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(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, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, 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, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

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

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

4
3
2
1

(57) Abstract: The present invention provides: a novel compound; and an organic light-emitting device comprising a first electrode, a second electrode provided to face the first electrode, and at least one organic material layer provided between the first electrode and the second electrode, wherein the organic material layer includes the novel compound.

(57) 요약서: 본 발명은 신규한 화합물; 및 제1 전극, 제1 전극과 대향하여 구비된 제2 전극, 및 제1 전극과 제2 전극 사이에 구비된 1층 이상의 유기물층을 포함하는 유기 발광 소자로서, 유기물층은 이 신규 화합물을 포함하는 유기 발광 소자를 제공한다.



WO 2025/009871 A1

명세서

발명의 명칭: 신규한 화합물 및 이를 포함한 유기 발광 소자 기술분야

- [1] 관련 출원(들)과의 상호 인용
- [2] 본 출원은 2023년 7월 3일자 한국 특허 출원 제10-2023-0085740호에 기초한 우선권의 이익을 주장하며, 해당 한국 특허 출원들의 문헌에 개시된 모든 내용은 본 명세서의 일부로서 포함된다.
- [3]
- [4] 본 발명은 신규한 화합물 및 이를 포함한 유기 발광 소자에 관한 것이다.
- [5]

배경기술

- [6] 일반적으로 유기 발광 현상이란 유기 물질을 이용하여 전기에너지를 빛에너지로 전환시켜주는 현상을 말한다. 유기 발광 현상을 이용하는 유기 발광 소자는 넓은 시야각, 우수한 콘트라스트, 빠른 응답 시간을 가지며, 휘도, 구동 전압 및 응답 속도 특성이 우수하여 많은 연구가 진행되고 있다.
- [7]
- [8] 유기 발광 소자는 일반적으로 양극과 음극 및 상기 양극과 음극 사이에 유기물층을 포함하는 구조를 가진다. 상기 유기물층은 유기 발광 소자의 효율과 안정성을 높이기 위하여 각기 다른 물질로 구성된 다층의 구조로 이루어진 경우가 많으며, 예컨대 정공주입층, 정공수송층, 발광층, 전자수송층, 전자주입층 등으로 이루어질 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.
- [9]
- [10] 상기와 같은 유기 발광 소자에 사용되는 유기물에 대하여 새로운 재료의 개발이 지속적으로 요구되고 있다.
- [11]
- [12] [선행기술문헌]
- [13] [특허문헌]
- [14] (특허문헌 0001) 한국특허 공개번호 제10-2000-0051826호
- [15]

발명의 상세한 설명

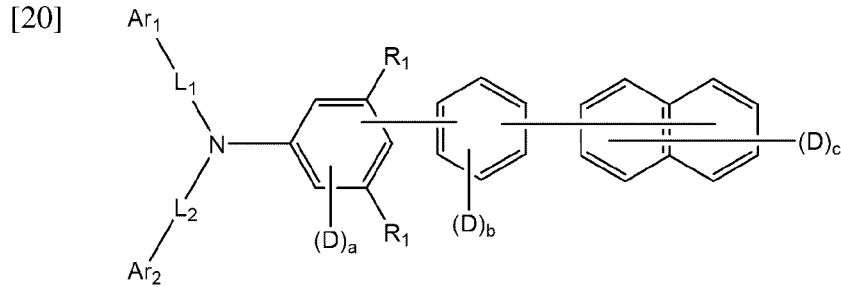
기술적 과제

- [16] 본 발명은 신규한 화합물 및 이를 포함하는 유기 발광 소자에 관한 것이다.
- [17]

과제 해결 수단

[18] 본 발명은 하기 화학식 1로 표시되는 화합물을 제공한다:

[19] [화학식 1]



[21] 상기 화학식 1에서,

[22] L_1 및 L_2 는 각각 독립적으로, 단일 결합, 또는 치환 또는 비치환된 C_{6-60} 아릴렌이고,

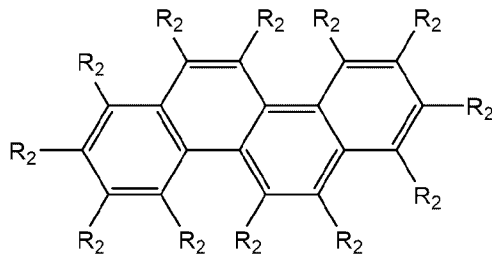
[23] R_1 은 각각 독립적으로, 수소, 또는 중수소이고,

[24] Ar_1 은 치환 또는 비치환된 C_{6-60} 아릴, 또는 치환 또는 비치환된 N, O 및 S로 구성되는 군으로부터 선택되는 어느 하나 이상의 헤테로원자를 포함하는 C_{2-60} 헤테로아릴이되, 단, Ar_1 에서 치환 또는 비치환된 디메틸플루오레닐, 디페닐플루오레닐, 및 스피로비플루오레닐은 제외되고,

[25] Ar_2 는 하기 화학식 2로 표시되는 치환기이고,

[26] [화학식 2]

[27]



[28] 상기 화학식 2에서,

[29] R_2 중 하나는 L_2 와 결합하고, 나머지는 각각 독립적으로, 수소, 또는 중수소이고,

[30] D 는 중수소이고,

[31] a 는 0 내지 2의 정수이고,

[32] b 는 0 내지 4의 정수이고,

[33] c 는 0 내지 7의 정수이다.

[34]

[35] 또한, 본 발명은 제1전극; 상기 제1 전극과 대향하여 구비된 제2 전극; 및 상기 제1 전극과 상기 제2 전극 사이에 구비된 1층 이상의 유기물 층을 포함하는 유기 발광 소자로서, 상기 유기물층 중 1층 이상은 상기 화학식 1로 표시되는 화합물을 포함하는, 유기 발광 소자를 제공한다.

[36]

발명의 효과

[37]

상술한 화학식 1로 표시되는 화합물은 유기 발광 소자의 유기물 층의 재료로서 사용될 수 있으며, 유기 발광 소자에서 효율의 향상, 낮은 구동전압 및/또는 수명 특성을 향상시킬 수 있다. 특히, 상술한 화학식 1로 표시되는 화합물은 정공주입, 정공수송, 정공주입 및 수송, 발광, 전자수송, 또는 전자주입 재료로 사용될 수 있다.

[38]

도면의 간단한 설명

[39]

도 1은 기판(1), 양극(2), 발광층(3), 음극(4)으로 이루어진 유기 발광 소자의 예를 도시한 것이다.

[40]

도 2는 기판(1), 양극(2), 정공주입층(5), 정공수송층(6), 정공수송보조층(7), 발광층(3), 정공저지층(8), 전자주입 및 수송층(9) 및 음극(4)로 이루어진 유기 발광 소자의 예를 도시한 것이다.

[41]

발명의 실시를 위한 형태

[42]

이하, 본 발명의 이해를 돕기 위하여 보다 상세히 설명한다.

[43]

[44]

본 명세서에서, --- 및 --- 는 다른 치환기에 연결되는 결합을 의미하고, "D"는 중수소를 의미한다.

[45]

[46]

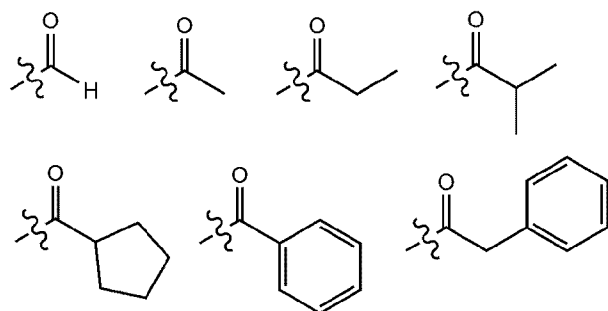
본 명세서에서 "치환 또는 비치환된"이라는 용어는 중수소; 할로젠기; 시아노기; 니트로기; 히드록시기; 카보닐기; 에스테르기; 이미드기; 아미노기; 포스포닉옥사이드기; 알콕시기; 아릴옥시기; 알킬티옥시기; 아릴티옥시기; 알킬술폰시기; 아릴술폰시기; 실릴기; 붕소기; 알킬기; 사이클로알킬기; 알케닐기; 아릴기; 아르알킬기; 아르알케닐기; 알킬아릴기; 알킬아민기; 아랄킬아민기; 헤테로아릴아민기; 아릴아민기; 아릴포스포닉기; 또는 N, O 및 S 원자 중 1개 이상을 포함하는 헤테로고리기로 이루어진 군에서 선택된 1개 이상의 치환기로 치환 또는 비치환되거나, 상기 예시된 치환기 중 2 이상의 치환기가 연결된 치환기로 치환 또는 비치환된 것을 의미한다. 예컨대, "2 이상의 치환기가 연결된 치환기"는 비페닐릴기일 수 있다. 즉, 비페닐릴기는 아릴기일 수도 있고, 2개의 페닐기가 연결된 치환기로 해석될 수 있다. 일례로, "치환 또는 비치환된"이라는 용어는 "비치환되거나, 또는 중수소, 할로젠, 시아노, C_{1-10} 알킬, C_{1-10} 알콕시 및 C_{6-20} 아릴로 구성되는 군으로부터 선택되는 1개 이상의 치환기로 치환된"; 또는 "비치환되거나, 또는 중수소, 할로젠, 시아노, 메틸, 에틸, 페닐 및 나프틸로 구성되는 군으로부터 선택되는 1개 이상의 치환기로 치환된"이라는 의미로 이해될 수 있다. 또한, 본 명세서에서 "1개 이상의 치환기로 치환된"이라는 용어는 "1개 내지 치환 가능한 수소의 최대

개수로 치환된"이라는 의미로 이해될 수 있다. 또는, 본 명세서에서 "1개 이상의 치환기로 치환된"이라는 용어는 "1개 내지 5개의 치환기로 치환된", 또는 "1개 또는 2개의 치환기로 치환된"이라는 의미로 이해될 수 있다.

[47]

[48] 본 명세서에서 카보닐기의 탄소수는 특별히 한정되지 않으나, 탄소수 1 내지 40인 것이 바람직하다. 구체적으로 하기와 같은 구조의 치환기가 될 수 있으나, 이에 한정되는 것은 아니다.

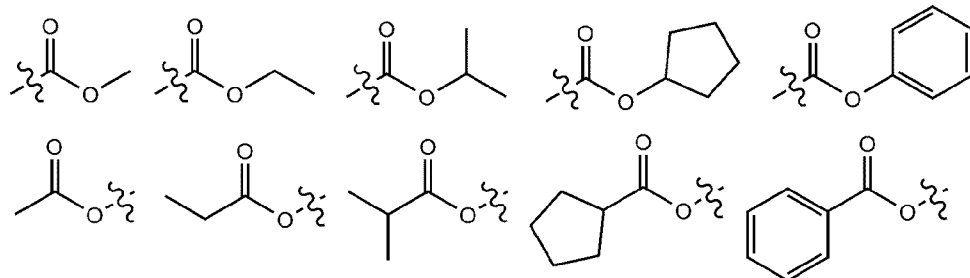
[49]



[50]

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

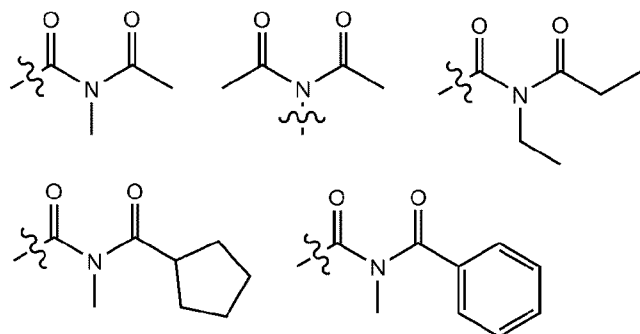
[52]



[53]

[54] 본 명세서에 있어서, 이미드기의 탄소수는 특별히 한정되지 않으나, 탄소수 1 내지 25인 것이 바람직하다. 구체적으로 하기와 같은 구조의 치환기가 될 수 있으나, 이에 한정되는 것은 아니다.

[55]



[56]

- [57] 본 명세서에 있어서, 치환 또는 비치환된 실릴기는 $-\text{Si}(\text{Z}_1)(\text{Z}_2)(\text{Z}_3)$ 를 의미하고, 여기서 Z_1 , Z_2 및 Z_3 는 각각 독립적으로 수소, 중수소, 치환 또는 비치환된 C_{1-60} 알킬, 치환 또는 비치환된 C_{1-60} 할로알킬, 치환 또는 비치환된 C_{2-60} 알케닐, 치환 또는 비치환된 C_{2-60} 할로알케닐, 또는 치환 또는 비치환된 C_{6-60} 아릴일 수 있다. 일 실시상태에 따르면, Z_1 , Z_2 및 Z_3 는 각각 독립적으로 수소, 중수소, 치환 또는 비치환된 C_{1-10} 알킬, 치환 또는 비치환된 C_{1-10} 할로알킬, 치환 또는 비치환된 C_{1-10} 할로알킬, 또는 치환 또는 비치환된 C_{6-20} 아릴일 수 있다. 상기 실릴기의 구체적인 예로는 트리메틸실릴기, 트리에틸실릴기, *t*-부틸디메틸실릴기, 비닐디메틸실릴기, 프로필디메틸실릴기, 트리페닐실릴기, 디페닐실릴기, 페닐실릴기 등이 있으나 이에 한정되지 않는다.
- [58]
- [59] 본 명세서에 있어서, 붕소기는 구체적으로 트리메틸붕소기, 트리에틸붕소기, *t*-부틸디메틸붕소기, 트리페닐붕소기, 페닐붕소기 등이 있으나 이에 한정되는 것은 아니다.
- [60]
- [61] 본 명세서에 있어서, 할로겐기의 예로는 플루오로, 클로로, 브로모, 또는 아이오도가 있다.
- [62]
- [63] 본 명세서에 있어서, 상기 알킬기는 직쇄 또는 분지쇄일 수 있고, 탄소수는 특별히 한정되지 않으나 1 내지 40인 것이 바람직하다. 일 실시상태에 따르면, 상기 알킬기의 탄소수는 1 내지 20이다. 또 하나의 실시상태에 따르면, 상기 알킬기의 탄소수는 1 내지 10이다. 또 하나의 실시상태에 따르면, 상기 알킬기의 구체적인 예로는 메틸, 에틸, 프로필, *n*-프로필, 이소프로필, 부틸, *n*-부틸, 이소부틸, *tert*-부틸, *sec*-부틸, 1-메틸-부틸, 1-에틸부틸, 펜틸, *n*-펜틸, 이소펜틸, 네오펜틸, *tert*-펜틸, 1-에틸-프로필, 1,1-디메틸프로필, 헥실, *n*-헥실, 1-메틸펜틸, 2-메틸펜틸, 4-메틸-2-펜틸, 3,3-디메틸부틸, 2-에틸부틸, 헵틸, *n*-헵틸, 이소헥실, 1-메틸헥실, 2-메틸헥실, 3-메틸헥실, 4-메틸헥실, 5-메틸헥실, 사이클로펜틸메틸, 사이클로헥실메틸, 옥틸, *n*-옥틸, *tert*-옥틸, 1-메틸헵틸, 2-에틸헥실, 2,4,4-트리메틸-1-펜틸, 2,4,4-트리메틸-2-펜틸, 2-프로필펜틸, *n*-노닐, 2,2-디메틸헵틸 등이 있으나, 이에 한정되는 것은 아니다.
- [64]
- [65] 본 명세서에 있어서, 상기 알케닐기는 직쇄 또는 분지쇄일 수 있고, 탄소수는 특별히 한정되지 않으나, 2 내지 40인 것이 바람직하다. 일 실시상태에 따르면, 상기 알케닐기의 탄소수는 2 내지 20이다. 또 하나의 실시상태에 따르면, 상기 알케닐기의 탄소수는 2 내지 10이다. 또 하나의 실시상태에 따르면, 상기 알케닐기의 탄소수는 2 내지 6이다. 구체적인 예로는 비닐, 1-프로페닐, 이소프로페닐, 1-부테닐, 2-부테닐, 3-부테닐, 1-펜테닐, 2-펜테닐, 3-펜테닐, 3-메틸-1-부테닐, 1,3-부타

디아닐, 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.

[66]

[67] 본 명세서에 있어서, 상기 지방족고리기(Alicyclic group)는 고리 형성 원자로 탄소만을 포함하면서 방향족성을 갖지 않는 포화 또는 불포화 탄화수소 고리 화합물로부터 유래된 1가의 치환기를 의미하는 것으로, 단환 또는 축합다환 화합물 모두를 포괄하는 것으로 이해된다. 일 실시상태에 따르면, 상기 지방족고리기의 탄소수는 3 내지 60 이다. 또 하나의 실시상태에 따르면, 상기 사이클로알킬기의 탄소수는 3 내지 30이다. 또 하나의 실시상태에 따르면, 상기 사이클로알킬기의 탄소수는 3 내지 20이다. 이러한 지방족고리기의 예로 사이클로알킬기와 같은 단일고리기(monocyclic group), 다리 걸친 탄화수소기(bridged hydrocarbon group), 스피로 고리 탄화수소기(spiro hydrocarbon group), 방향족 탄화수소 화합물의 수소화된 유도체로부터 유래된 치환기 등을 들 수 있다.

[68]

[69] 구체적으로, 상기 사이클로알킬기의 예로 사이클로프로필, 사이클로부틸, 사이클로펜틸, 3-메틸사이클로펜틸, 2,3-디메틸사이클로펜틸, 사이클로헥실, 3-메틸사이클로헥실, 4-메틸사이클로헥실, 2,3-디메틸사이클로헥실, 3,4,5-트리메틸사이클로헥실, 4-tert-부틸사이클로헥실, 사이클로헵틸, 사이클로옥틸 등이 있으나, 이에 한정되는 것은 아니다.

[70]

[71] 또한, 상기 다리 걸친 탄화수소기의 예로 바이사이클로[1.1.0]부틸, 바이사이클로[2.2.1]헵틸, 바이사이클로[4.2.0]옥타-1,3,5-트리에닐, 아다만틸, 데칼리닐 등이 있으나, 이에 한정되는 것은 아니다.

[72]

[73] 또한, 상기 스피로 고리 탄화수소기의 예로 스피로[3.4]옥틸, 스피로[5.5]운데카닐 등이 있으나, 이에 한정되는 것은 아니다.

