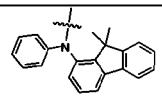
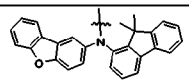
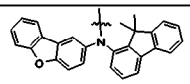
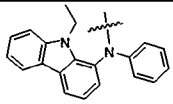
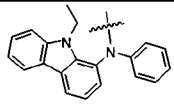
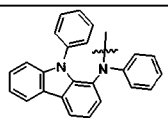
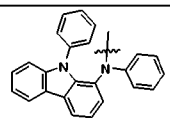
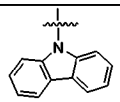
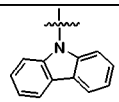
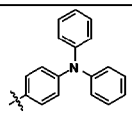
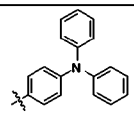
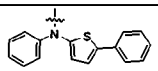
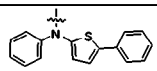
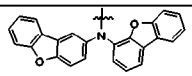
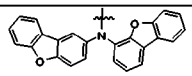
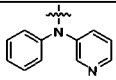
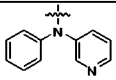
3-11					H
3-12					H
3-13					H
3-14					H
3-15					H
3-16					H
3-17					H
3-18					H
3-19					H
3-20					H

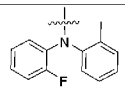
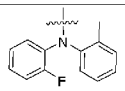
화합물	X1	X2	R1	R2	R3 내지 R6
4-1					H
4-2					H
4-3					H
4-4					H
4-5					H
4-6					H
4-7					H
4-8					H
4-9					H
4-10					H

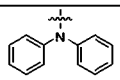
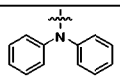
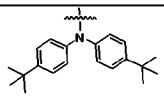
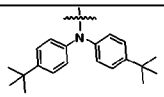
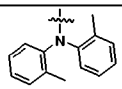
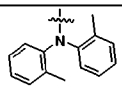
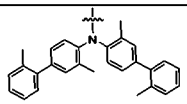
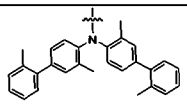
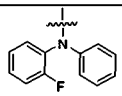
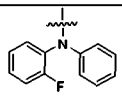
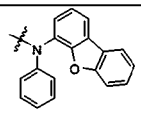
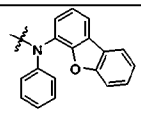
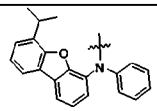
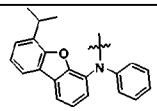
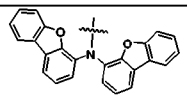
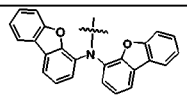
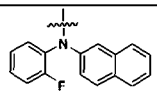
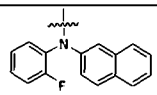
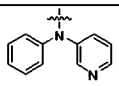
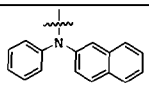
4-11					H
4-12					H
4-13					H
4-14					H
4-15					H
4-16					H
4-17					H
4-18					H
4-19					H
4-20					H

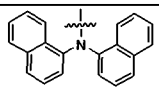
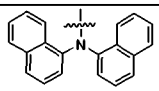
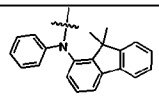
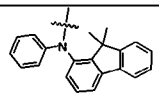
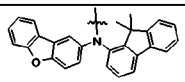
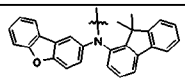
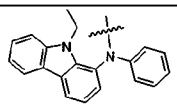
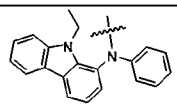
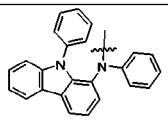
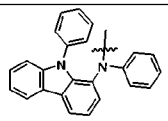
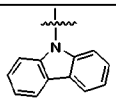
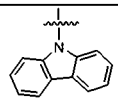
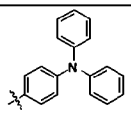
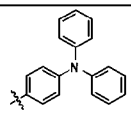
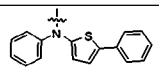
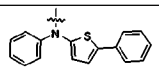
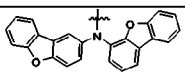
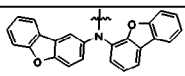
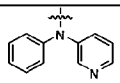
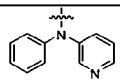
4-21					H

화합물	X1	X2	R1	R2	R3 내지 R6
5-1	C	C			H
5-2	C	C			H
5-3	C	C			H
5-4	C	C			H
5-5	C	C			H
5-6	C	C			H
5-7	C	C			H
5-8	C	C			H
5-9	C	C			H
5-10	C	C			H

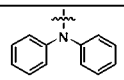
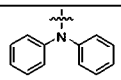
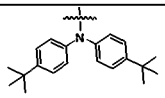
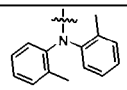
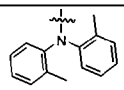
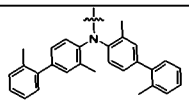
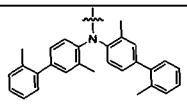
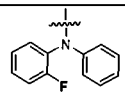
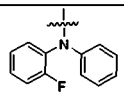
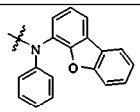
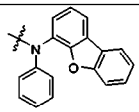
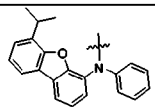
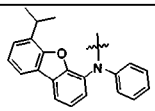
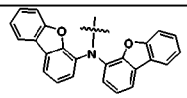
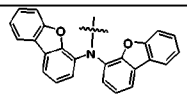
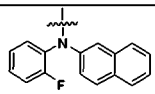
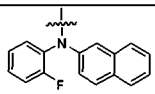
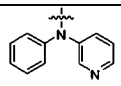
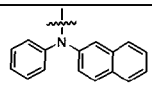
5-11	C	C			H
5-12	C	C			H
5-13	C	C			H
5-14	C	C			H
5-15	C	C			H
5-16	C	C			H
5-17	C	C			H
5-18	C	C			H
5-19	C	C			H
5-20	C	C			H

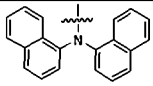
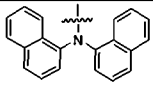
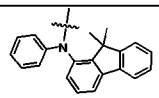
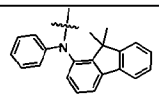
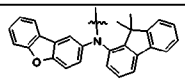
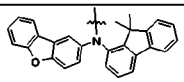
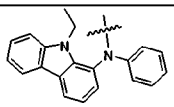
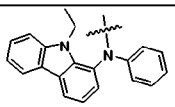
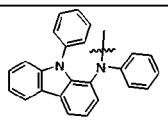
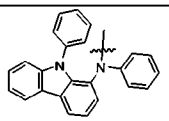
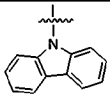
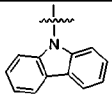
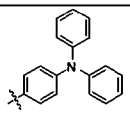
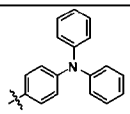
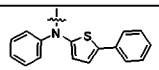
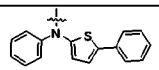
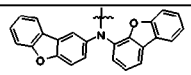
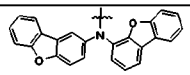
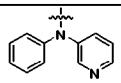
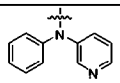
5-21	C	C			H