[74]

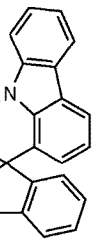
[75] 또한, 상기 방향족 탄화수소 화합물의 수소화된 유도체로부터 유래된 치환기는 단환 또는 다환의 방향족 탄화수소 화합물의 불포화 결합 일부에 수소가 첨가된 화합물로부터 유래된 치환기를 의미하는 것으로, 이러한 치환기의 예로 1*H*-인덴닐, 2*H*-인덴닐, 4*H*-인덴닐, 2,3-디하이드로-1*H*-인덴닐, 1,4-디하이드로나프탈레닐, 1,2,3,4-테트라하이드로나프탈레닐, 6,7,8,9-테트라하이드로-5*H*-벤조[7]아눌레닐(6,7,8,9-tetrahydro-5*H*-benzo[7]annulenyl), 6,7-디하이드로-5*H*-벤조사이클로헵테닐 등이 있으나, 이에 한정되는 것은 아니다.

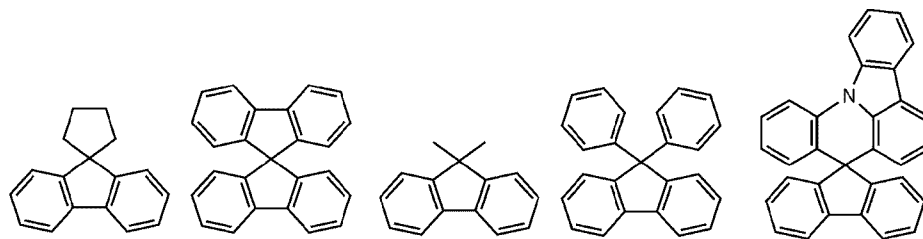
[76]

[77] 본 명세서에 있어서, 아릴기는 고리 형성 원자로 탄소만을 포함하면서 방향족성을 갖는 단환 또는 축합다환 화합물로부터 유래된 치환기를 의미하는 것으로

이해되며, 탄소수는 특별히 한정되지 않으나 탄소수 6 내지 60인 것이 바람직하다. 일 실시상태에 따르면, 상기 아릴기의 탄소수는 6 내지 30이다. 일 실시상태에 따르면, 상기 아릴기의 탄소수는 6 내지 20이다. 상기 아릴기가 단환식 아릴기로는 페닐기, 비페닐릴기, 터페닐릴기 등이 될 수 있으나, 이에 한정되는 것은 아니다. 상기 다환식 아릴기로는 나프틸기, 안트라세닐기, 페난트릴기, 파이레닐기, 페릴레닐기, 크라이세닐기, 플루오레닐기 등이 될 수 있으나, 이에 한정되는 것은 아니다.

[78]

[79] 본 명세서에 있어서, 플루오레닐기는 치환될 수 있고, 치환기 2개가 서로 결합하여 스피로 구조를 형성할 수 있다. 상기 플루오레닐기가 치환되는 경우,  등이 될 수



있다. 다만, 이에 한정되는 것은 아니다.

[80]

[81] 본 명세서에 있어서, 헤테로고리기(Heterocyclic group)는 고리 형성 원자로 탄소 외에 O, N, Si 및 S 중에서 선택되는 1개 이상의 헤테로원자를 더 포함하는 단환 또는 축합다환 화합물로부터 유래된 1개의 치환기를 의미하는 것으로, 방향족성을 갖는 치환기 또는 방향족성을 갖지 않는 치환기 모두를 포괄하는 것으로 이해된다. 일 실시상태에 따르면, 상기 헤테로고리기의 탄소수는 탄소수 2 내지 60이다. 또 하나의 실시상태에 따르면, 상기 헤테로고리기의 탄소수는 2 내지 30이다. 또 하나의 실시상태에 따르면, 상기 헤테로고리기의 탄소수는 2 내지 20이다. 이러한 헤테로고리기의 예로 헤테로아릴기, 헤테로방향족 화합물의 수소화된 유도체로부터 유래된 치환기 등을 들 수 있다.

[82]

[83] 구체적으로, 상기 헤테로아릴기는 고리 형성 원자로 탄소 외에 N, O 및 S 중에서 선택되는 1개 이상의 헤테로원자를 더 포함하는 단환 또는 축합다환 화합물로부터 유래된 치환기를 의미하는 것으로, 방향족성을 갖는 치환기를 의미한다. 일 실시상태에 따르면, 상기 헤테로아릴기의 탄소수는 탄소수 2 내지 60이다. 또 하나의 실시상태에 따르면, 상기 헤테로아릴기의 탄소수는 2 내지 30이다. 또 하나의 실시상태에 따르면, 상기 헤테로아릴기의 탄소수는 2 내지 20이다. 상기 헤테로아릴기의 예로 티오펜기, 퓨라닐기, 피롤일기, 이미다졸일기, 티아졸일기, 옥사졸일기, 옥사디아졸일기, 트리아졸일기, 피리디닐기, 비피리디닐기, 피리미디닐기, 트리아지닐기, 아크리디닐기, 피리다지닐기, 피라지닐기, 퀴놀리닐기, 퀴나졸리닐기, 퀴녹살리닐기, 프탈라지닐기, 피리도피리미디닐기, 피리도피라

지닐기, 이소퀴놀리닐기, 인돌일기, 카바졸일기, 벤즈옥사졸일기, 벤조이미다졸일기, 벤조티아졸일기, 벤조카바졸일기, 벤조티오펜일기, 디벤조티오펜일기, 벤조퓨라닐기, 디벤조퓨라닐기, 페난트롤리닐기, 이소옥사졸일기, 티아디아졸일기 및 페노티아지닐기 등이 있으나, 이에 한정되는 것은 아니다.

[84]

[85] 또한, 상기 헤테로방향족 화합물의 수소화된 유도체로부터 유래된 치환기는 단환 또는 다환의 헤테로방향족 화합물의 불포화 결합 일부에 수소가 첨가된 화합물로부터 유래된 치환기를 의미하는 것으로, 이러한 치환기의 예로 1,3-디하이드로이소벤조퓨라닐(1,3-dihydroisobenzofuranyl), 2,3-디하이드로벤조퓨라닐(2,3-dihydrobenzofuranyl), 1,3-디하이드로벤조[c]티오펜일(1,3-dihydrobenzo[c]thiophenyl), 2,3-디하이드로[b]티오펜일(2,3-디하이드로[b]티오펜일) 등이 있으나, 이에 한정되는 것은 아니다.

[86]

[87] 본 명세서에 있어서, 아르알킬기, 아르알케닐기, 알킬아릴기, 아릴아민기, 아릴실릴기 중의 아릴기는 전술한 아릴기의 예시와 같다. 본 명세서에 있어서, 아르알킬기, 알킬아릴기, 알킬아민기 중 알킬기는 전술한 알킬기의 예시와 같다. 본 명세서에 있어서, 헤테로아릴아민 중 헤테로아릴은 전술한 헤테로아릴에 관한 설명이 적용될 수 있다. 본 명세서에 있어서, 아르알케닐기 중 알케닐기는 전술한 알케닐기의 예시와 같다. 본 명세서에 있어서, 아릴렌은 2가기인 것을 제외하고는 전술한 아릴기에 관한 설명이 적용될 수 있다. 본 명세서에 있어서, 헤테로아릴렌은 2가기인 것을 제외하고는 전술한 헤테로아릴에 관한 설명이 적용될 수 있다. 본 명세서에 있어서, 탄화수소 고리는 1가기가 아니고, 2개의 치환기가 결합하여 형성한 것을 제외하고는 전술한 아릴기 또는 사이클로알킬기에 관한 설명이 적용될 수 있다. 본 명세서에 있어서, 헤테로고리는 1가기가 아니고, 2개의 치환기가 결합하여 형성한 것을 제외하고는 전술한 헤테로아릴에 관한 설명이 적용될 수 있다.

[88]

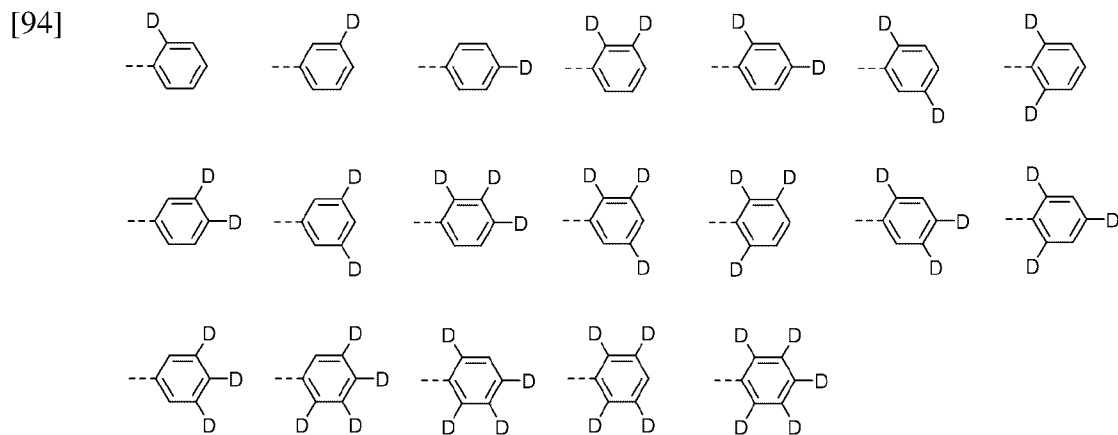
[89] 본 명세서에 있어서, "중수소화된 또는 중수소로 치환된"이라는 의미는 화합물, 2가의 연결기 또는 1가의 치환기 내 치환 가능한 수소 중 적어도 하나가 중수소로 치환됨을 의미한다.

[90]

[91] 또한, "비치환되거나 또는 중수소로 치환된" 또는 "중수소로 치환 또는 비치환된"이라는 의미는 "비치환되거나 또는 치환 가능한 수소 중 1개 내지 최대 개수가 중수소로 치환된"을 의미한다. 일례로, "비치환되거나 또는 중수소로 치환된 페난트릴"이라는 용어는 페난트릴 구조 내 중수소로 치환 가능한 수소의 최대 개수가 9개라는 점 고려할 때, "비치환되거나 또는 1개 내지 9개의 중수소로 치환된 페난트릴"이라는 의미로 이해될 수 있다.

[92]

[93] 또한, "중수소화된 구조"라는 의미는 적어도 하나의 수소가 중수소로 치환된 모든 구조의 화합물, 2가의 연결기 또는 1가의 치환기를 포괄하는 것을 의미한다. 일례로, 페닐의 중수소화된 구조는 하기와 같이 페닐기 내 치환가능한 적어도 하나의 수소가 중수소로 치환된 모든 구조의 1가의 치환기들을 일컫는 것으로 이해될 수 있다.



[95]

[96] 또한, 화합물의 "중수소 치환율" 또는 "중수소화도"는 화합물 내 존재할 수 있는 수소의 총 개수(화합물 내 중수소로 치환 가능한 수소의 개수 및 치환된 중수소의 개수의 총 합)에 대한 치환된 중수소의 개수의 비율을 백분율로 계산한 것을 의미한다. 따라서 화합물의 "중수소 치환율" 또는 "중수소화도"가 "K%"라고 함은, 화합물 내 중수소로 치환 가능한 수소 중 K%가 중수소로 치환된 것을 의미한다.

[97]

[98] 이 때, 상기 "중수소 치환율" 또는 "중수소화도"는 MALDI-TOF MS(Matrix-Assisted Laser Desorption/Ionization Time-of-Flight Mass Spectrometer), 핵자기 공명 분광법(^1H NMR), TLC/MS(Thin-Layer Chromatography/Mass Spectrometry), 또는 GC/MS(Gas Chromatography/Mass Spectrometry) 등을 이용하여 통상적으로 알려진 방법에 따라 측정할 수 있다. 보다 구체적으로, MALDI-TOF MS를 이용하는 경우 상기 "중수소 치환율" 또는 "중수소화도"는 MALDI-TOF MS 분석을 통해 화합물 내에 치환된 중수소 개수를 구한 다음, 화합물 내 존재할 수 있는 수소의 총 개수 대비 치환된 중수소의 개수의 비율을 백분율로 계산하여 구할 수 있다.

[99]

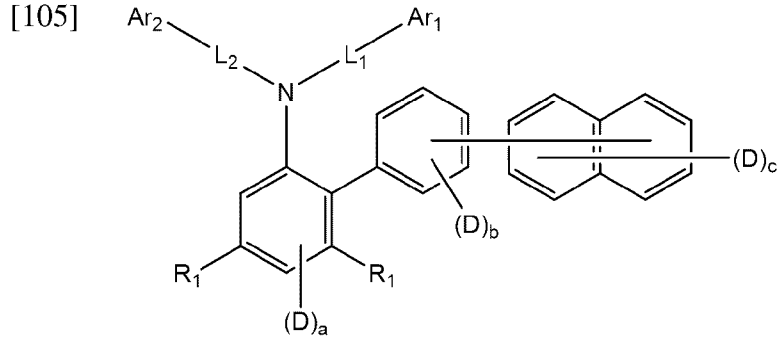
[100] (화합물)

[101] 본 발명은 상기 화학식 1로 표시되는 화합물을 제공한다.

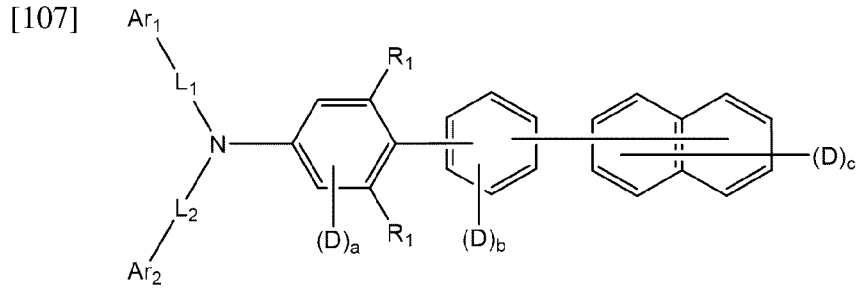
[102]

[103] 바람직하게는, 상기 화학식 1은 하기 화학식 1-1 또는 1-2로 표시된다:

[104] [화학식 1-1]



[106] [화학식 1-2]



[108] 상기 화학식 1-1 및 1-2에서,

[109] L_1 , L_2 , R_1 , Ar_1 , Ar_2 , D , a , b 및 c 는 앞서 정의한 바와 같다.

[110]

[111] 바람직하게는, L_1 및 L_2 는 각각 독립적으로, 단일 결합, 또는 비치환되거나 1개 이상의 중수소로 치환된 페닐렌이다.

[112] 구체적으로, L_1 및 L_2 는 모두 단일 결합이거나;

[113] L_1 은 단일 결합이고, L_2 는 비치환되거나 1개 이상의 중수소로 치환된 페닐렌이거나;

[114] L_1 은 비치환되거나 1개 이상의 중수소로 치환된 페닐렌이고, L_2 는 단일 결합이거나; 또는

[115] L_1 및 L_2 는 모두 비치환되거나 1개 이상의 중수소로 치환된 페닐렌이다.

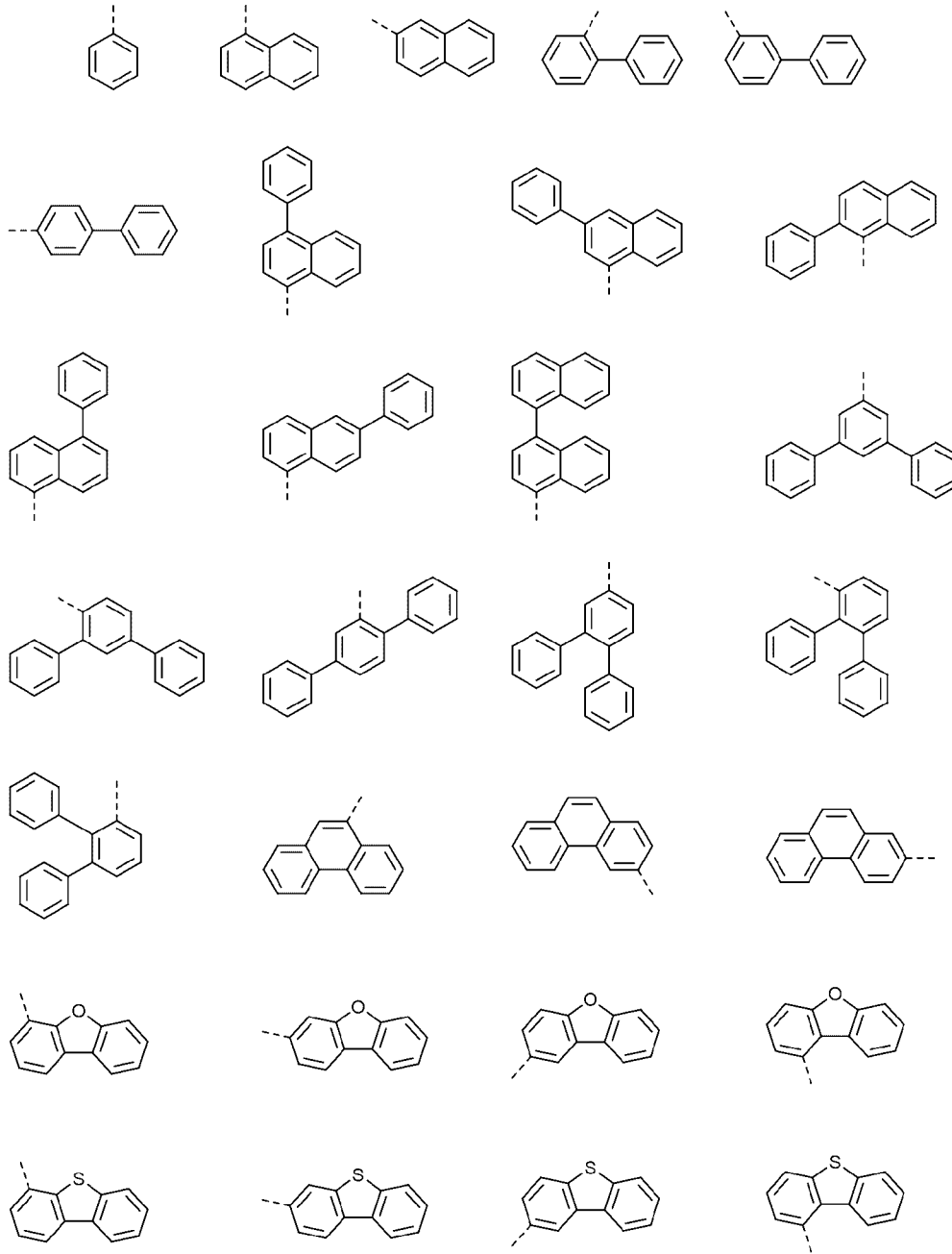
[116] 여기서, 상기 페닐렌은 비치환되거나, 1개, 2개, 3개, 또는 4개의 중수소로 치환될 수 있다.

[117]

[118] 바람직하게는, Ar_1 은 페닐, 비페닐릴, 터터페닐릴, 나프틸, 페닐 나프틸, 나프틸 페닐, 나프틸 나프틸, 페난트릴, 디벤조푸라닐 또는 디벤조티오페닐이고; 상기 Ar_1 은 비치환되거나 1개 이상의 중수소로 치환된다.

[119] 구체적으로, Ar_1 은 하기로 구성되는 군 및 이들의 중수소화된 구조로부터 선택되는 어느 하나이다:

[120]



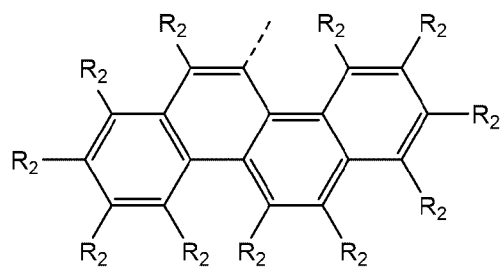
[121]

[122]

[123] 바람직하게는, 화학식 2는 하기 화학식 2-1 내지 2-6 중 어느 하나로 표시된다:

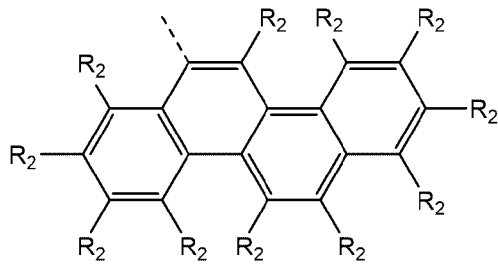
[124] [화학식 2-1]

[125]



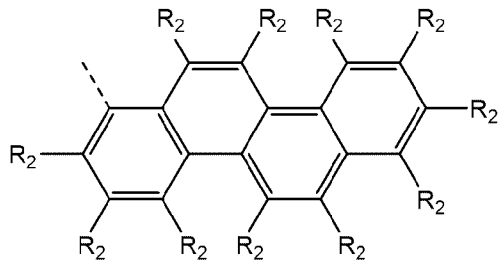
[126] [화학식 2-2]

[127]



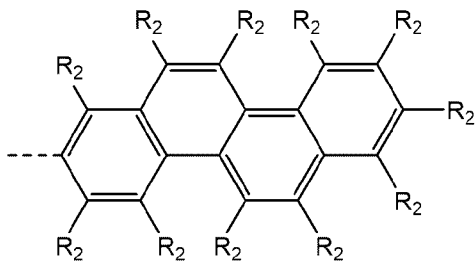
[128] [화학식 2-3]

[129]



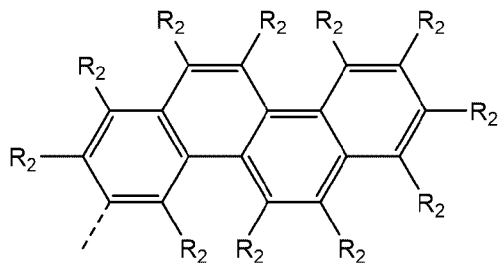
[130] [화학식 2-4]

[131]



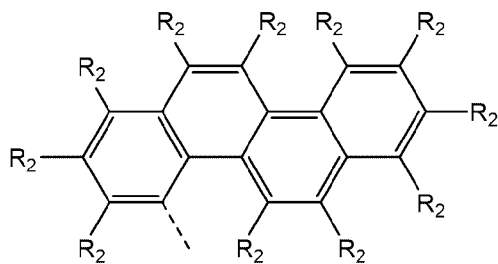
[132] [화학식 2-5]

[133]



[134] [화학식 2-6]

[135]



[136] 상기 화학식 2-1 내지 2-6에서,

[137] R_2 는 각각 독립적으로, 수소, 또는 중수소이다.

[138]

[139] 바람직하게는, R_2 중 하나는 L_2 와 결합하고, 나머지는 모두 수소이거나, 또는 모두 중수소이다.

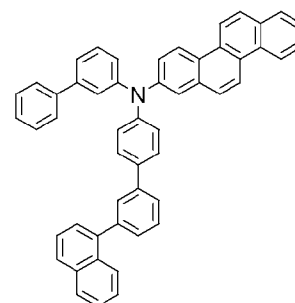
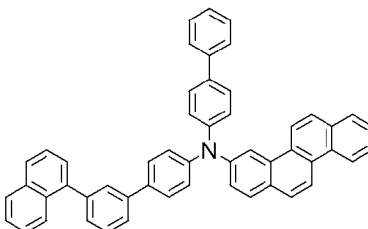
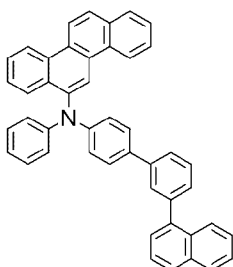
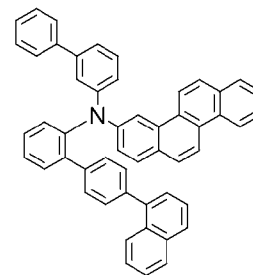
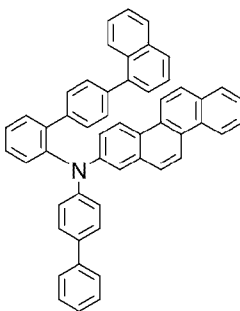
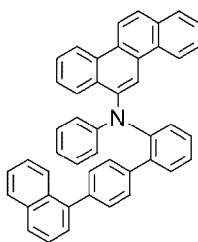
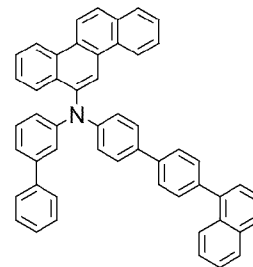
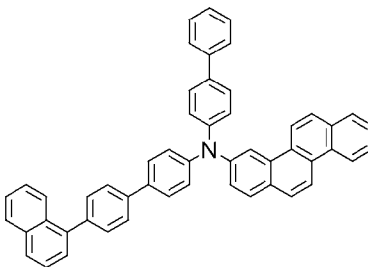
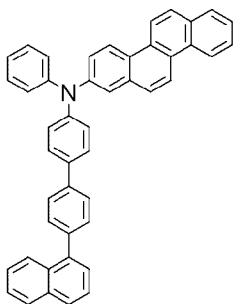
[140]

[141] 그리고, 화학식 1에서, a, b 및 c는 D의 개수를 의미하는 것으로, a는 0, 1 또는 2이고, b는 0, 1, 2, 3 또는 4이고, c는 0, 1, 2, 3, 4, 5, 6 또는 7이다.

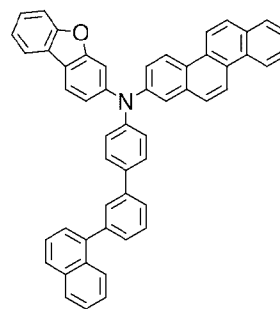
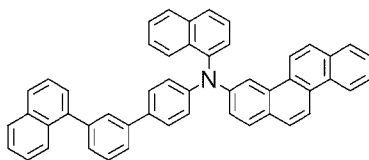
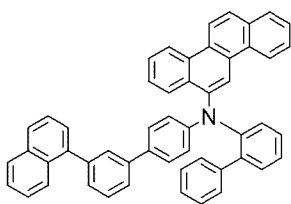
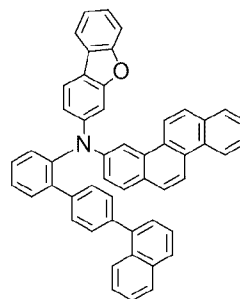
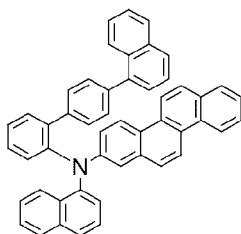
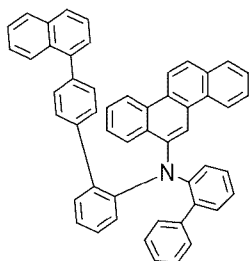
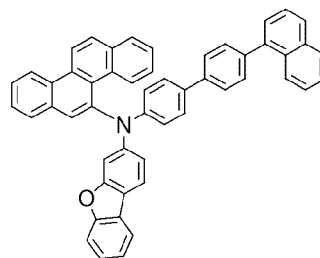
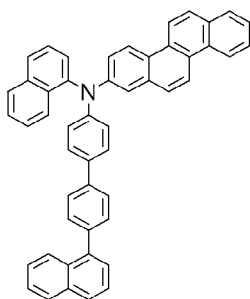
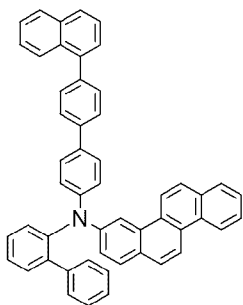
[142]

[143] 상기 화학식 1로 표시되는 화합물의 대표적인 예는 하기와 같다:

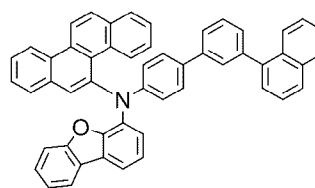
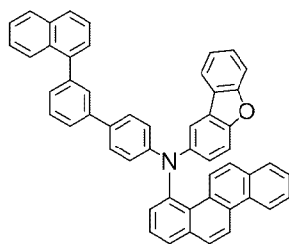
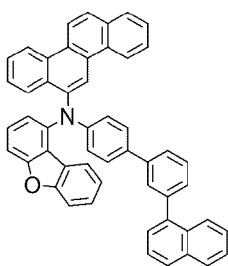
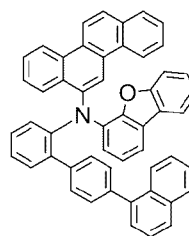
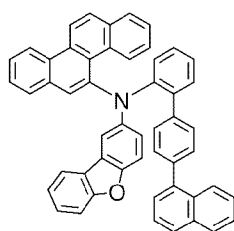
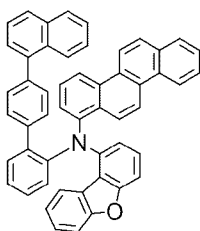
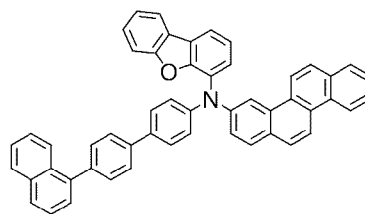
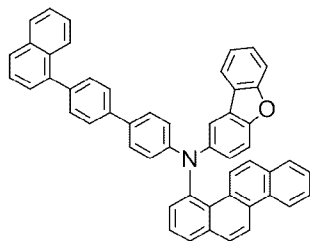
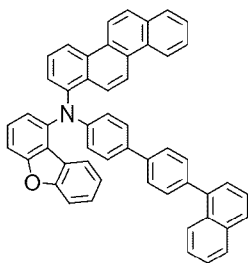
[144]



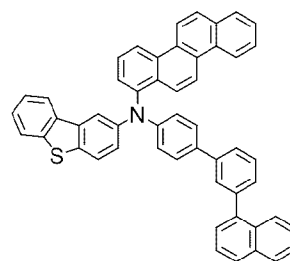
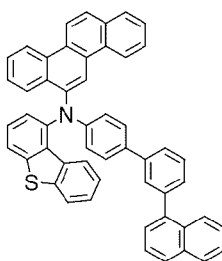
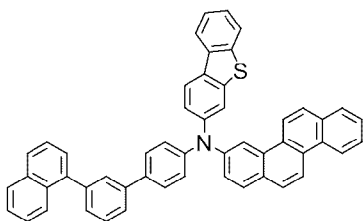
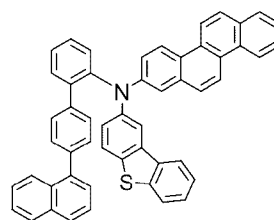
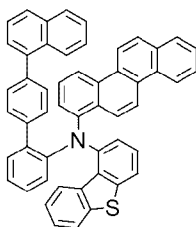
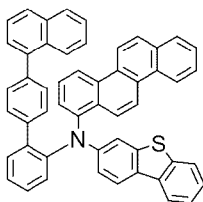
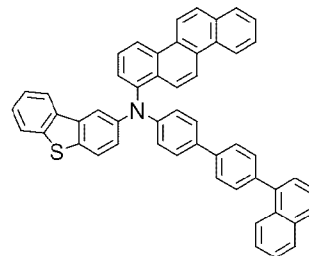
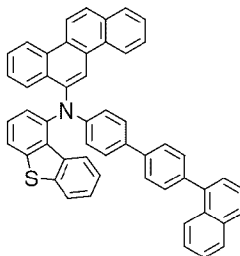
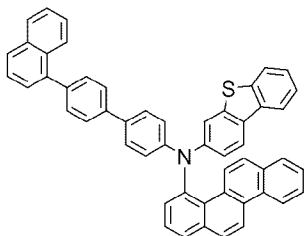
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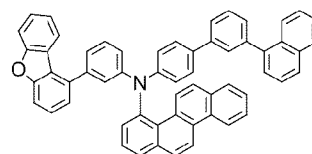
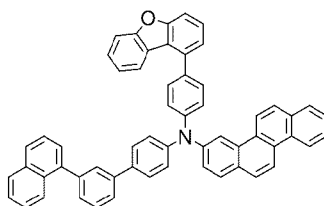
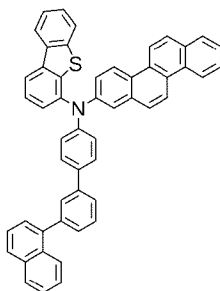
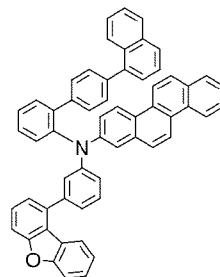
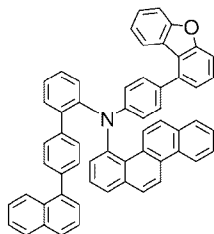
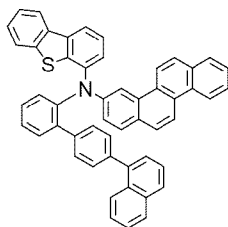
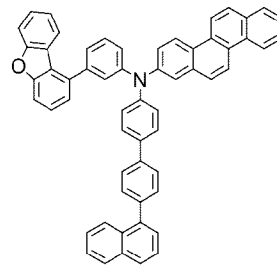
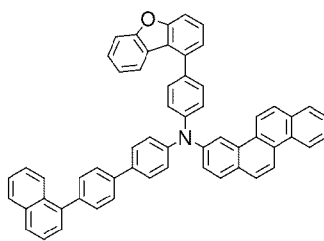
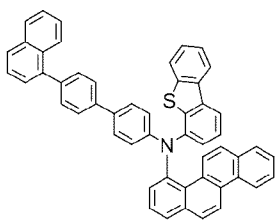
[146]



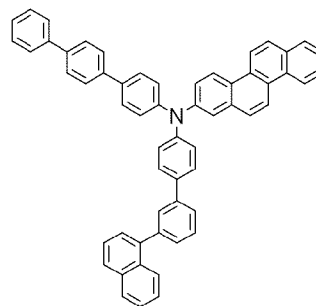
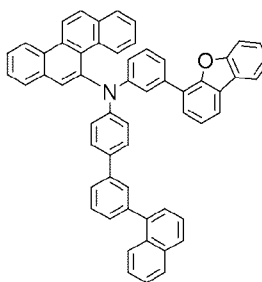
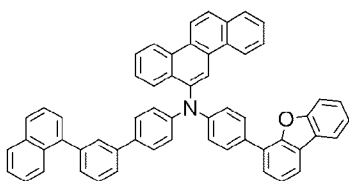
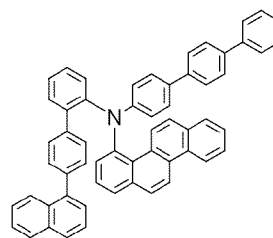
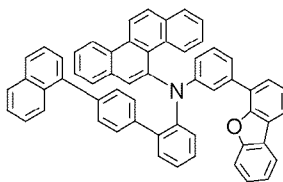
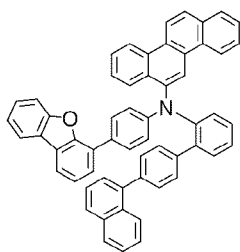
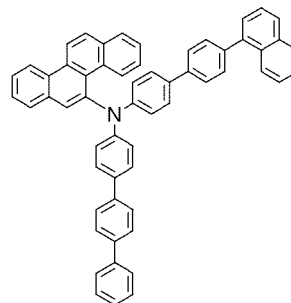
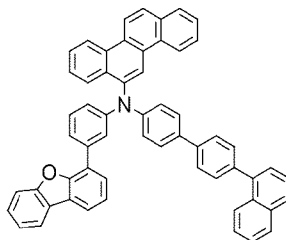
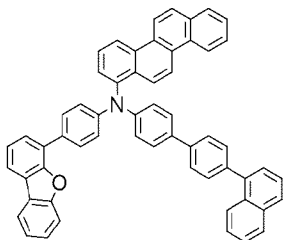
[147]