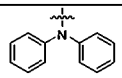
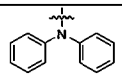
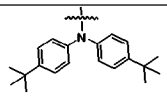
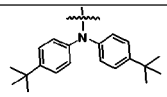
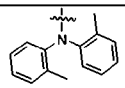
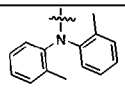
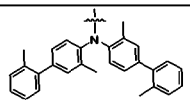
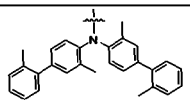
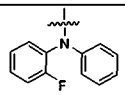
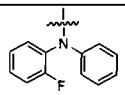
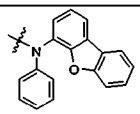
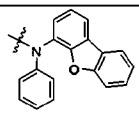
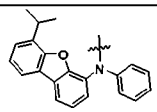
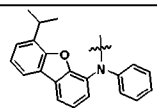
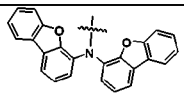
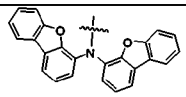
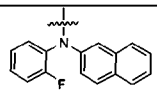
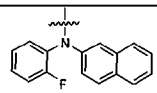
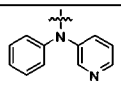
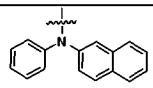
화합물	X1	X2	R1	R2	R3 내지 R6
6-1					H
6-2					H
6-3					H
6-4					H
6-5					H
6-6					H
6-7					H
6-8					H
6-9					H
6-10					H

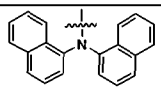
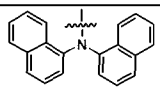
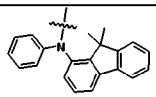
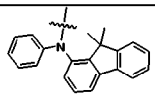
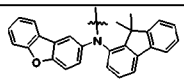
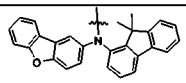
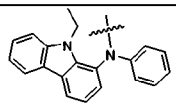
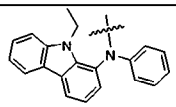
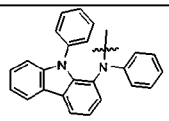
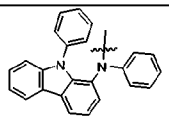
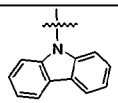
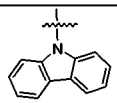
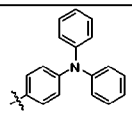
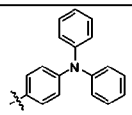
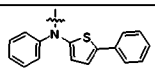
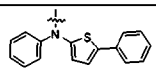
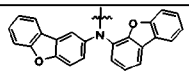
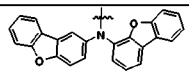
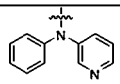
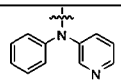
6-11					H
6-12					H
6-13					H
6-14					H
6-15					H
6-16					H
6-17					H
6-18					H
6-19					H
6-20					H

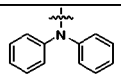
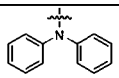
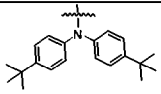
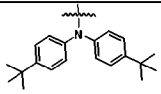
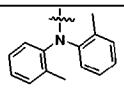
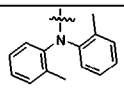
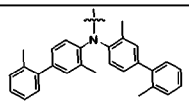
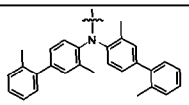
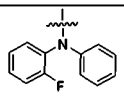
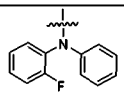
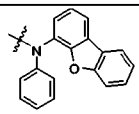
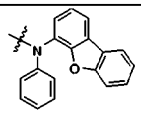
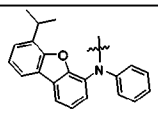
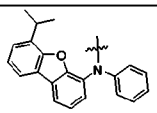
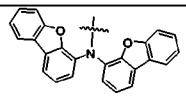
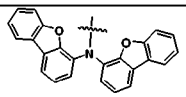
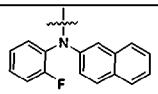
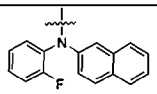
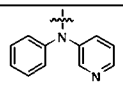
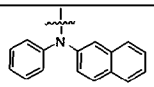
6-21					H

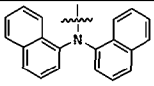
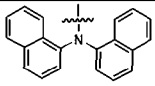
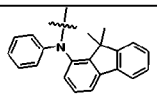
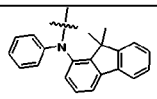
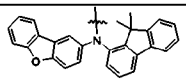
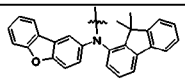
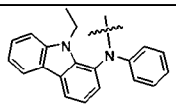
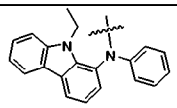
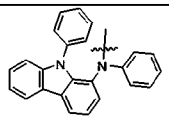
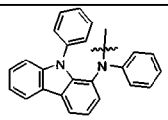
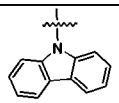
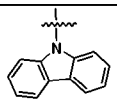
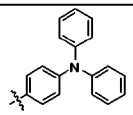
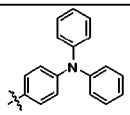
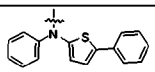
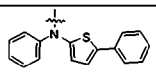
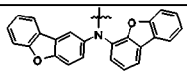
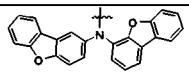
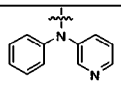
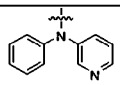
화합물	X1	X2	R1	R2	R3 내지 R6
7-1	O	S			H
7-2	O				H
7-3	O				H
7-4	O				H
7-5	O				H
7-6	S				H
7-7	S				H
7-8	S				H
7-9	S				H
7-10					H

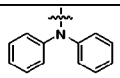
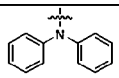
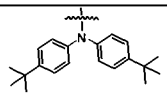
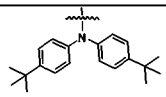
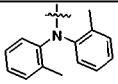
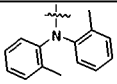
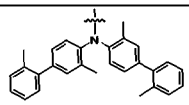
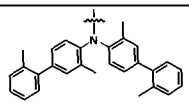
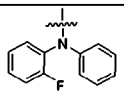
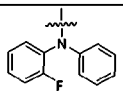
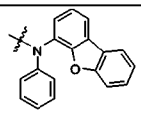
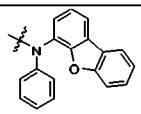
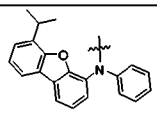
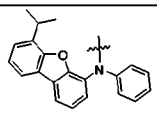
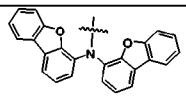
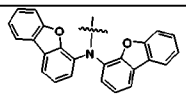
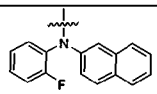
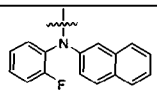
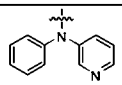
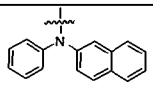
7-11					H
7-12					H
7-13					H
7-14					H
7-15					H
7-16	O	S			H
7-17	O				H
7-18	O				H
7-19	O				H
7-20	O				H

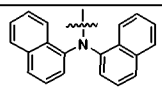
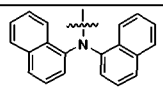
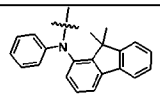
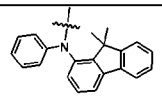
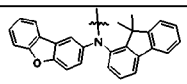
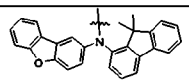
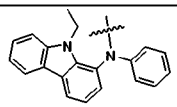
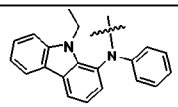
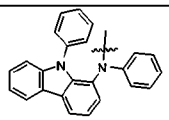
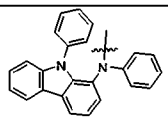
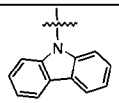
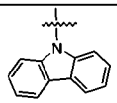
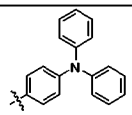
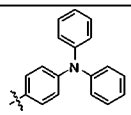
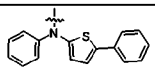
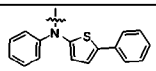
화합물	X1	X2	R1	R2	R3 내지 R6
8-1	O	O			
8-2	O	O			
8-3	O	O			
8-4	O	O			
8-5	O	O			
8-6	O	O			
8-7	O	O			
8-8	O	O			
8-9	O	O			
8-10	O	O			