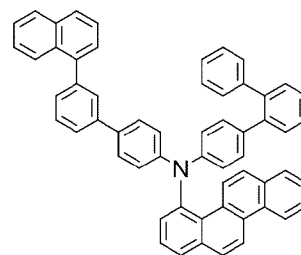
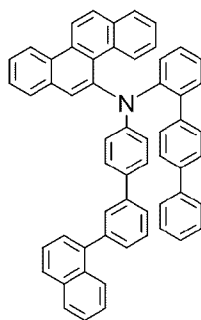
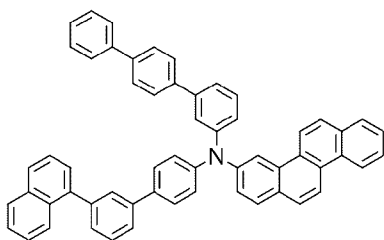
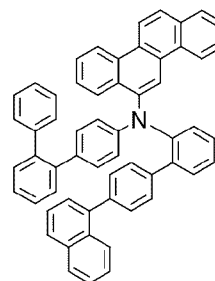
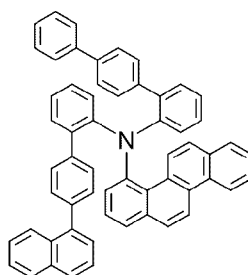
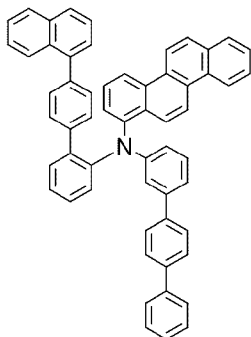
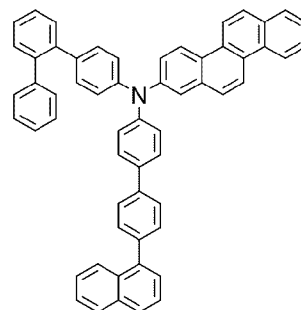
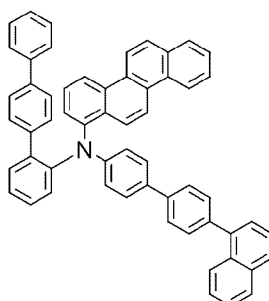
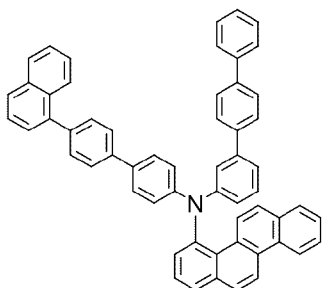
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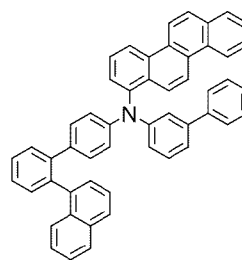
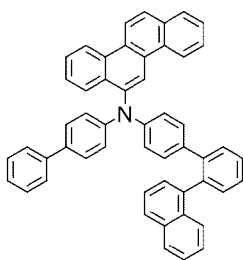
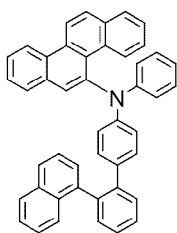
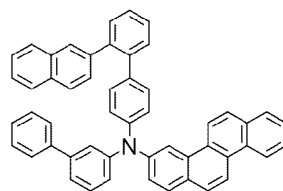
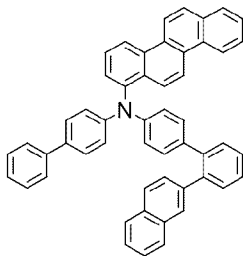
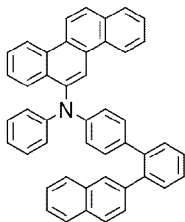
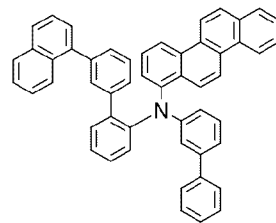
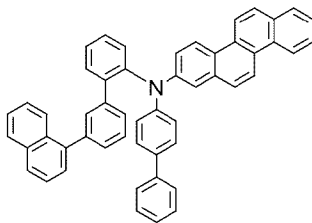
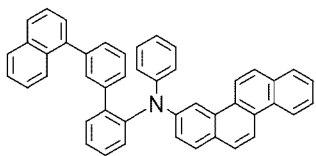
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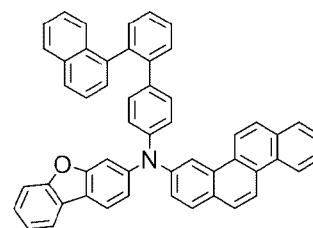
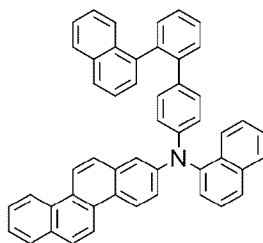
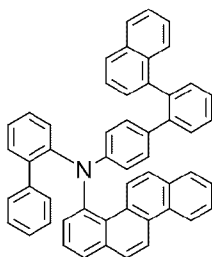
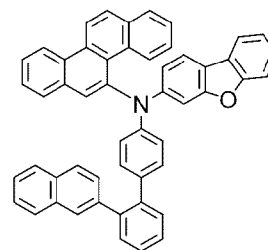
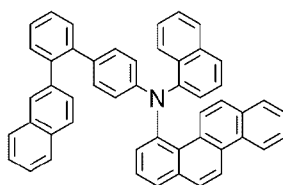
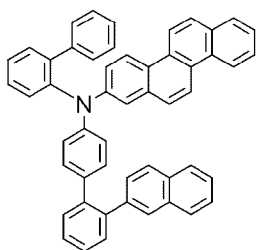
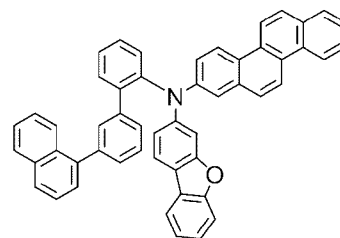
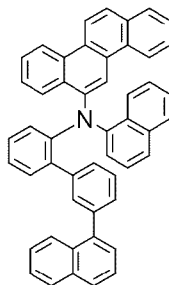
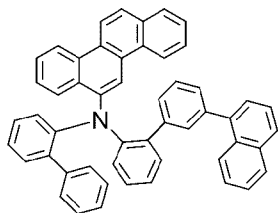
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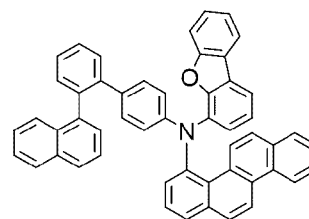
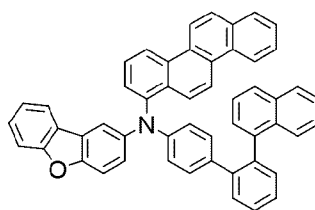
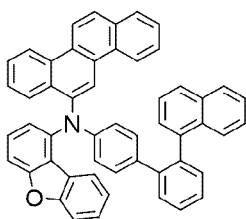
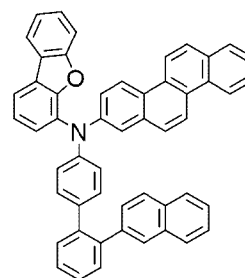
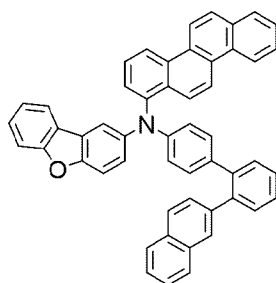
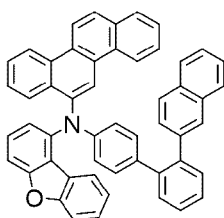
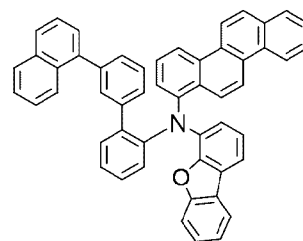
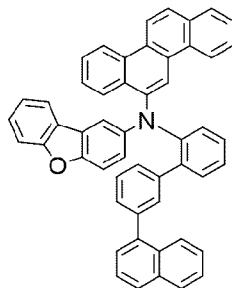
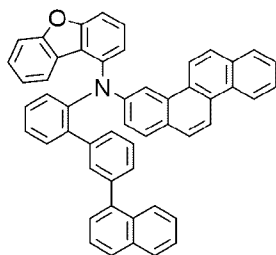
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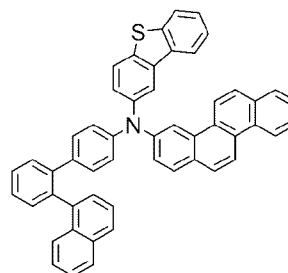
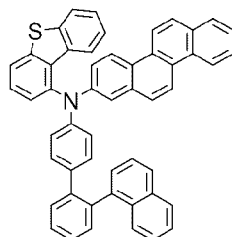
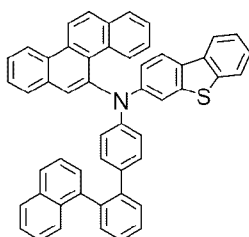
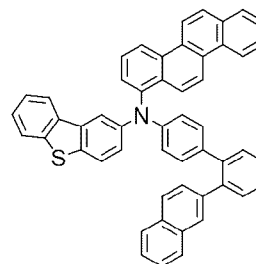
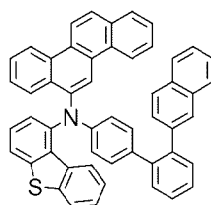
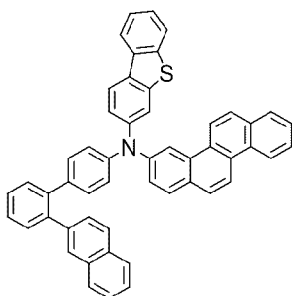
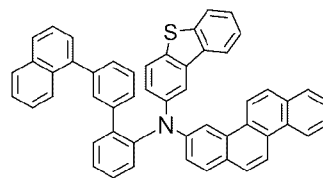
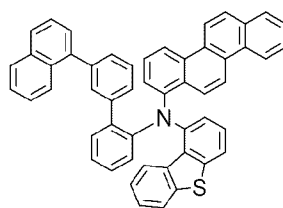
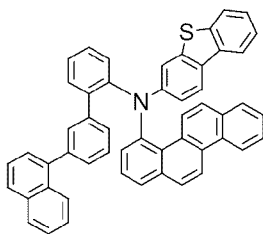
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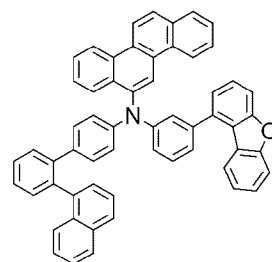
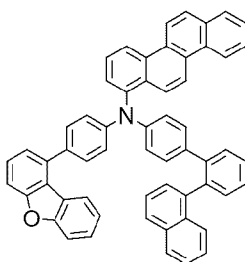
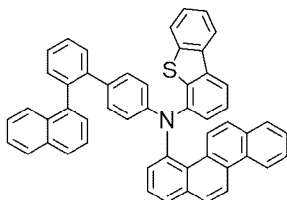
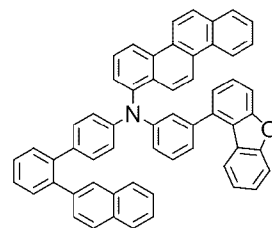
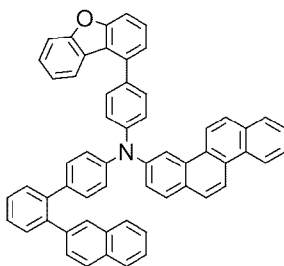
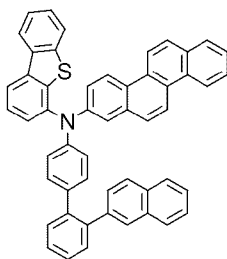
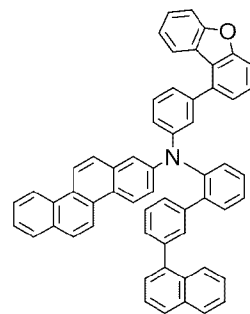
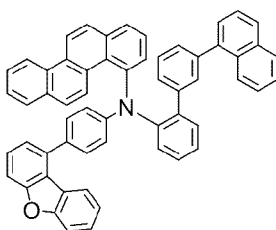
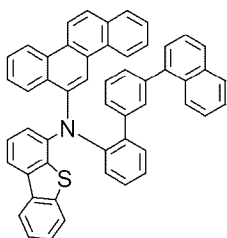
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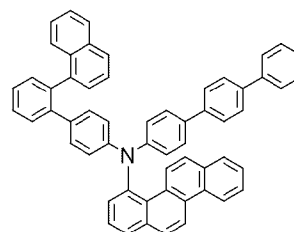
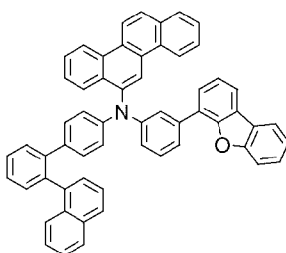
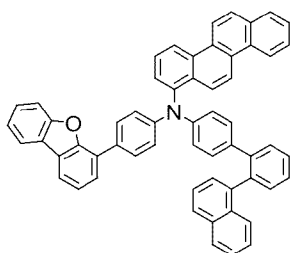
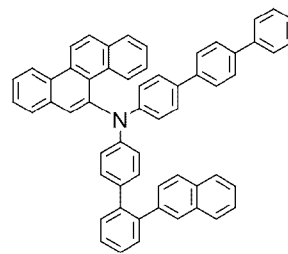
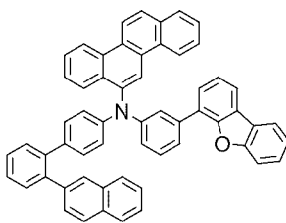
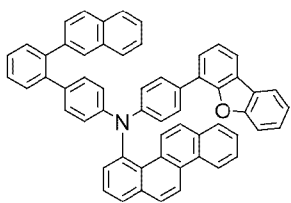
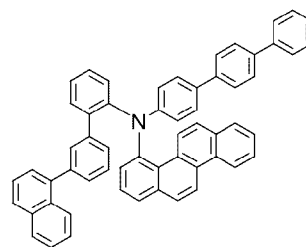
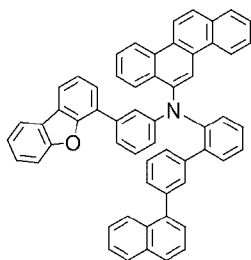
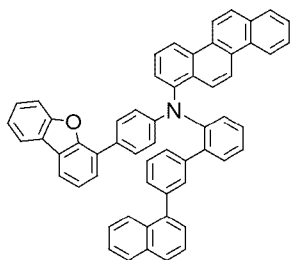
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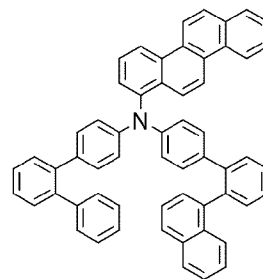
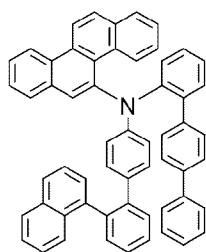
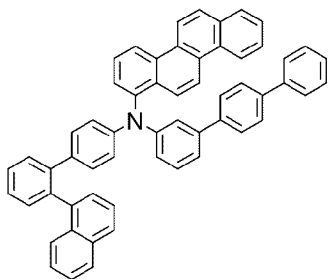
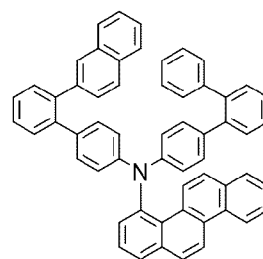
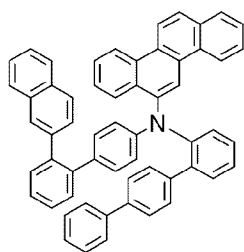
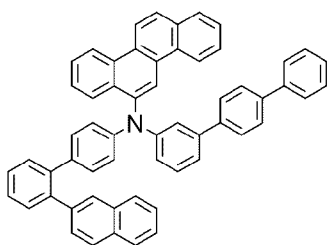
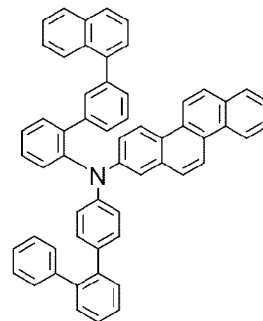
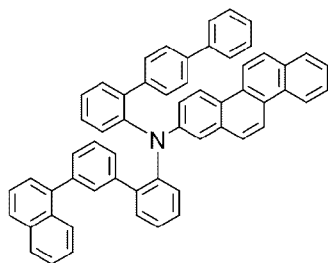
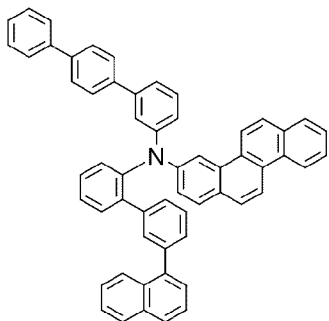
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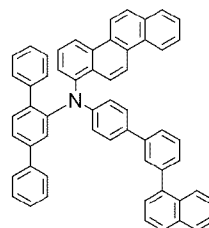
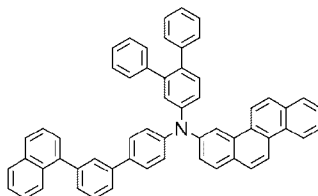
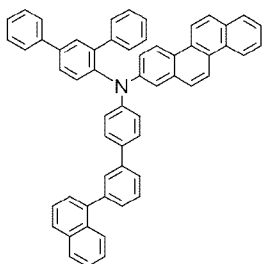
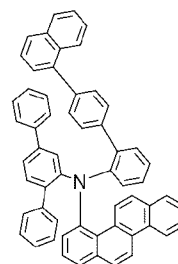
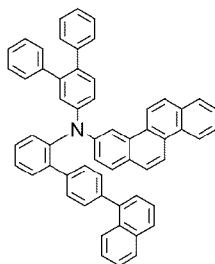
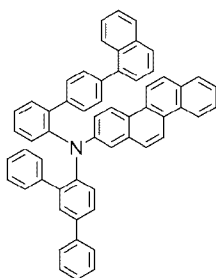
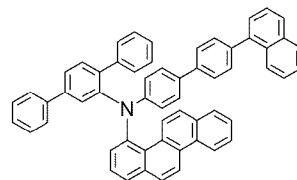
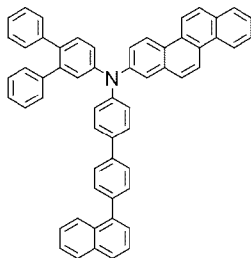
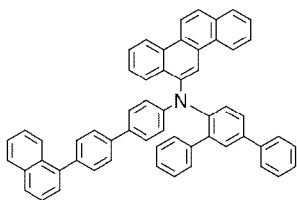
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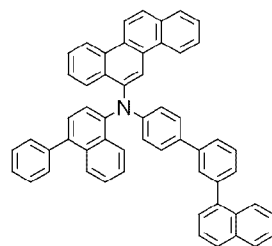
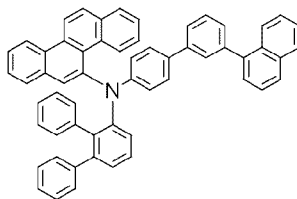
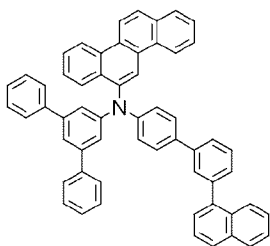
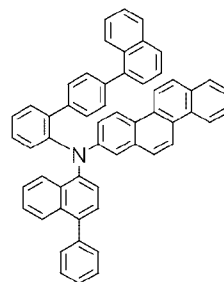
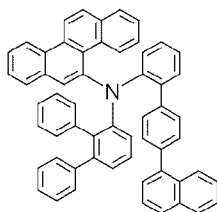
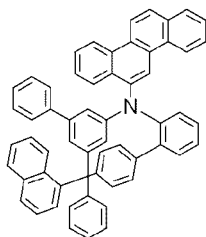
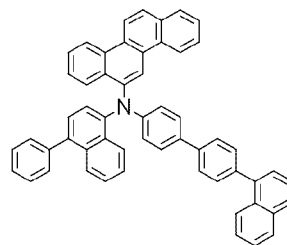
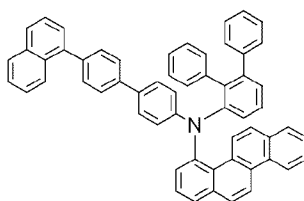
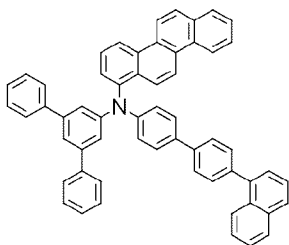
[157]



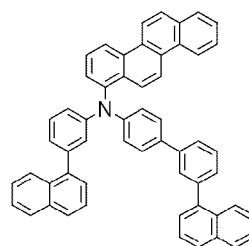
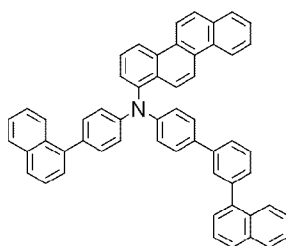
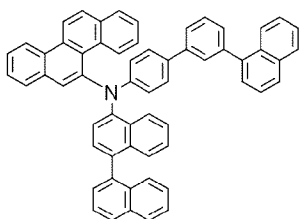
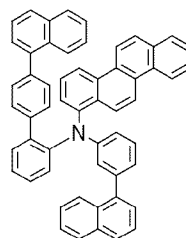
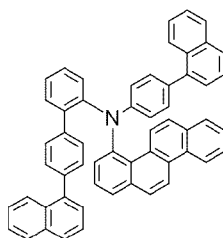
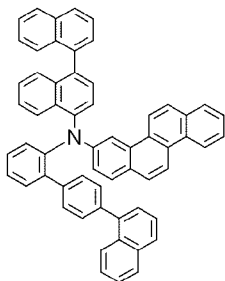
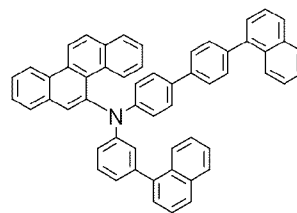
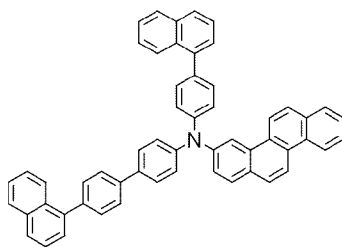
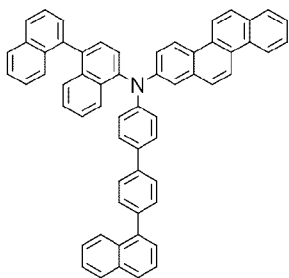
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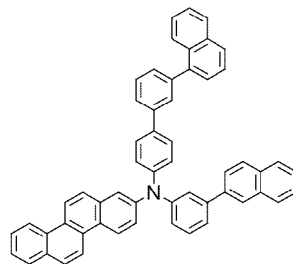
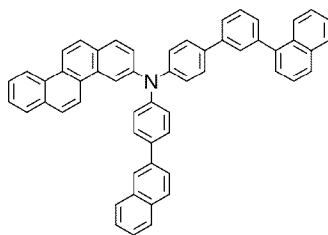
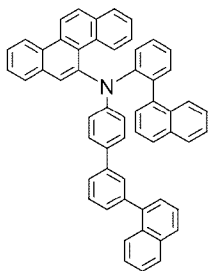
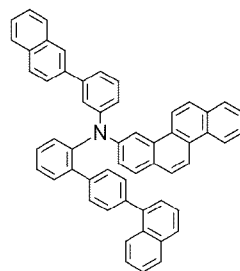
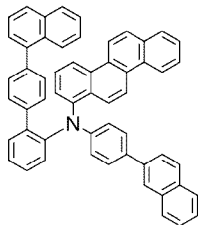
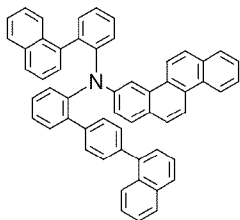
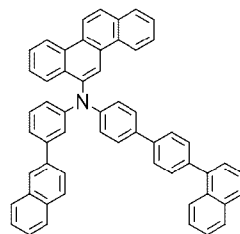
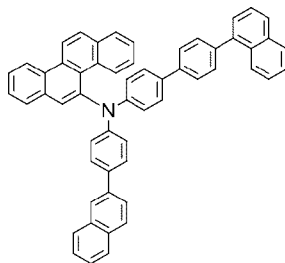
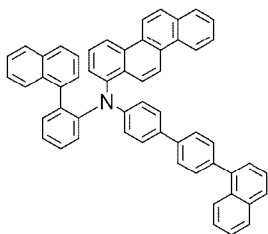
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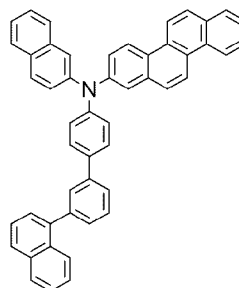
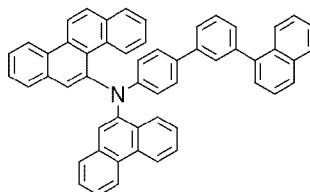
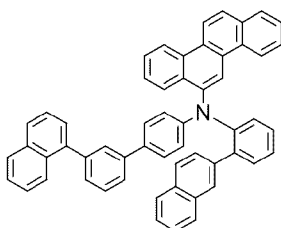
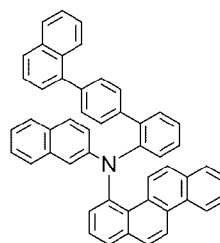
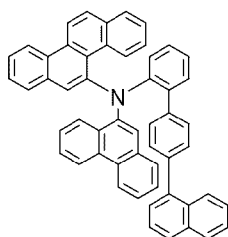
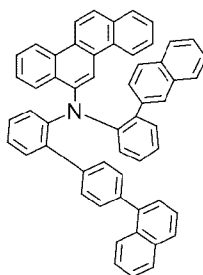
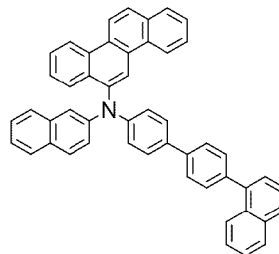
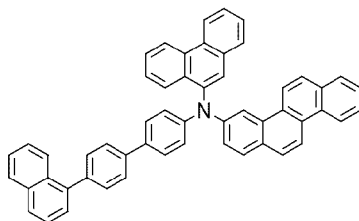
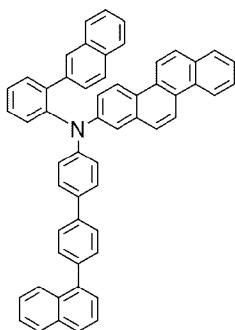
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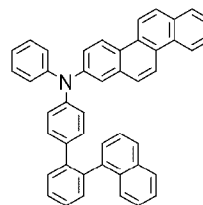
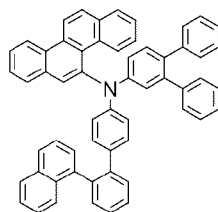
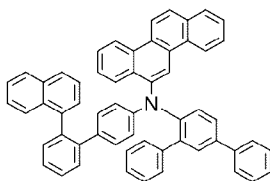
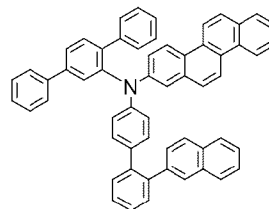
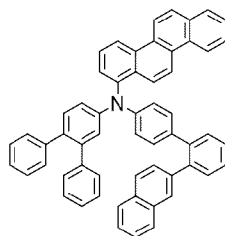
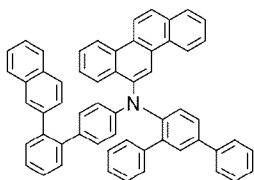
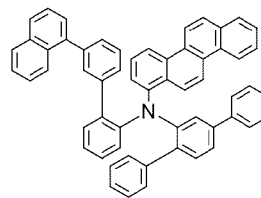
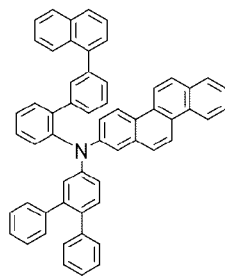
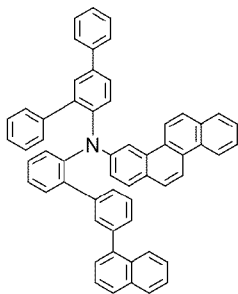
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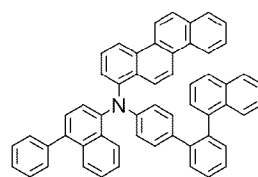
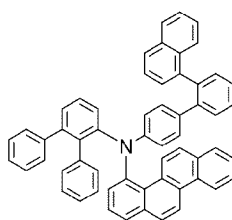
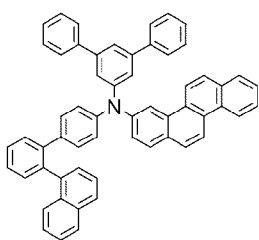
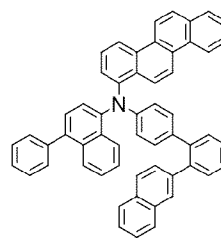
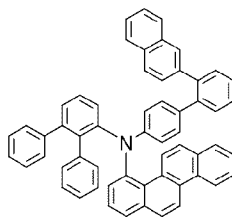
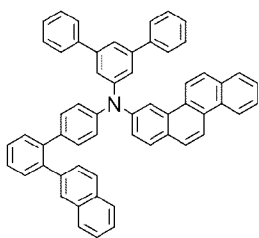
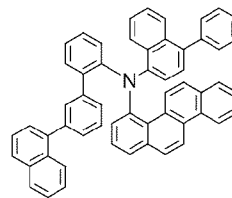
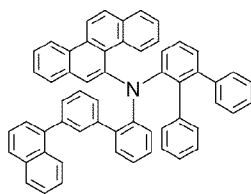
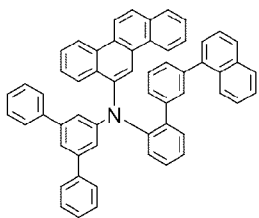
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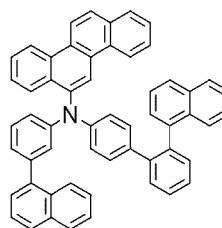
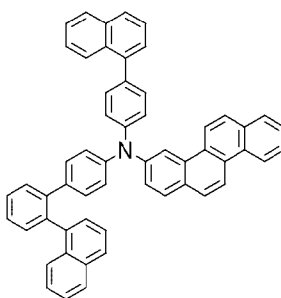
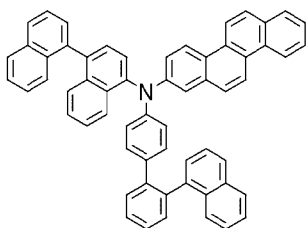
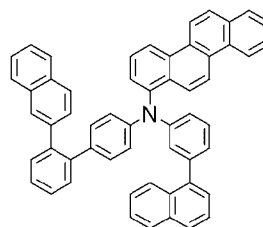
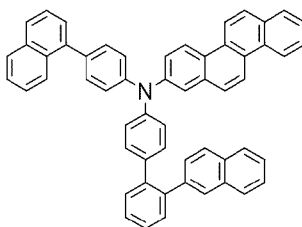
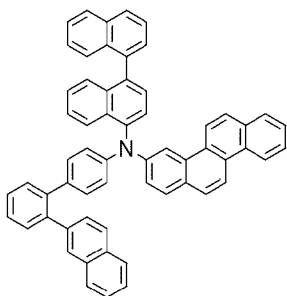
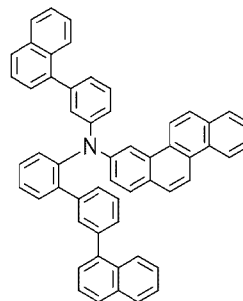
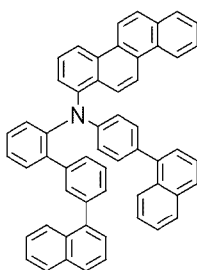
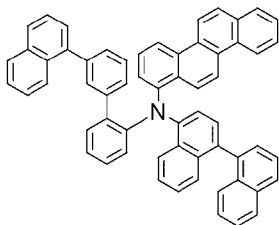
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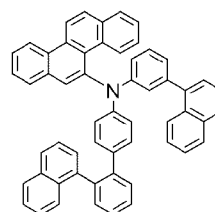
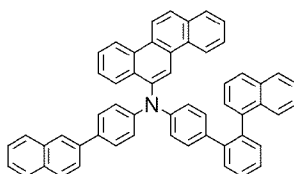
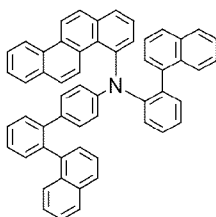
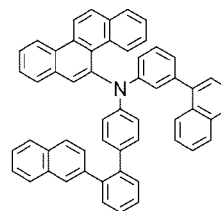
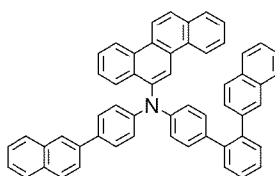
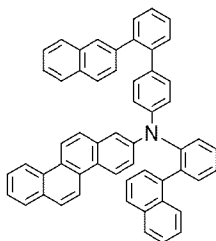
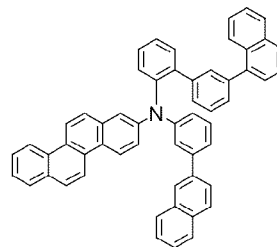
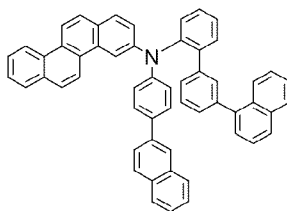
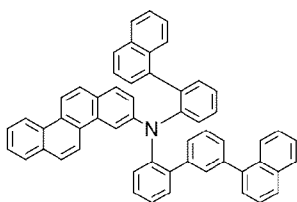
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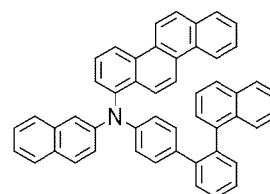
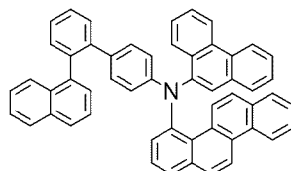
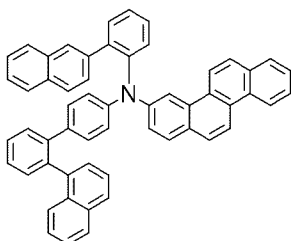
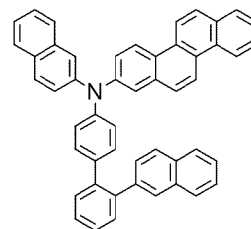
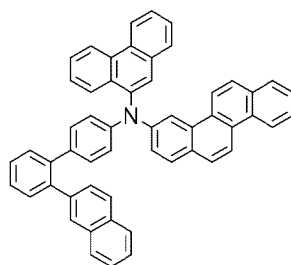
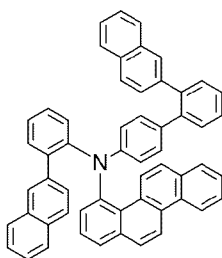
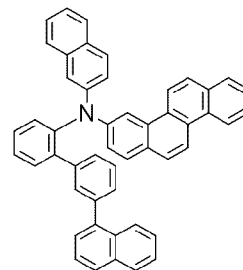
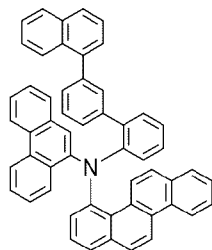
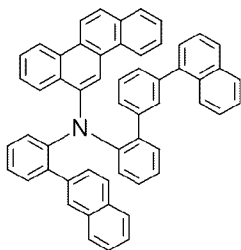
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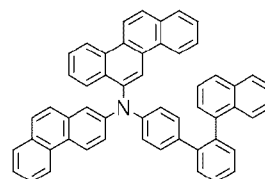
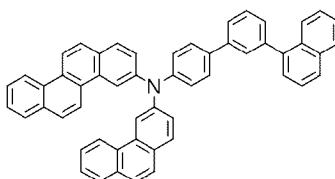
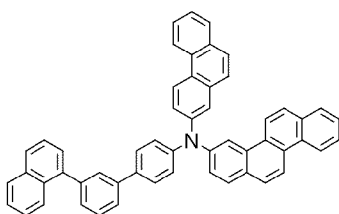
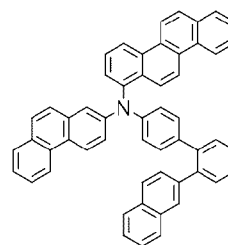
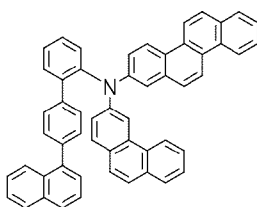
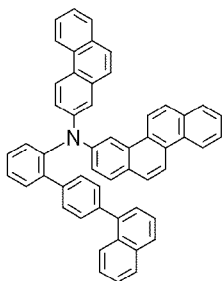
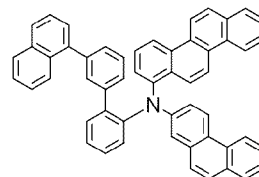
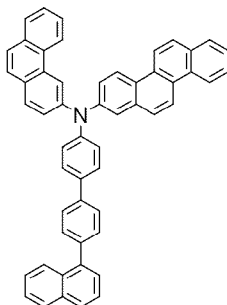
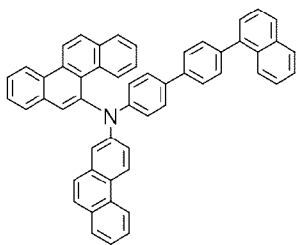
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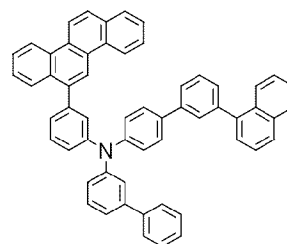
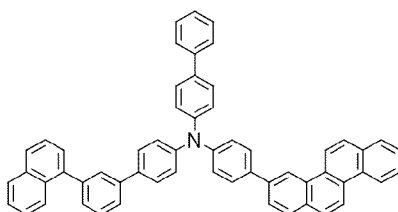
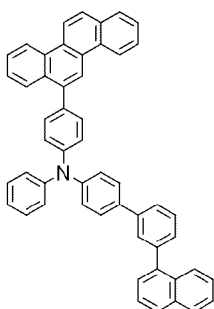
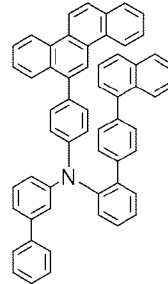
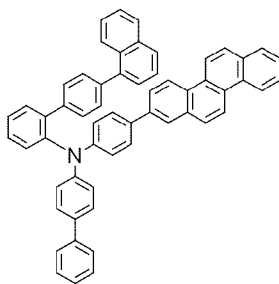
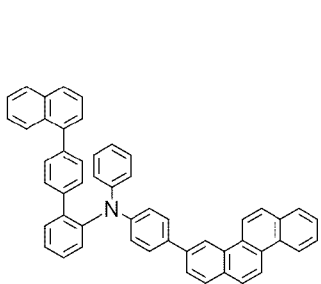
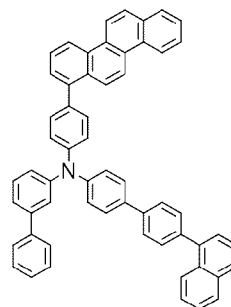
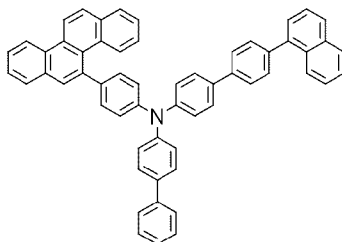
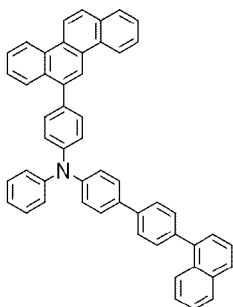
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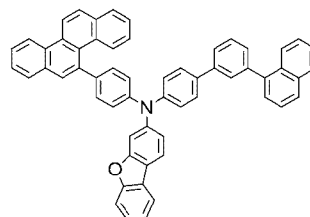
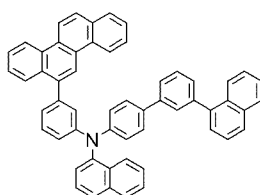
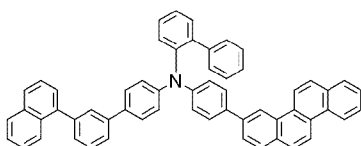
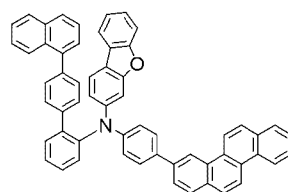
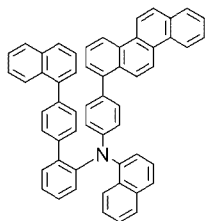
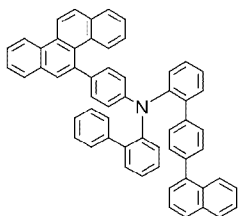
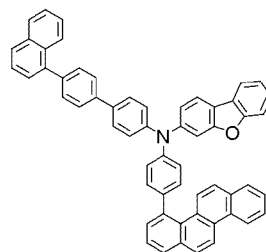
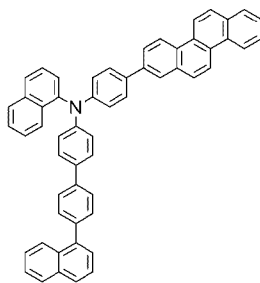
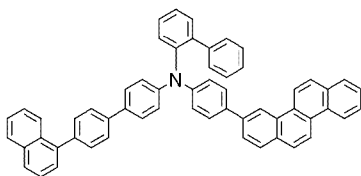
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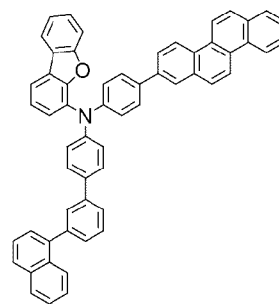
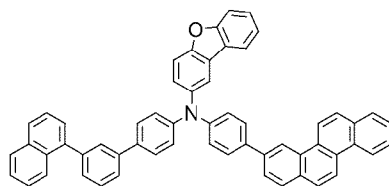
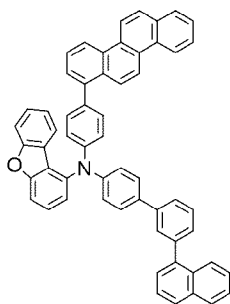
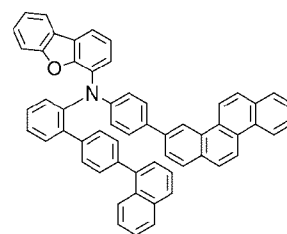
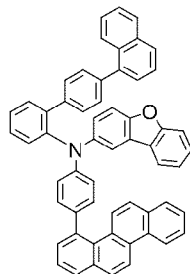
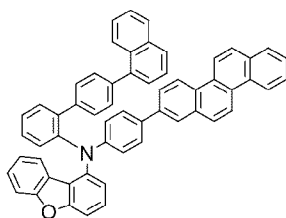
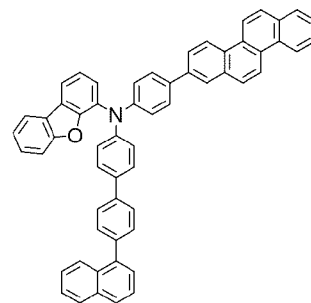
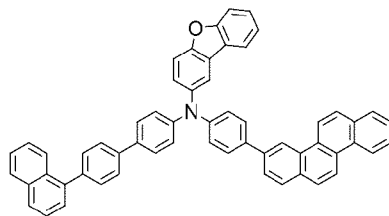
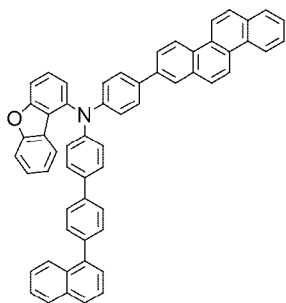
[169]