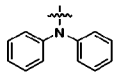
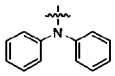
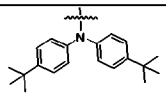
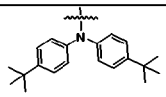
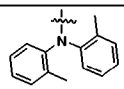
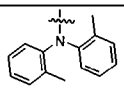
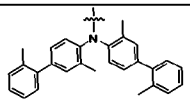
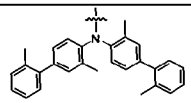
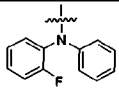
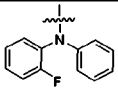
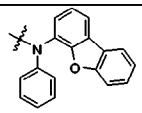
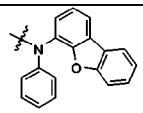
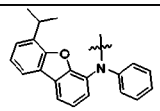
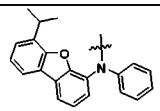
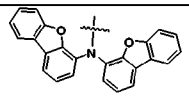
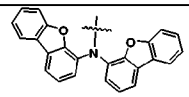
8-11	O	O			
8-12	O	O			
8-13	O	O			
8-14	O	O			
8-15	O	O			
8-16	O	O			
8-17	O	O			
8-18	O	O			
8-19	O	O			
8-20	O	O			

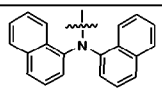
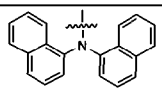
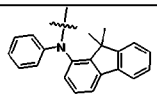
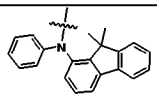
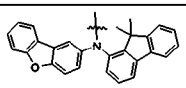
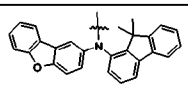
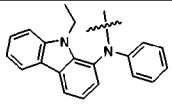
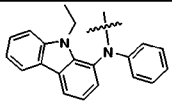
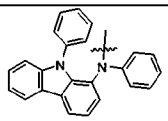
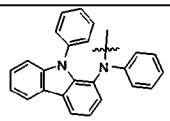
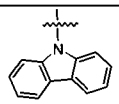
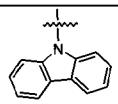
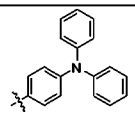
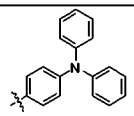
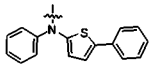
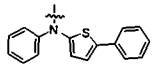
화합물	X1	X2	R1	R2	R3 내지 R6
9-1	S	S			$-CH_3$
9-2	S	S			$-CH_3$
9-3	S	S			$-CH_3$
9-4	S	S			$-CH_3$
9-5	S	S			$-CH_3$
9-6	S	S			$-CH_3$
9-7	S	S			$-CH_3$
9-8	S	S			$-CH_3$
9-9	S	S			$-CH_3$
9-10	S	S			$-CH_3$

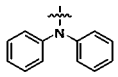
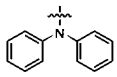
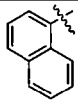
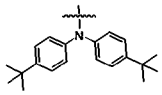
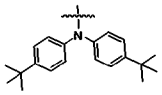
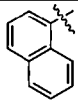
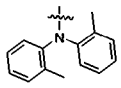
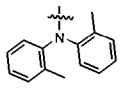
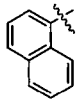
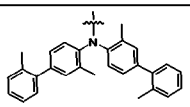
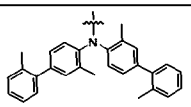
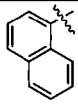
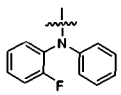
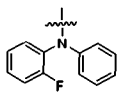
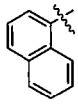
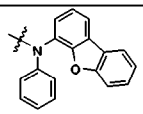
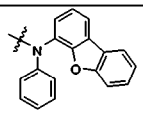
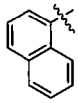
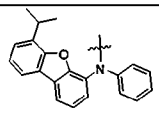
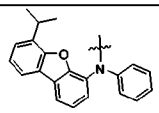
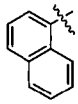
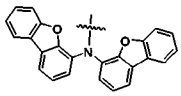
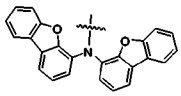
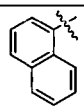
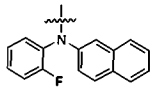
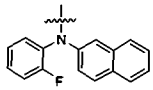
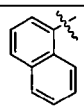
9-11	S	S			$-CH_3$
9-12	S	S			$-CH_3$
9-13	S	S			$-CH_3$
9-14	S	S			$-CH_3$
9-15	S	S			$-CH_3$
9-16	S	S			$-CH_3$
9-17	S	S			$-CH_3$
9-18	S	S			$-CH_3$
9-19	S	S			$-CH_3$
9-20	S	S			$-CH_3$

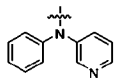
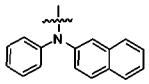
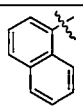
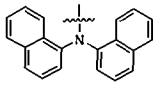
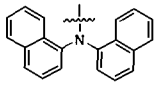
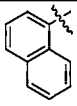
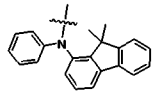
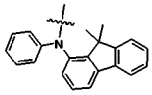
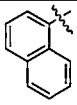
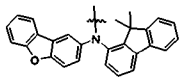
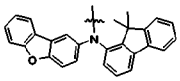
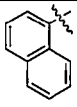
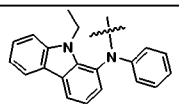
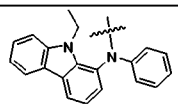
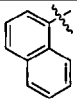
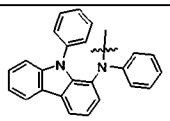
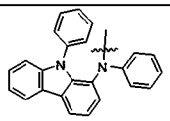
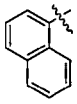
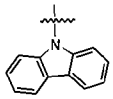
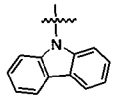
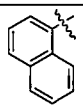
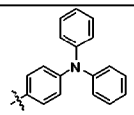
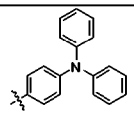
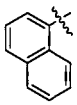
화합물	X1	X2	R1	R2	R3 내지 R6
10-1	N	N			
10-2	N	N			
10-3	N	N			
10-4	N	N			
10-5	N	N			
10-6	N	N			
10-7	N	N			
10-8	N	N			
10-9	N	N			
10-10	N	N			

10-11					
10-12					
10-13					
10-14					
10-15					
10-16					
10-17					
10-18					
10-19					
10-20					

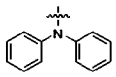
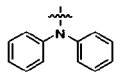
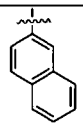
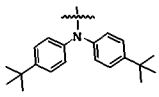
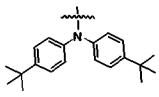
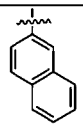
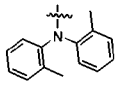
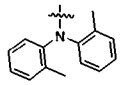
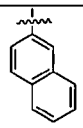
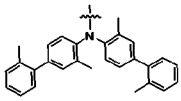
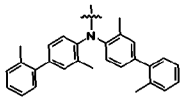
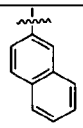
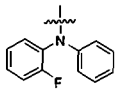
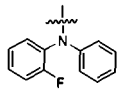
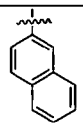
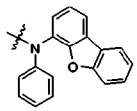
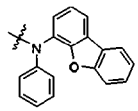
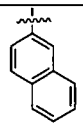
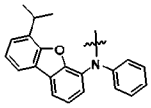
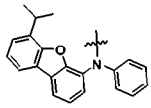
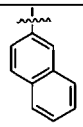
화합물	X1	X2	R1	R2	R3 내지 R6
11-1					
11-2					
11-3					
11-4					
11-5					
11-6					
11-7					
11-8					
11-9					
11-10					