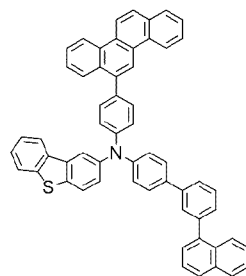
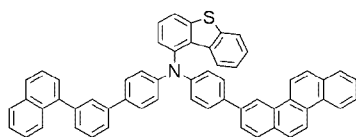
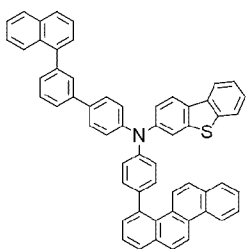
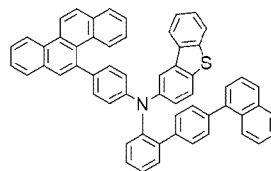
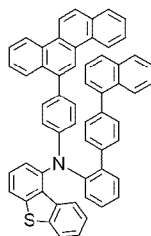
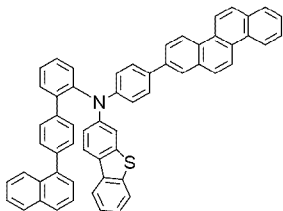
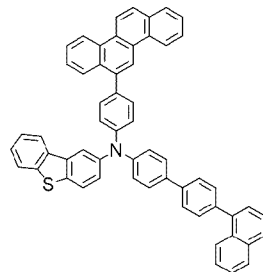
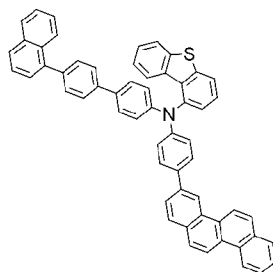
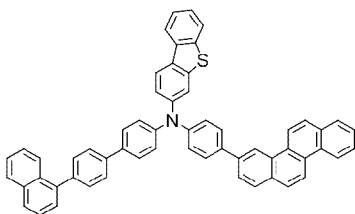
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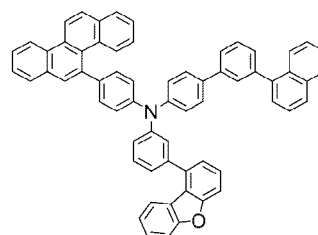
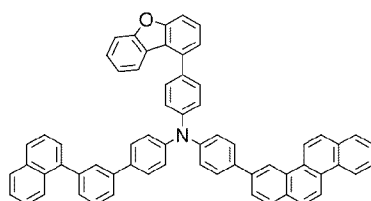
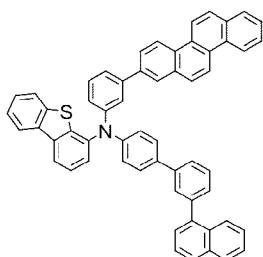
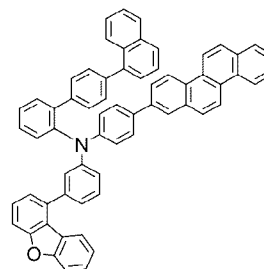
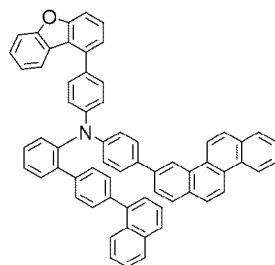
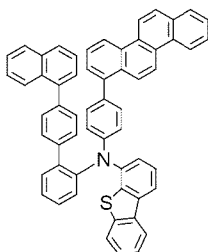
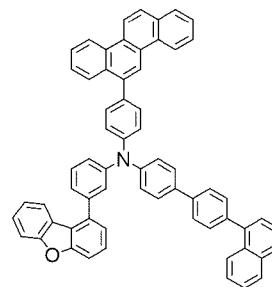
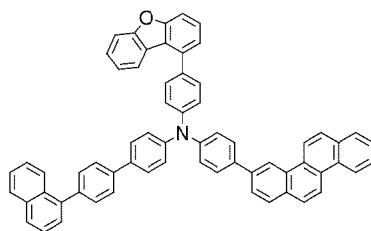
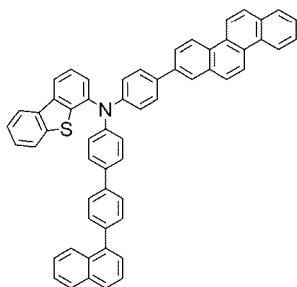
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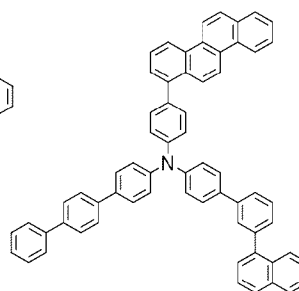
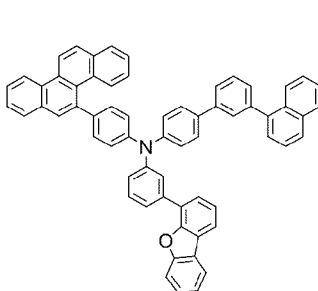
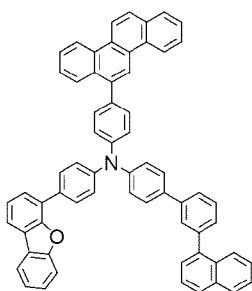
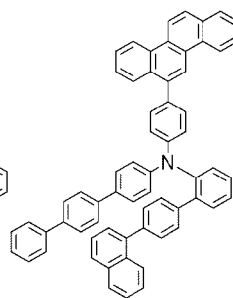
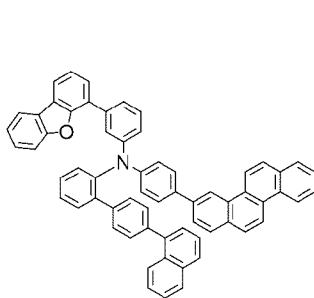
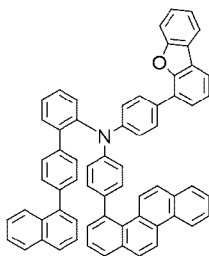
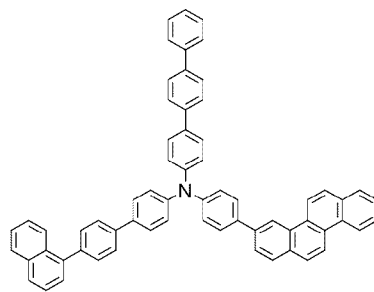
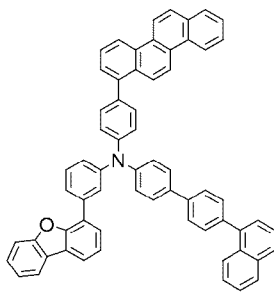
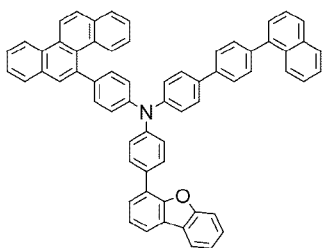
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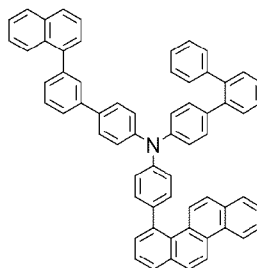
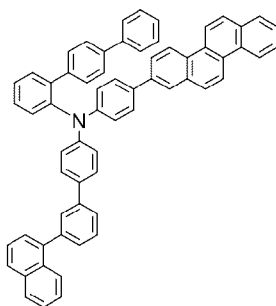
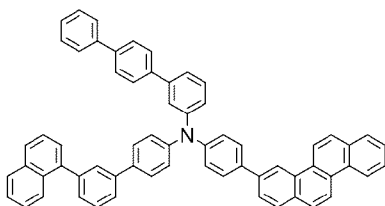
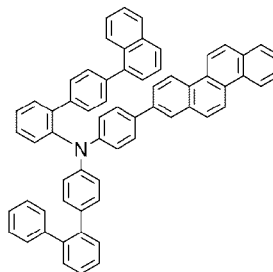
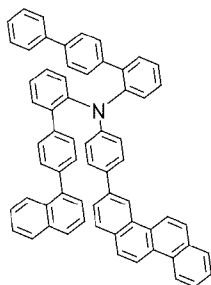
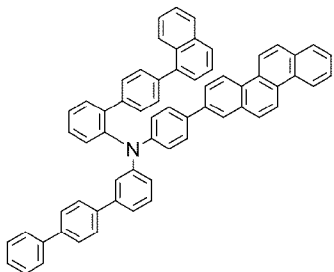
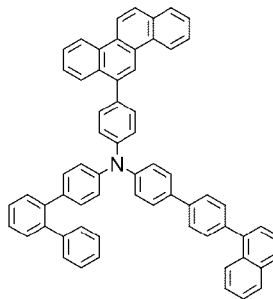
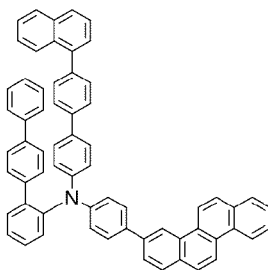
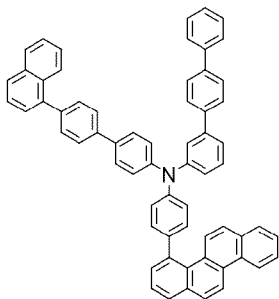
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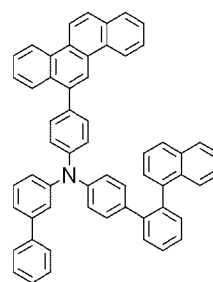
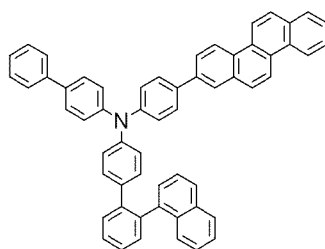
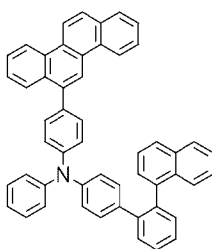
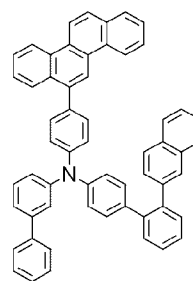
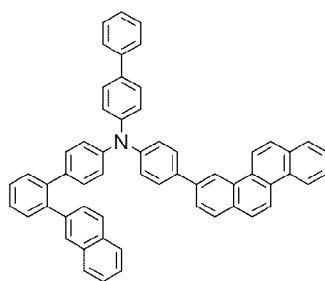
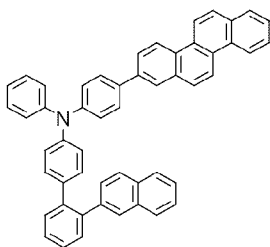
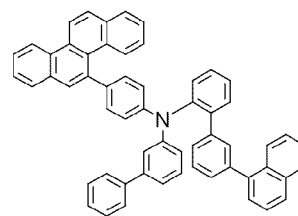
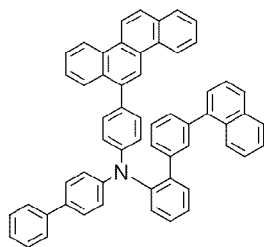
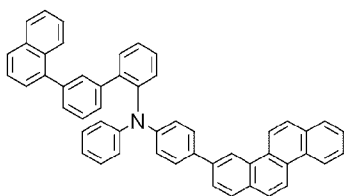
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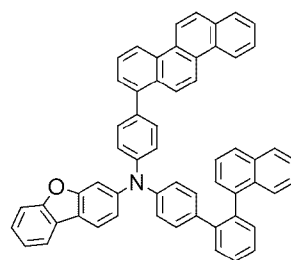
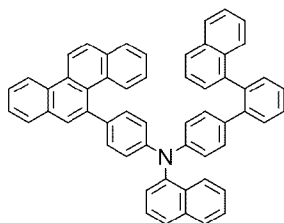
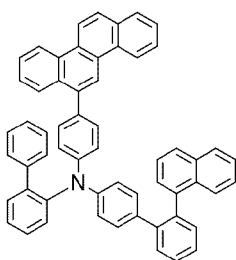
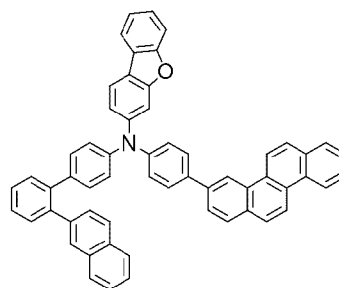
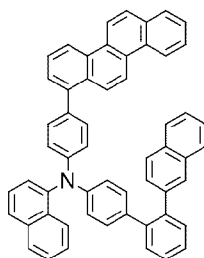
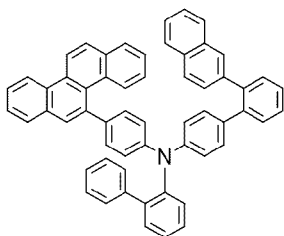
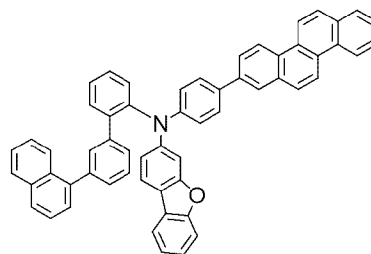
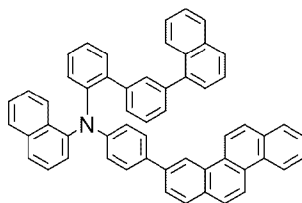
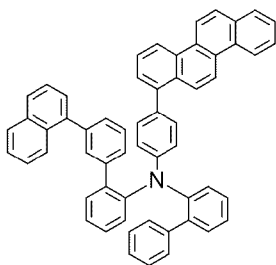
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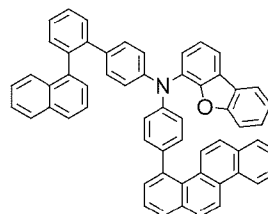
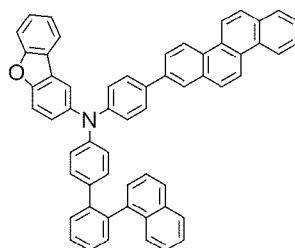
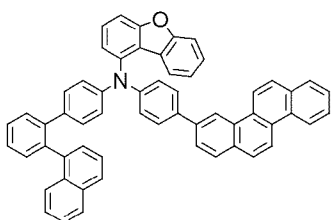
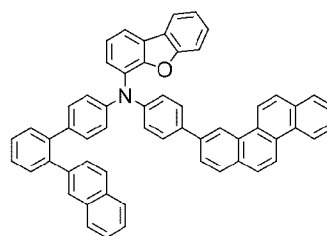
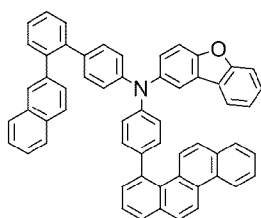
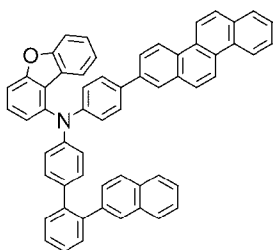
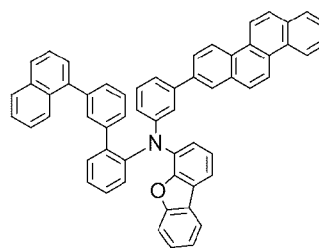
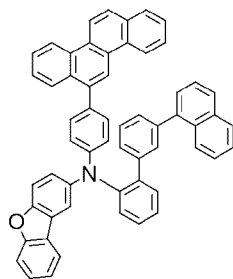
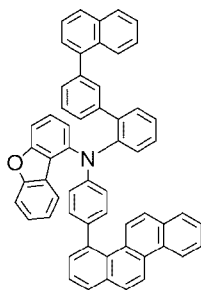
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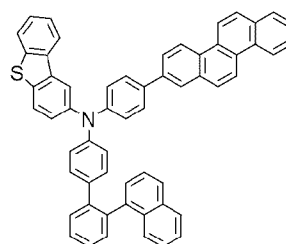
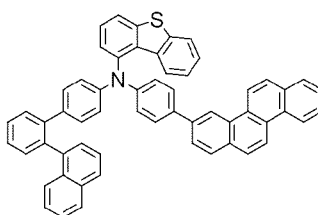
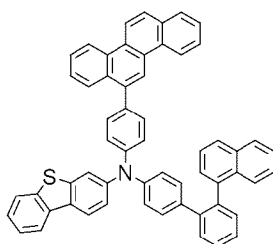
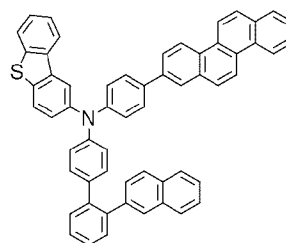
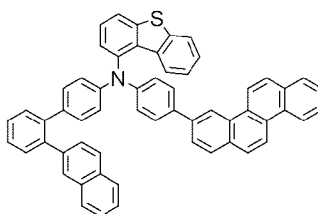
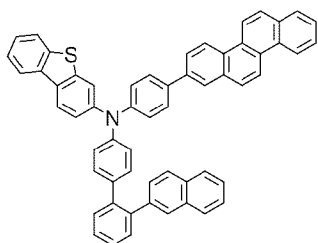
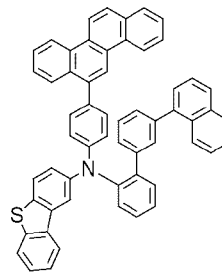
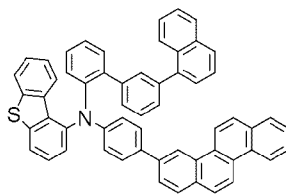
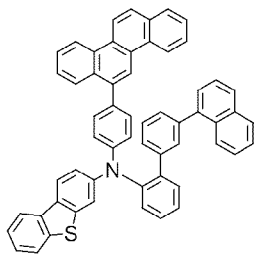
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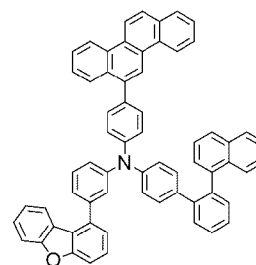
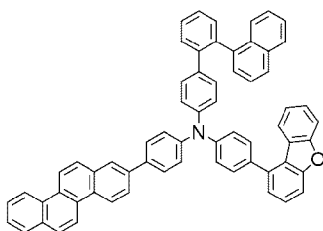
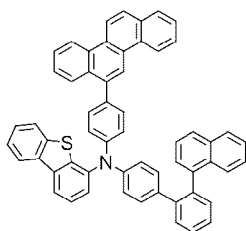
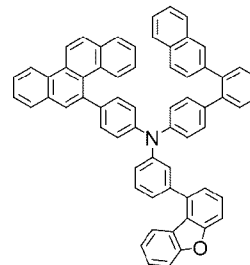
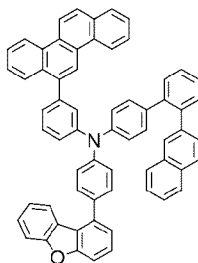
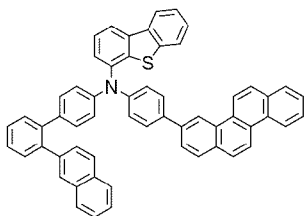
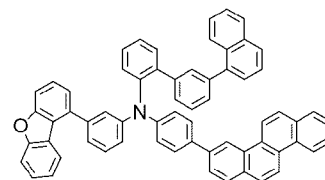
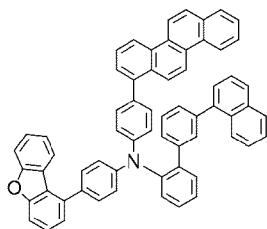
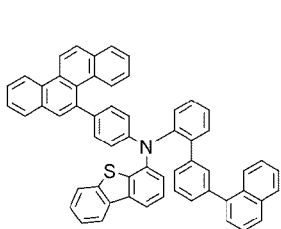
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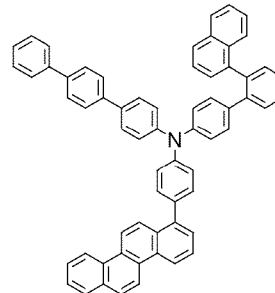
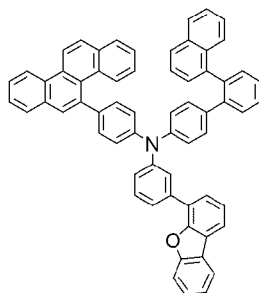
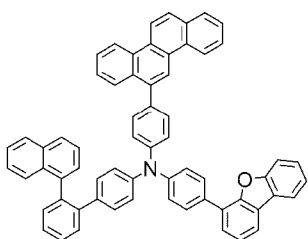
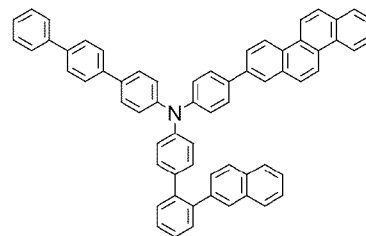
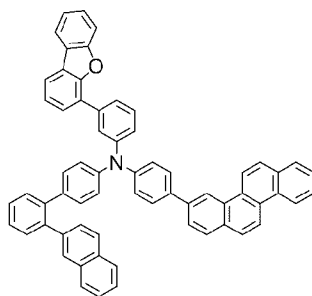
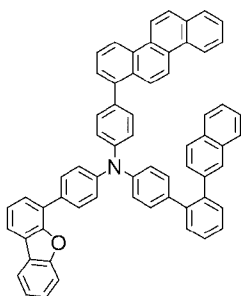
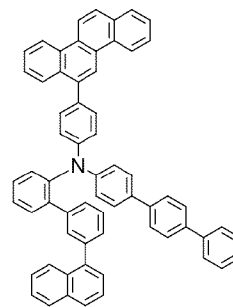
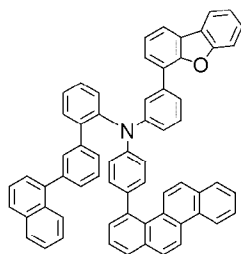
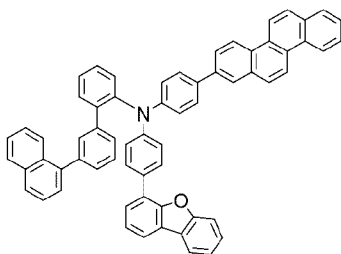
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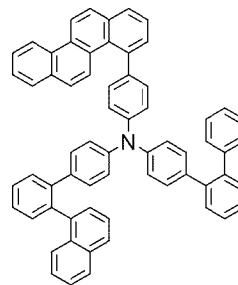
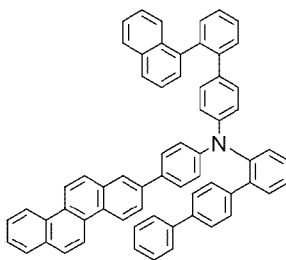
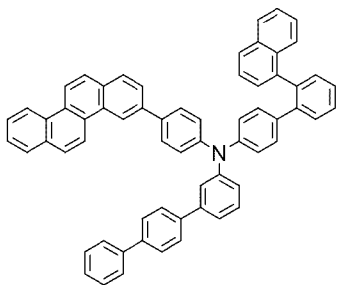
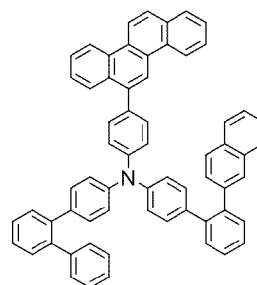
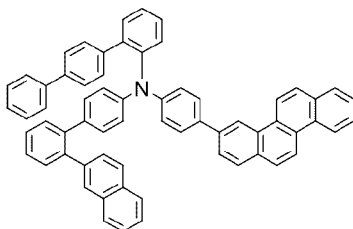
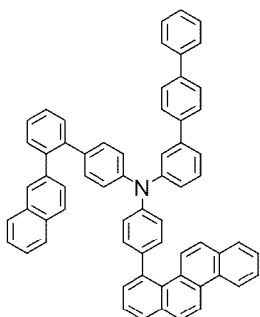
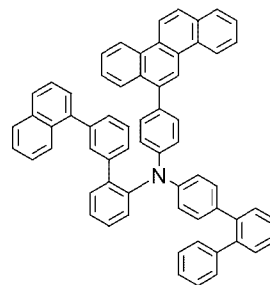
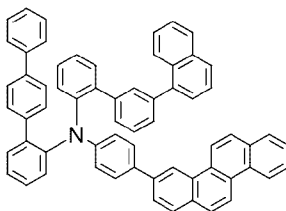
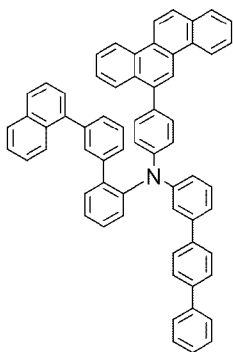
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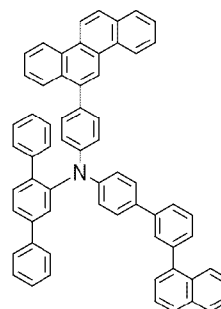
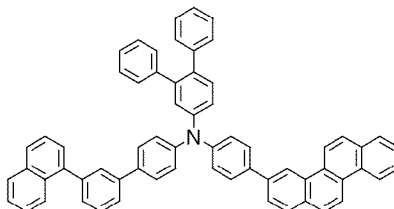
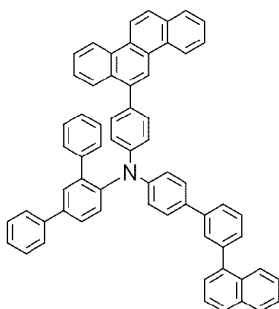
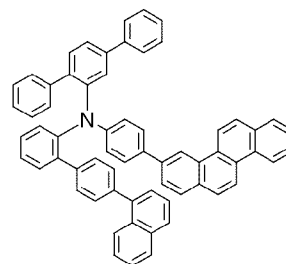
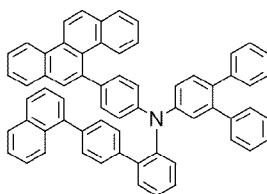
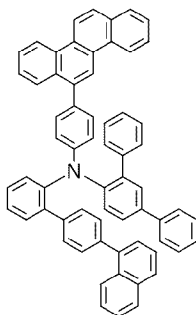
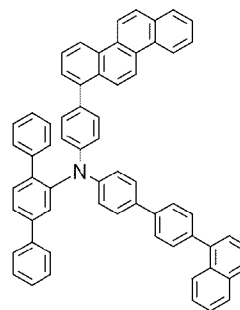
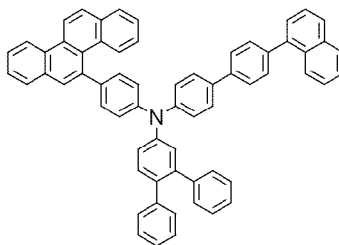
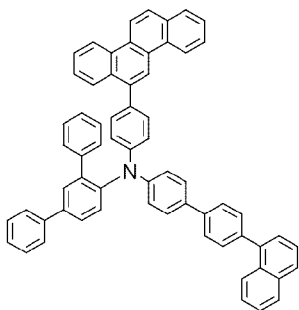
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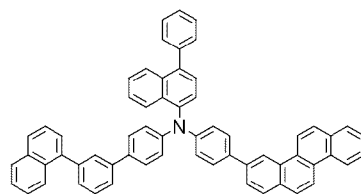
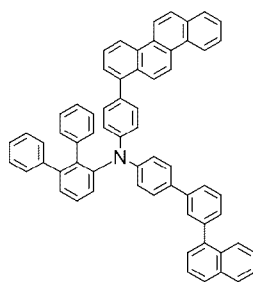
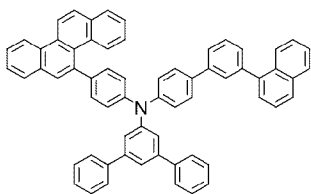
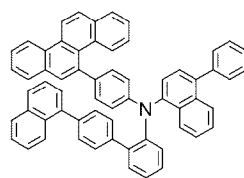
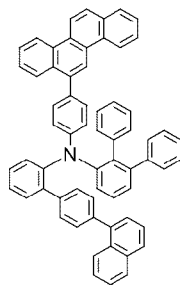
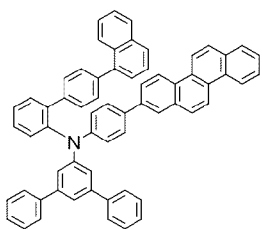
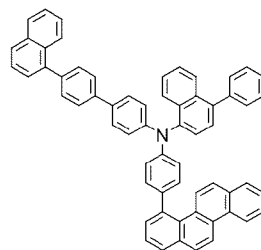
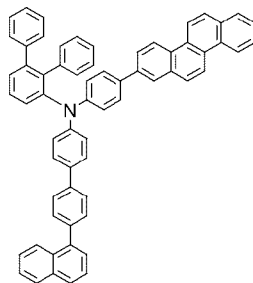
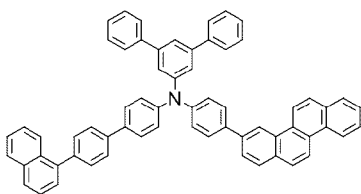
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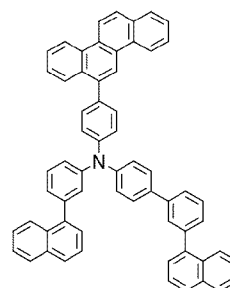
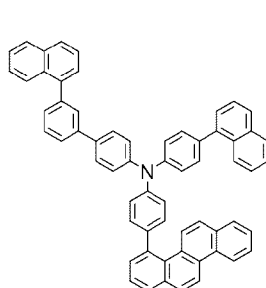
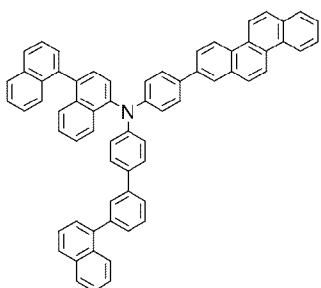
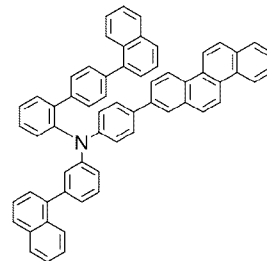
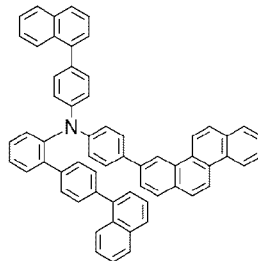
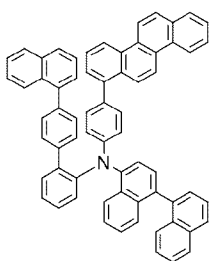
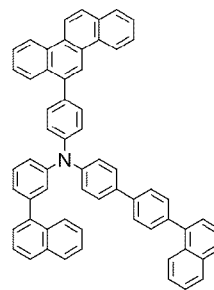
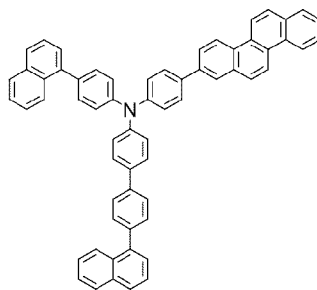
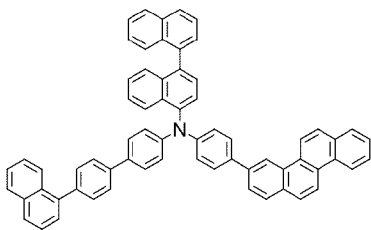
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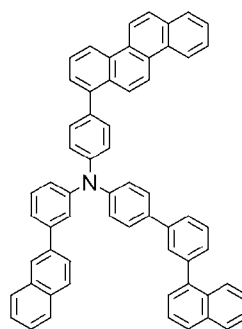
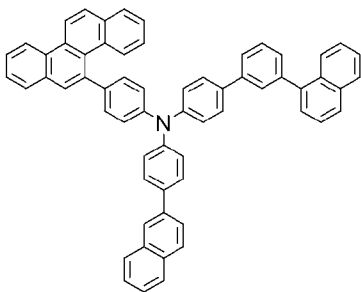
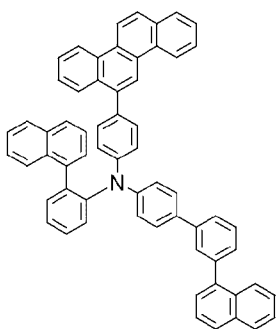
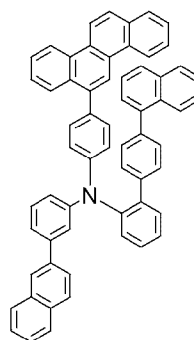
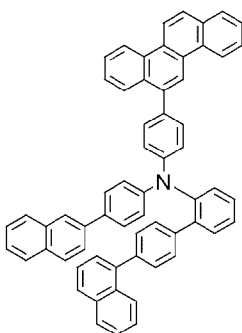
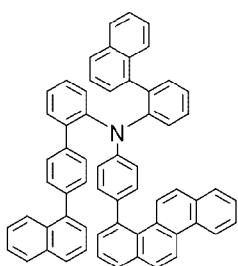
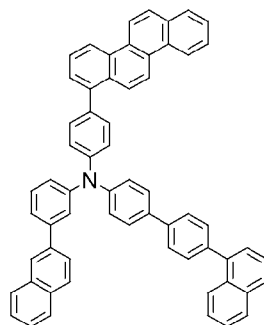
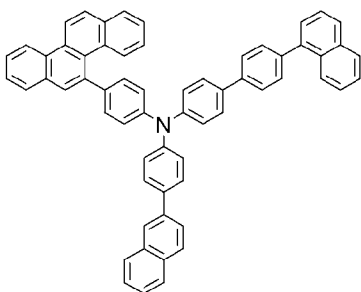
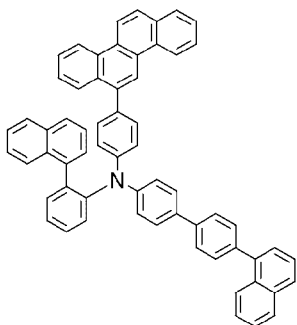
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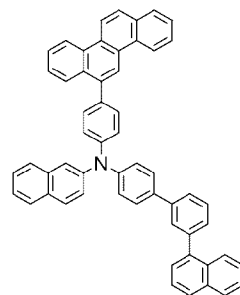