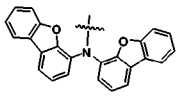
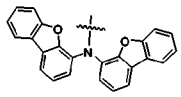
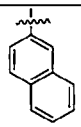
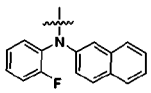
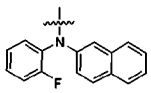
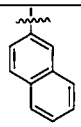
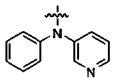
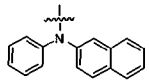
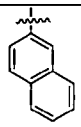
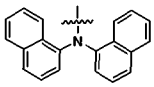
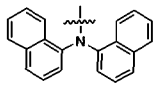
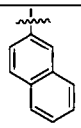
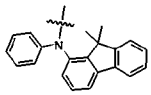
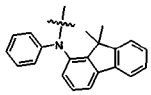
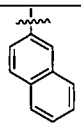
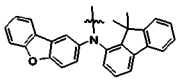
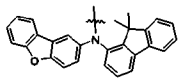
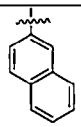
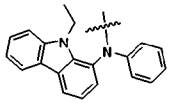
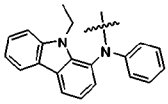
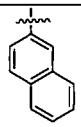
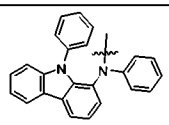
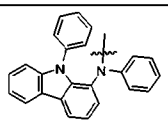
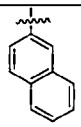
11-11					
11-12					
11-13					
11-14					
11-15					
11-16					
11-17					
11-18					
11-19					
11-20					

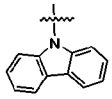
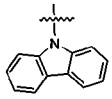
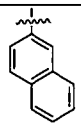
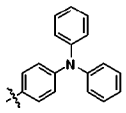
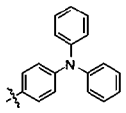
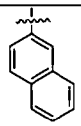
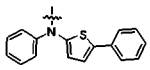
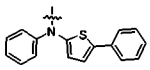
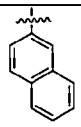
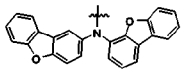
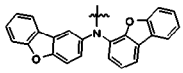
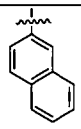
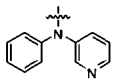
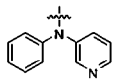
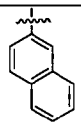
화합물	X1	X2	R1	R2	R3 내지 R6
12-1	C	C			
12-2	C	C			
12-3	C	C			
12-4	C	C			
12-5	C	C			
12-6	C	C			
12-7	C	C			
12-8	C	C			
12-9	C	C			

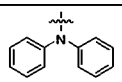
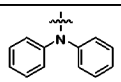
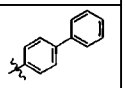
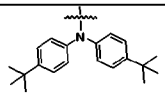
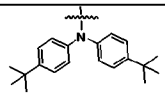
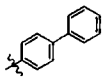
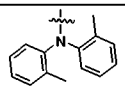
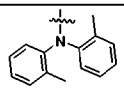
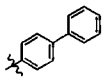
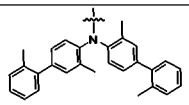
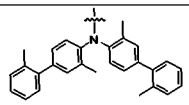
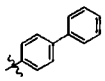
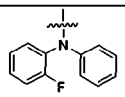
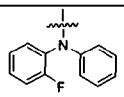
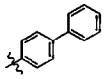
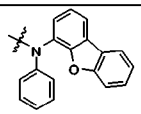
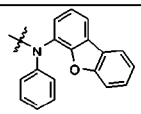
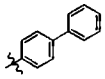
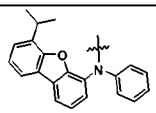
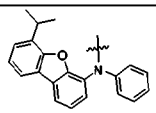
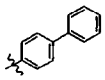
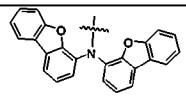
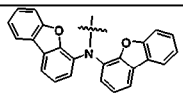
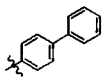
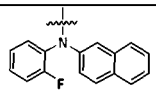
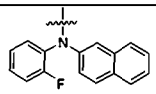
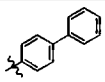
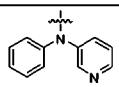
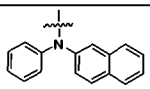
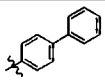
12-10					
12-11					
12-12					
12-13					
12-14					
12-15					
12-16					
12-17					
12-18					

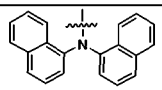
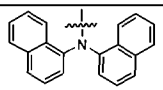
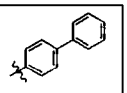
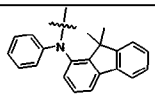
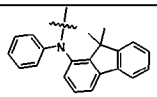
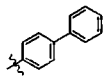
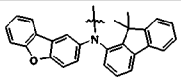
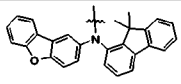
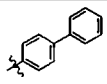
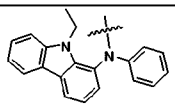
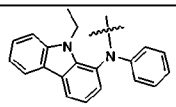
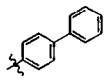
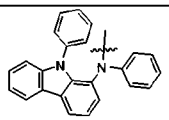
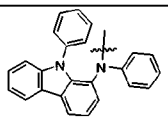
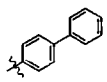
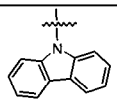
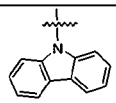
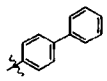
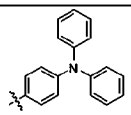
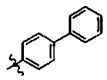
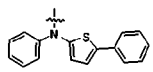
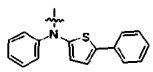
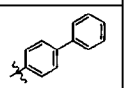
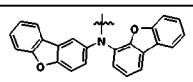
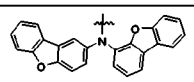
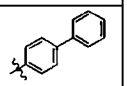
12-19					
12-20					

화합물	X1	X2	R1	R2	R3 내지 R6
13-1					
13-2					
13-3					
13-4					
13-5					
13-6					
13-7					

13-8					
13-9					
13-10					
13-11					
13-12					
13-13					
13-14					
13-15					

13-16					
13-17					
13-18					
13-19					
13-20					

화합물	X1	X2	R1	R2	R3 내지 R6
14-1	O	S			
14-2	O	N			
14-3	O	N			
14-4	O	C			
14-5	O	C			
14-6	S	N			
14-7	S	N			
14-8	S	C			
14-9	S	C			
14-10	N	N			

14-11					
14-12					
14-13					
14-14					
14-15					
14-16	O	S			
14-17	O				
14-18	O				
14-19	O				
14-20	O				

[청구항 8] 제1 전극; 상기 제1 전극에 대향하여 구비된 제2 전극; 및 상기 제1 전극과 제2 전극 사이에 구비된 1층 이상의 유기물층을 포함하는 유기 발광 소자로서, 상기 유기물층 중 1 층 이상은 청구항 1 내지 7 중 어느 한 항의 화합물을 포함하는 것인 유기 발광 소자.

[청구항 9] 청구항 8에 있어서, 상기 유기물층은 발광층을 포함하고, 상기 발광층은 상기 화합물을 포함하는 것인 유기 발광 소자.

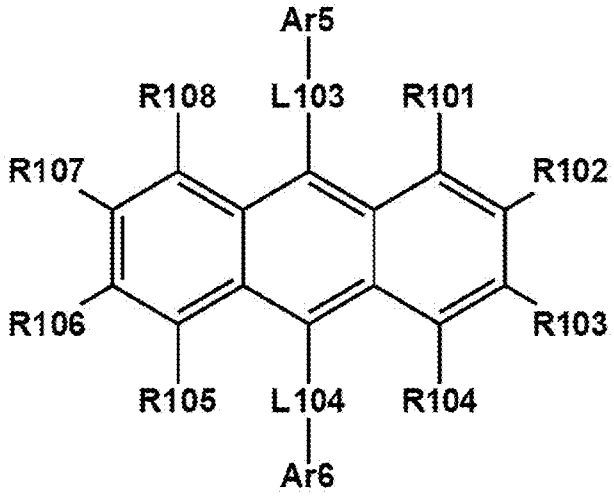
[청구항 10] 청구항 8에 있어서, 상기 유기물층은 정공주입층 또는 정공수송층을 포함하고, 상기 정공주입층 또는 정공수송층은 상기 화합물을 포함하는 것인 유기 발광 소자.

[청구항 11] 청구항 8에 있어서, 상기 유기물층은 전자주입층, 전자수송층, 또는 전자 주입 및 수송을 동시에 하는 층을 포함하고, 상기 전자주입층, 전자수송층, 또는 전자 주입 및 수송을 동시에 하는 층은 상기 화합물을 포함하는 것인 유기 발광 소자.

[청구항 12] 청구항 8에 있어서, 상기 유기물은 전자차단층 또는 정공차단층을 포함하고, 상기 전자차단층 또는 정공차단층은 상기 화합물을 포함하는 것인 유기 발광 소자.

[청구항 13] 청구항 8에 있어서, 상기 유기물층은 발광층을 포함하고, 상기 발광층은 하기 화학식 1A로 표시되는 화합물을 포함하는 것인 유기 발광 소자:

[화학식 1A]



상기 화학식 1A에 있어서,

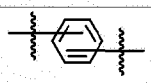
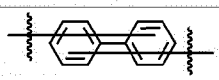
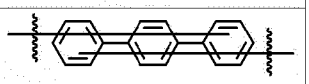
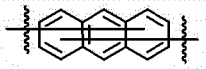
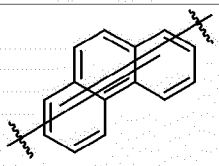
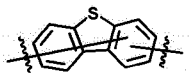
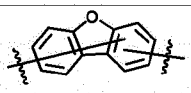
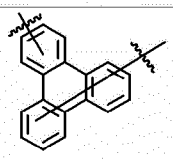
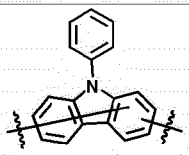
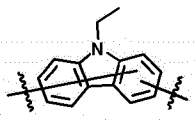
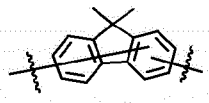
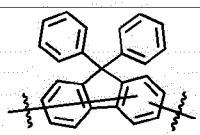
L103 및 L104는 서로 같거나 상이하고, 각각 독립적으로 직접결합; 치환 또는 비치환된 아릴렌기; 또는 치환 또는 비치환된 헤테로아릴렌기이고,

Ar5 및 Ar6은 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이며,

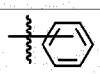
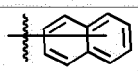
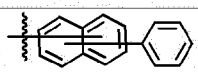
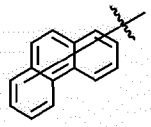
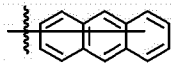
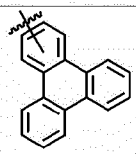
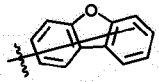
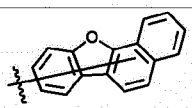
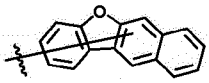
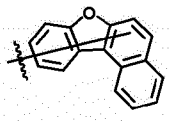
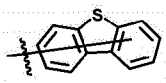
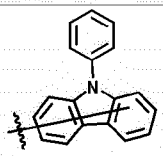
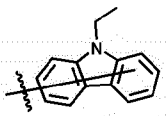
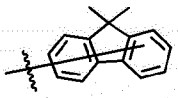
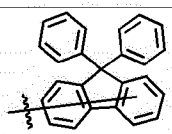
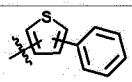
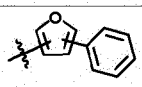
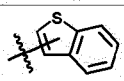
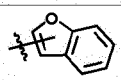
R101 내지 R108은 서로 같거나 상이하고, 각각 독립적으로 수소; 중수소; 할로겐기; 니트릴기; 니트로기; 치환 또는 비치환된 알킬기; 치환 또는 비치환된 시클로알킬기; 치환 또는 비치환된 실릴기; 치환 또는 비치환된 포스핀옥사이드기; 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이다.

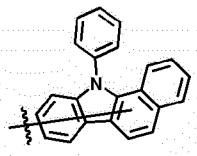
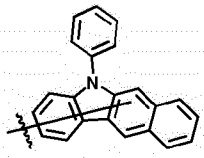
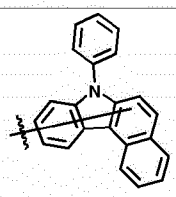
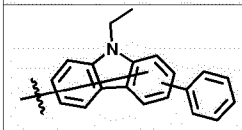
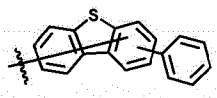
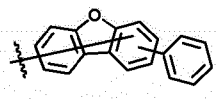
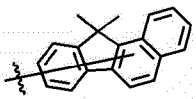
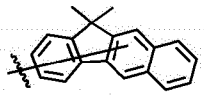
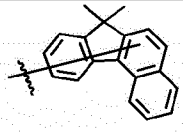
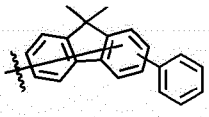
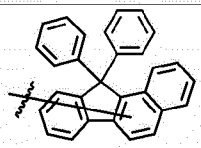
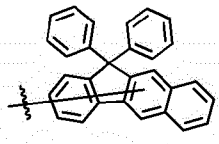
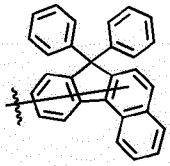
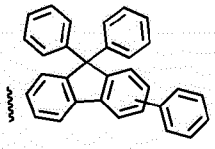
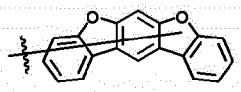
[청구항 14] 청구항 13에 있어서, 상기 L103 및 L104는 서로 같거나 상이하고, 각각 독립적으로 하기 표 1의 치환기 중에서 선택되며, 상기 Ar5 및 Ar6은 서로 같거나 상이하고, 각각 독립적으로 하기 표 2의 치환기 중에서 선택되는 것인 유기 발광 소자:

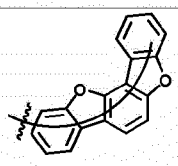
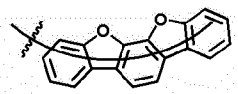
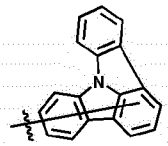
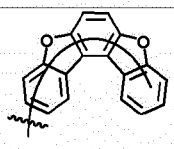
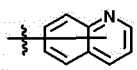
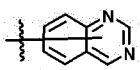
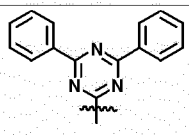
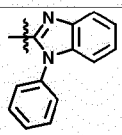
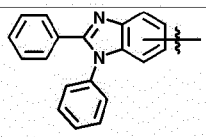
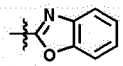
[표 1]

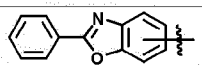
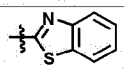
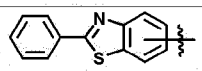
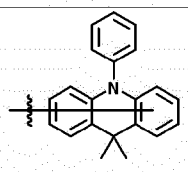
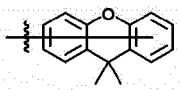
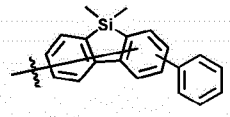
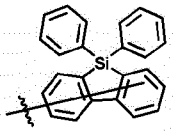
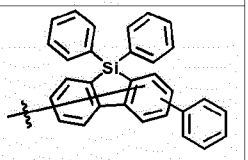
치환기 A1	치환기 A2	치환기 A3
		
치환기 A4	치환기 A5	치환기 A6
		
치환기 A7	치환기 A8	치환기 A9
		
치환기 A10	치환기 A11	치환기 A12
		
치환기 A13	치환기 A14	치환기 A15
		

[표 2]

치환기 B1	치환기 B2	치환기 B3
		
치환기 B4	치환기 B5	치환기 B6
		
치환기 B7	치환기 B8	치환기 B9
		
치환기 B10	치환기 B11	치환기 B12
		
치환기 B13	치환기 B14	치환기 B15
		
치환기 B16	치환기 B17	치환기 B18
		
치환기 B19	치환기 B20	치환기 B21
		

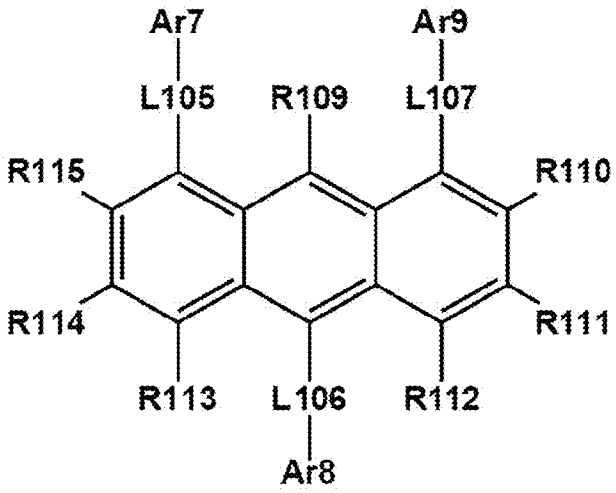
치환기 B22	치환기 B23	치환기 B24
		
치환기 B25	치환기 B26	치환기 B27
		
치환기 B28	치환기 B29	치환기 B30
		
치환기 B31	치환기 B32	치환기 B33
		
치환기 B34	치환기 B35	치환기 B36
		

치환기 B37	치환기 B38	치환기 B39
		
치환기 B40	치환기 B41	치환기 B42
		
치환기 B43	치환기 B44	치환기 B45
		
치환기 B46	치환기 B47	치환기 B48
		

치환기 B49	치환기 B50	치환기 B51
		
치환기 B52	치환기 B53	치환기 B54
		
치환기 B55	치환기 B56	
		

[청구항 15] 청구항 8에 있어서, 상기 유기물층은 발광층을 포함하고, 상기 발광층은 하기 화학식 1B로 표시되는 화합물을 포함하는 것인 유기 발광 소자:

[화학식 1B]



상기 화학식 1B에 있어서,

L105 내지 L107은 서로 같거나 상이하고, 각각 독립적으로 직접결합; 치환 또는 비치환된 아릴렌기; 또는 치환 또는 비치환된 헤테로아릴렌기이고,

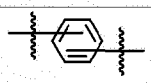
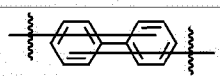
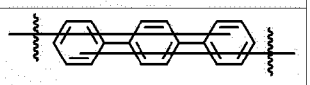
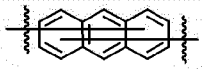
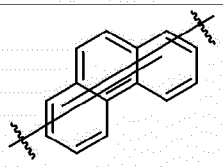
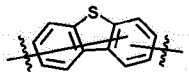
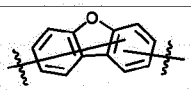
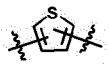
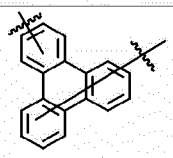
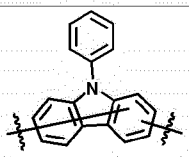
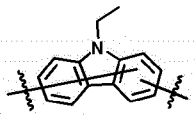
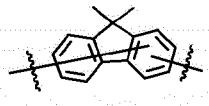
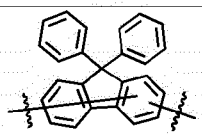
Ar7 내지 Ar9는 서로 같거나 상이하고, 각각 독립적으로 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이며,

R109 내지 R115는 서로 같거나 상이하고, 각각 독립적으로 수소; 중수소; 할로겐기; 니트릴기; 니트로기; 치환 또는 비치환된 알킬기; 치환 또는 비치환된 시클로알킬기; 치환 또는 비치환된 실릴기; 치환 또는 비치환된 포스핀옥사이드기; 치환 또는 비치환된 아릴기; 또는 치환 또는 비치환된 헤테로아릴기이다.

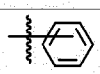
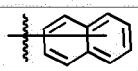
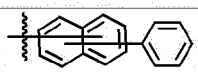
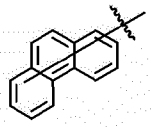
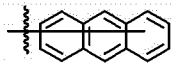
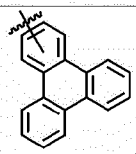
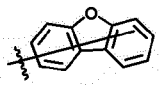
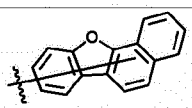
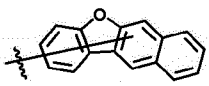
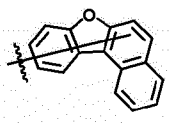
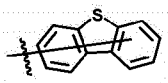
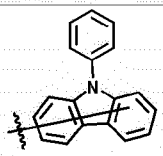
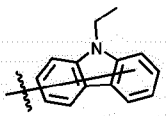
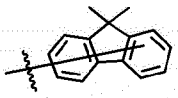
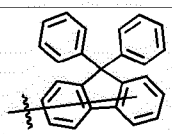
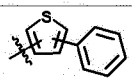
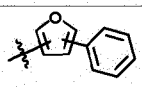
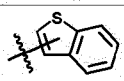
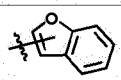
[청구항 16] 청구항 15에 있어서, 상기 L105 내지 L107은 서로 같거나 상이하고, 각각

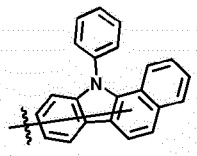
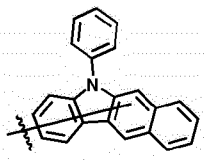
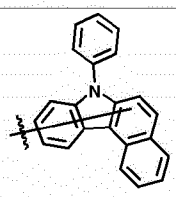
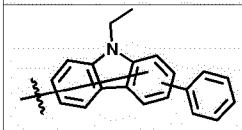
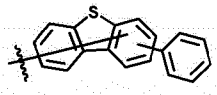
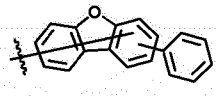
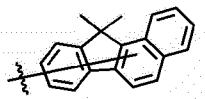
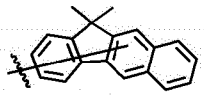
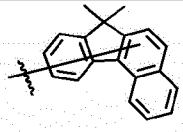
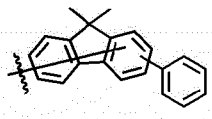
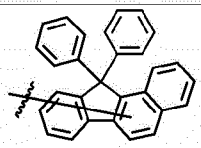
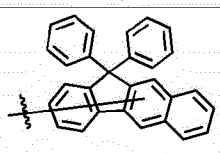
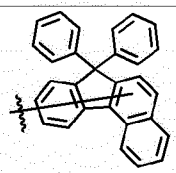
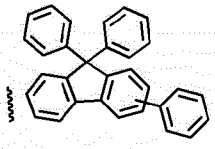
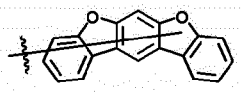
독립적으로 하기 표 3의 치환기 중에서 선택되며, 상기 Ar7 내지 Ar9는 서로 같거나 상이하고, 각각 독립적으로 하기 표 4의 치환기 중에서 선택되는 것인 유기 발광 소자:

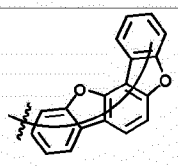
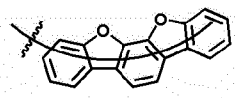
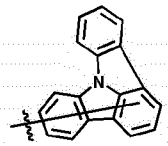
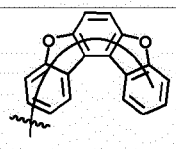
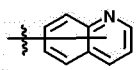
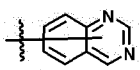
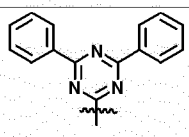
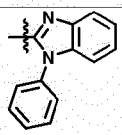
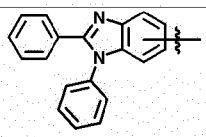
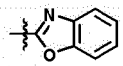
[표 3]

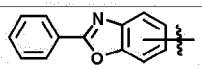
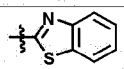
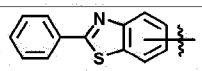
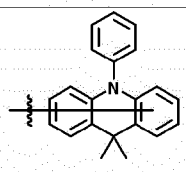
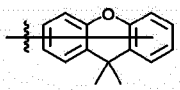
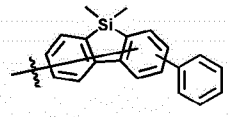
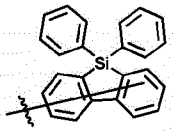
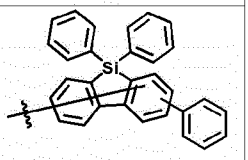
치환기 A1	치환기 A2	치환기 A3
		
치환기 A4	치환기 A5	치환기 A6
		
치환기 A7	치환기 A8	치환기 A9
		
치환기 A10	치환기 A11	치환기 A12
		
치환기 A13	치환기 A14	치환기 A15
		

[표 4]

치환기 B1	치환기 B2	치환기 B3
		
치환기 B4	치환기 B5	치환기 B6
		
치환기 B7	치환기 B8	치환기 B9
		
치환기 B10	치환기 B11	치환기 B12
		
치환기 B13	치환기 B14	치환기 B15
		
치환기 B16	치환기 B17	치환기 B18
		
치환기 B19	치환기 B20	치환기 B21
		

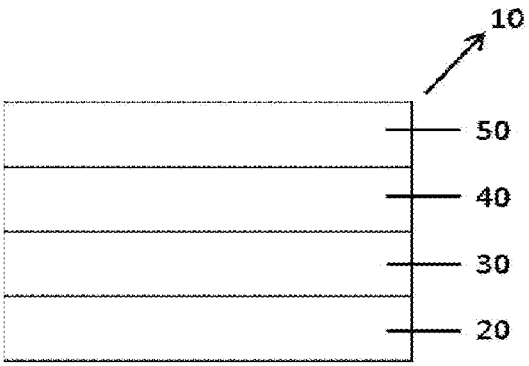
치환기 B22	치환기 B23	치환기 B24
		
치환기 B25	치환기 B26	치환기 B27
		
치환기 B28	치환기 B29	치환기 B30
		
치환기 B31	치환기 B32	치환기 B33
		
치환기 B34	치환기 B35	치환기 B36
		

치환기 B37	치환기 B38	치환기 B39
		
치환기 B40	치환기 B41	치환기 B42
		
치환기 B43	치환기 B44	치환기 B45
		
치환기 B46	치환기 B47	치환기 B48
		

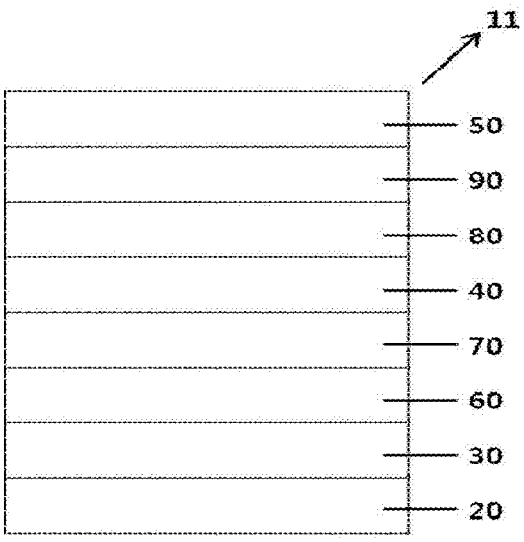
치환기 B49	치환기 B50	치환기 B51
		
치환기 B52	치환기 B53	치환기 B54
		
치환기 B55	치환기 B56	
		

[청구항 17] 청구항 8에 있어서, 상기 유기 발광 소자는 발광층, 정공주입층, 정공수송층. 전자주입층, 전자수송층, 전자차단층 및 정공차단층으로 이루어진 군으로부터 선택되는 1층 이상을 더 포함하는 것인 유기 발광 소자.

[도1]



[도2]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2018/007740

A. CLASSIFICATION OF SUBJECT MATTER

C07D 493/04(2006.01)i, C07D 495/04(2006.01)i, C07D 487/04(2006.01)i, H01L 51/00(2006.01)i, H01L 51/50(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C07D 493/04; C07C 15/28; C07D 209/82; C07D 401/10; C07D 487/04; C07D 495/04; C09D 125/06; C09K 11/06; H01L 51/00; H01L 51/50

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility models and applications for Utility models: IPC as above
Japanese Utility models and applications for Utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal), STN (Registry, Caplus) & Keywords: 6-ring condensed structure, 3-ring cyclic compound, anthracene, luminous layer, organic layer, organic light-emitting element

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 10-2014-0023407 A (ROHM AND HAAS ELECTRONIC MATERIALS KOREA LTD.) 26 February 2014 See claims 1, 4, 5; paragraphs [0077]-[0092], [0146], [0177]-[0182], [0193]-[0199], [0211]-[0251].	1-14,17
Y		15,16
Y	KR 10-1115255 B1 (LG CHEM, LTD.) 15 February 2012 See claims 1, 7, 11, 13; table 1; chemical formulas 1-31.	15,16
X	KR 10-2015-0070475 A (ROHM AND HAAS ELECTRONIC MATERIALS KOREA LTD.) 25 June 2015 See claims 1-7.	1-12,17
X	US 2015-0218184 A1 (FUJIFILM CORPORATION) 06 August 2015 See claims 1-19; paragraphs [0054], [0148].	1-12,17
X	KR 10-2013-0073700 A (DOOSAN CORPORATION) 03 July 2013 See claims 1-8; paragraphs [0029], [0030], [0057]-[0069], [0150]-[0155].	1-12,17
X	CN 104513662 A (ETERNAL MATERIAL TECHNOLOGY et al.) 15 April 2015 See claims 1-10.	1-12,17

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 OCTOBER 2018 (11.10.2018)	**12 OCTOBER 2018 (12.10.2018)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office Government Complex Daejeon Building 4, 189, Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea Facsimile No. +82-42-481-8578	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2018/007740

Patent document cited in search report	Publication date	Patent family member	Publication date
KR 10-2014-0023407 A	26/02/2014	CN 101659593 A	03/03/2010
		CN 101659593 B	26/02/2014
		CN 102924217 A	13/02/2013
		EP 2145936 A2	20/01/2010
		EP 2145936 A3	17/03/2010
		JP 2010-059147 A	18/03/2010
		JP 2014-237682 A	18/12/2014
		KR 10-1456521 B1	31/10/2014
		KR 10-1554860 B1	22/09/2015
		KR 10-1554862 B1	23/09/2015
		KR 10-1563142 B1	27/10/2015
		KR 10-2010-0007780 A	22/01/2010
		KR 10-2014-0023408 A	26/02/2014
		KR 10-2014-0024438 A	28/02/2014
		KR 10-2014-0024439 A	28/02/2014
		KR 10-2014-0024440 A	28/02/2014
		KR 10-2014-0024441 A	28/02/2014
		TW 201009046 A	01/03/2010
		US 2010-0032658 A1	11/02/2010
KR 10-1115255 B1	15/02/2012	US 2011-0114934 A1	19/05/2011
		US 9012040 B2	21/04/2015
		WO 2010-005266 A2	14/01/2010
		WO 2010-005266 A3	29/04/2010
KR 10-2015-0070475 A	25/06/2015	TW 201529582 A	01/08/2015
		TW I506028 B	01/11/2015
		WO 2015-093814 A1	25/06/2015
US 2015-0218184 A1	06/08/2015	JP 2014-082247 A	08/05/2014
		JP 5975834 B2	23/08/2016
		TW 201414717 A	16/04/2014
		TW I594983 B	11/08/2017
		US 9447111 B2	20/09/2016
		WO 2014-061464 A1	24/04/2014
KR 10-2013-0073700 A	03/07/2013	KR 10-1827039 B1	07/02/2018
		WO 2013-094999 A2	27/06/2013
		WO 2013-094999 A3	22/08/2013
CN 104513662 A	15/04/2015	NONE	

국 제 조 사 보 고 서

국제출원번호
PCT/KR2018/007740

A. 발명이 속하는 기술분류(국제특허분류(IPC))

C07D 493/04(2006.01)i, C07D 495/04(2006.01)i, C07D 487/04(2006.01)i, H01L 51/00(2006.01)i, H01L 51/50(2006.01)i

B. 조사된 분야

조사된 최소문헌(국제특허분류를 기재)
C07D 493/04; C07C 15/28; C07D 209/82; C07D 401/10; C07D 487/04; C07D 495/04; C09D 125/06; C09K 11/06; H01L 51/00; H01L 51/50

조사된 기술분야에 속하는 최소문헌 이외의 문헌
한국등록실용신안공보 및 한국공개실용신안공보: 조사된 최소문헌란에 기재된 IPC
일본등록실용신안공보 및 일본공개실용신안공보: 조사된 최소문헌란에 기재된 IPC

국제조사에 이용된 전산 데이터베이스(데이터베이스의 명칭 및 검색어(해당하는 경우))
eKOMPASS(특허청 내부 검색시스템),STN(Registry, Caplus) & 키워드: 6환 축합 구조, 3환 고리 화합물, 안트라센, 발광층, 유기층, 유기발광소자

C. 관련 문헌

카테고리*	인용문헌명 및 관련 구절(해당하는 경우)의 기재	관련 청구항
X	KR 10-2014-0023407 A (롬엔드하스전자재료코리아유한회사) 2014.02.26 청구항 1, 4, 5; 단락 [0077]-[0092], [0146], [0177]-[0182], [0193]-[0199], [0211]-[0251] 참조.	1-14,17
Y		15,16
Y	KR 10-1115255 B1 (주식회사 엘지화학) 2012.02.15 청구항 1, 7, 11, 13; 표 1; 화학식 1-31 참조.	15,16
X	KR 10-2015-0070475 A (롬엔드하스전자재료코리아유한회사) 2015.06.25 청구항 1-7 참조.	1-12,17
X	US 2015-0218184 A1 (FUJIFILM CORPORATION) 2015.08.06 청구항 1-19; 단락 [0054], [0148] 참조.	1-12,17
X	KR 10-2013-0073700 A (주식회사 두산) 2013.07.03 청구항 1-8; 단락 [0029], [0030], [0057]-[0069], [0150]-[0155] 참조.	1-12,17
X	CN 104513662 A (ETERNAL MATERIAL TECHNOLOGY 등) 2015.04.15 청구항 1-10 참조.	1-12,17

☐ 추가 문헌이 C(계속)에 기재되어 있습니다.

☒ 대응특허에 관한 별지를 참조하십시오.

* 인용된 문헌의 특별 카테고리:

"A" 특별히 관련이 없는 것으로 보이는 일반적인 기술수준을 정의한 문헌

"E" 국제출원일보다 빠른 출원일 또는 우선일을 가지나 국제출원일 이후에 공개된 선출원 또는 특허 문헌

"L" 우선권 주장에 의문을 제기하는 문헌 또는 다른 인용문헌의 공개일 또는 다른 특별한 이유(이유를 명시)를 밝히기 위하여 인용된 문헌

"O" 구두 개시, 사용, 전시 또는 기타 수단을 언급하고 있는 문헌

"P" 우선일 이후에 공개되었으나 국제출원일 이전에 공개된 문헌

"T" 국제출원일 또는 우선일 후에 공개된 문헌으로, 출원과 상충하지 않으며 발명의 기초가 되는 원리나 이론을 이해하기 위해 인용된 문헌

"X" 특별한 관련이 있는 문헌. 해당 문헌 하나만으로 청구된 발명의 신규성 또는 진보성이 없는 것으로 본다.

"Y" 특별한 관련이 있는 문헌. 해당 문헌이 하나 이상의 다른 문헌과 조합하는 경우로 그 조합이 당업자에게 자명한 경우 청구된 발명은 진보성이 없는 것으로 본다.

"&" 동일한 대응특허문헌에 속하는 문헌

국제조사의 실제 완료일	국제조사보고서 발송일
2018년 10월 11일 (11.10.2018)	2018년 10월 12일 (12.10.2018)

ISA/KR의 명칭 및 우편주소
대한민국 특허청
(35208) 대전광역시 서구 청사로 189,
4동 (둔산동, 정부대전청사)
팩스 번호 +82-42-481-8578

심사관
감유림
전화번호 +82-42-481-3516

국제조사보고서
대응특허에 관한 정보

국제출원번호
PCT/KR2018/007740

국제조사보고서에서 인용된 특허문헌	공개일	대응특허문헌	공개일
KR 10-2014-0023407 A	2014/02/26	CN 101659593 A	2010/03/03
		CN 101659593 B	2014/02/26
		CN 102924217 A	2013/02/13
		EP 2145936 A2	2010/01/20
		EP 2145936 A3	2010/03/17
		JP 2010-059147 A	2010/03/18
		JP 2014-237682 A	2014/12/18
		KR 10-1456521 B1	2014/10/31
		KR 10-1554860 B1	2015/09/22
		KR 10-1554862 B1	2015/09/23
		KR 10-1563142 B1	2015/10/27
		KR 10-2010-0007780 A	2010/01/22
		KR 10-2014-0023408 A	2014/02/26
		KR 10-2014-0024438 A	2014/02/28
		KR 10-2014-0024439 A	2014/02/28
		KR 10-2014-0024440 A	2014/02/28
		KR 10-2014-0024441 A	2014/02/28
		TW 201009046 A	2010/03/01
		US 2010-0032658 A1	2010/02/11
KR 10-1115255 B1	2012/02/15	US 2011-0114934 A1	2011/05/19
		US 9012040 B2	2015/04/21
		WO 2010-005266 A2	2010/01/14
		WO 2010-005266 A3	2010/04/29
KR 10-2015-0070475 A	2015/06/25	TW 201529582 A	2015/08/01
		TW I506028 B	2015/11/01
		WO 2015-093814 A1	2015/06/25
US 2015-0218184 A1	2015/08/06	JP 2014-082247 A	2014/05/08
		JP 5975834 B2	2016/08/23
		TW 201414717 A	2014/04/16
		TW I594983 B	2017/08/11
		US 9447111 B2	2016/09/20
		WO 2014-061464 A1	2014/04/24
KR 10-2013-0073700 A	2013/07/03	KR 10-1827039 B1	2018/02/07
		WO 2013-094999 A2	2013/06/27
		WO 2013-094999 A3	2013/08/22
CN 104513662 A	2015/04/15	없음	