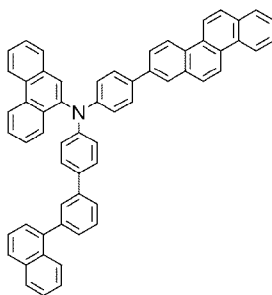
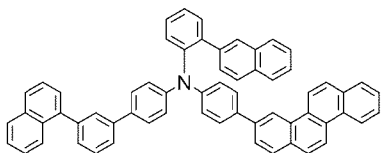
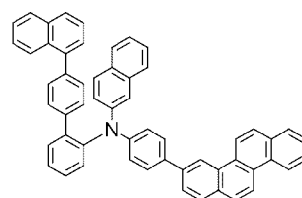
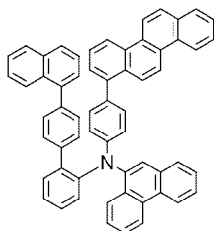
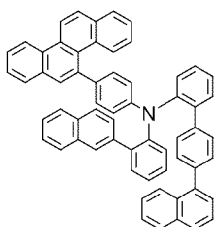
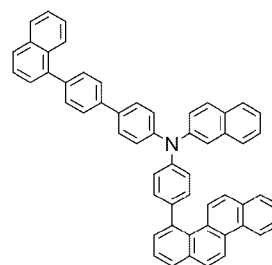
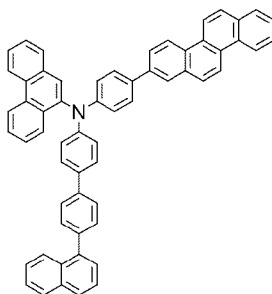
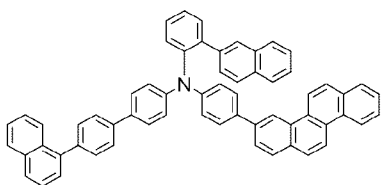
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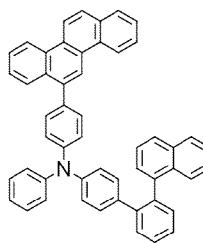
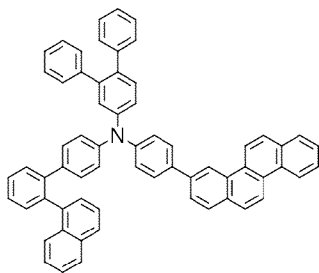
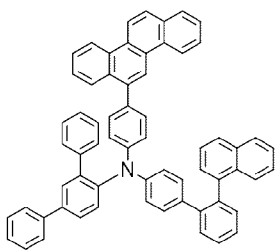
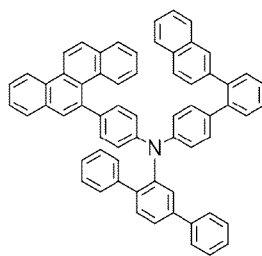
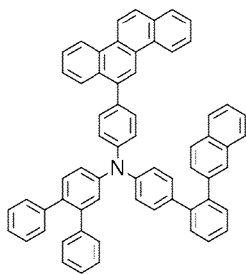
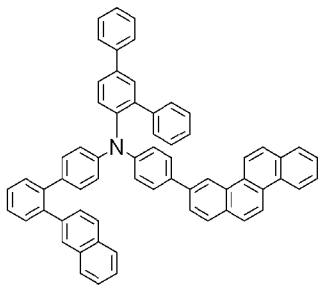
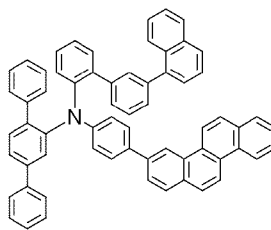
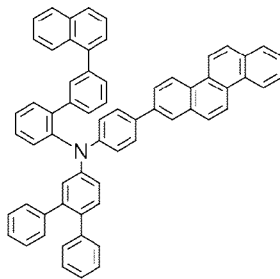
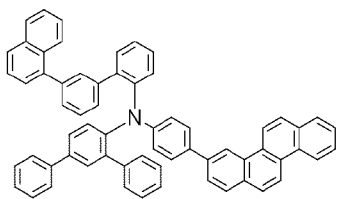
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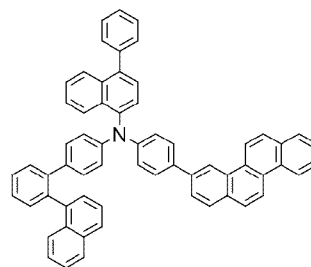
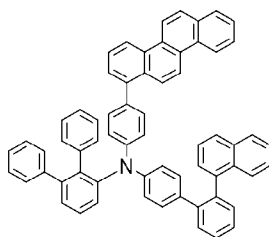
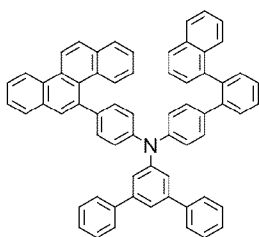
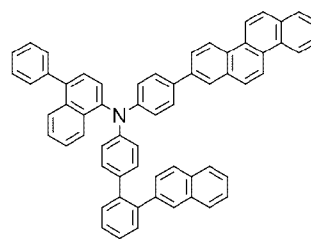
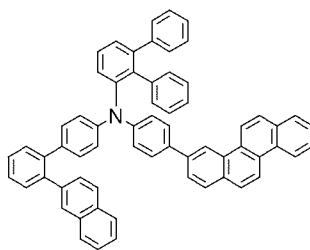
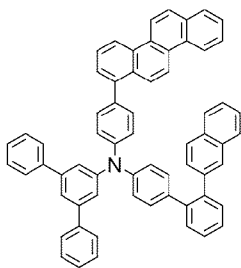
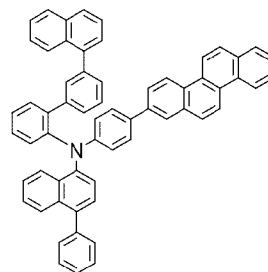
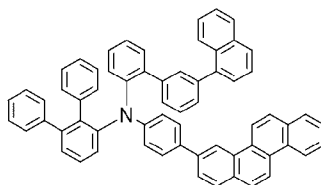
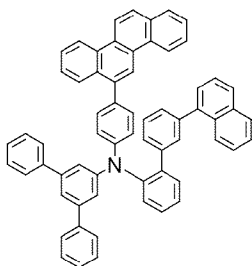
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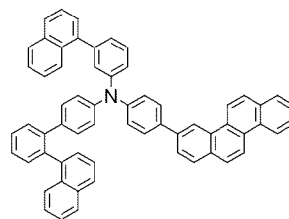
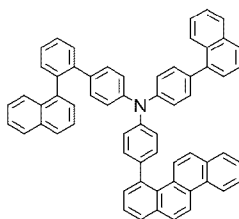
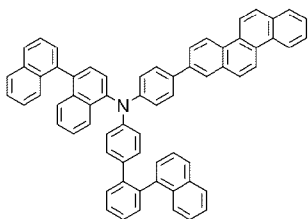
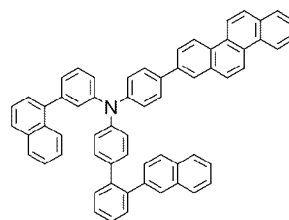
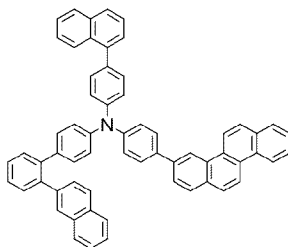
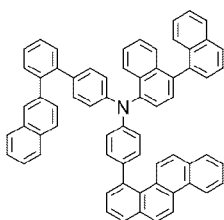
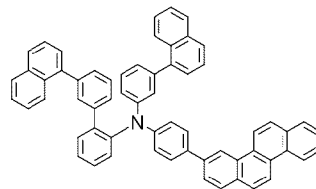
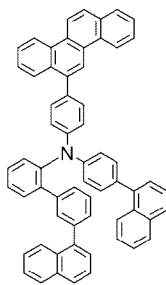
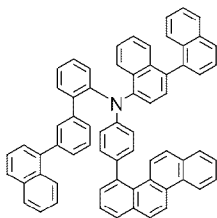
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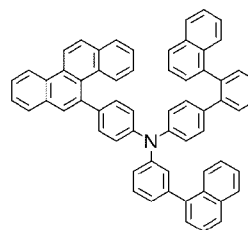
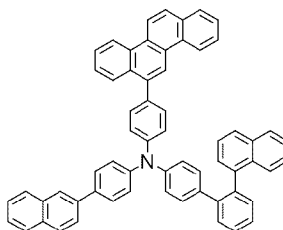
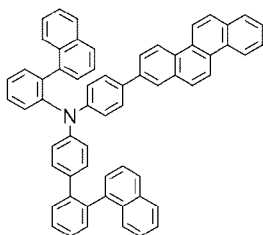
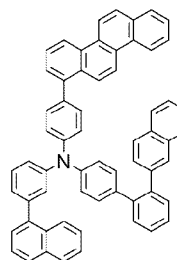
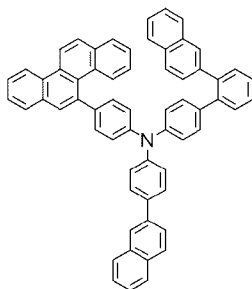
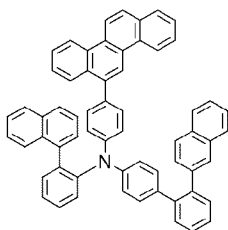
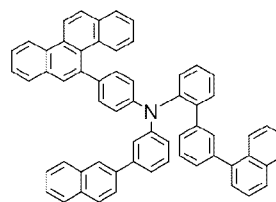
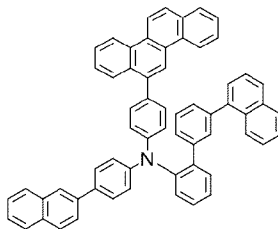
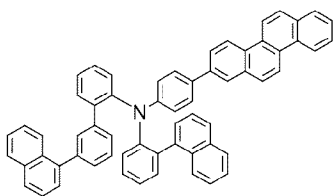
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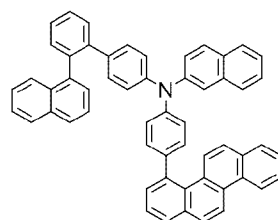
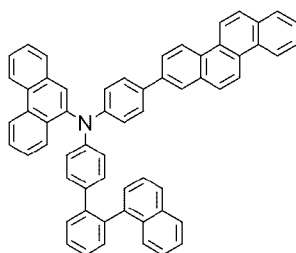
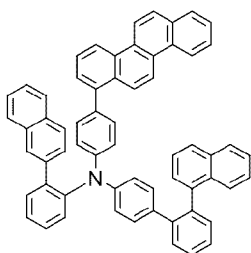
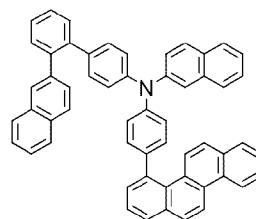
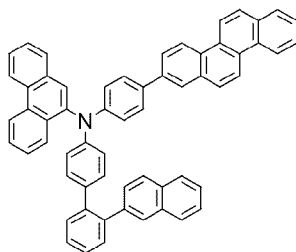
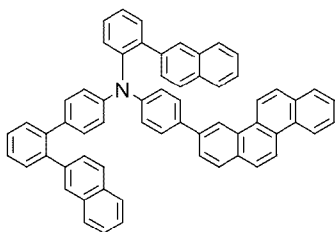
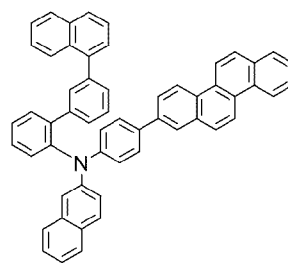
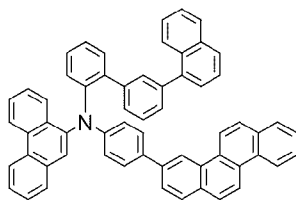
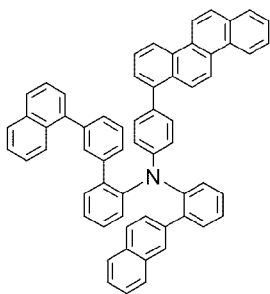
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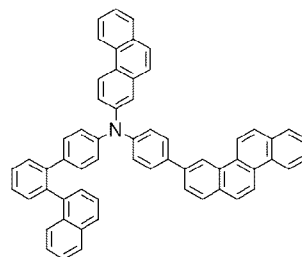
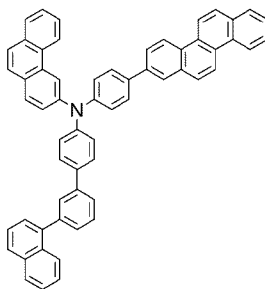
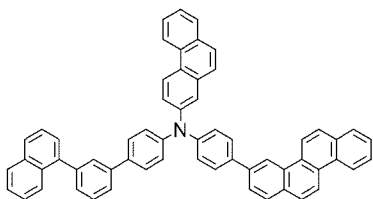
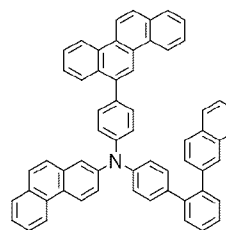
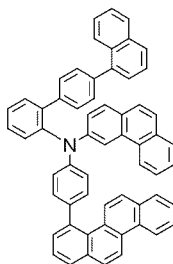
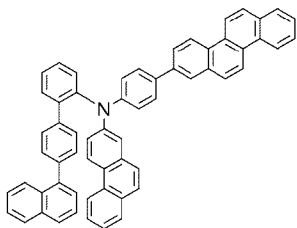
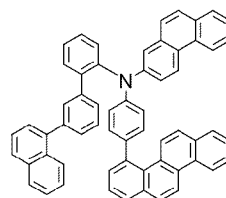
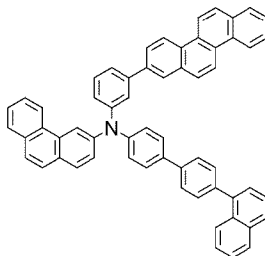
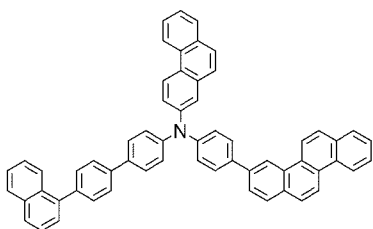
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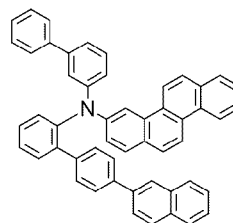
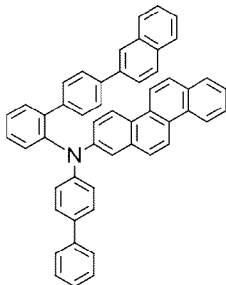
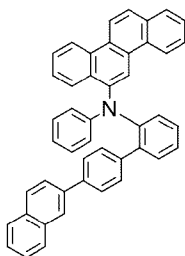
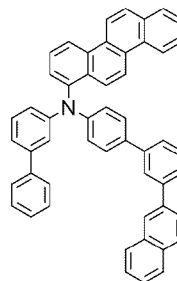
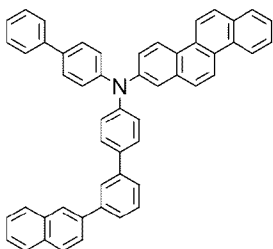
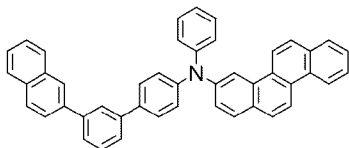
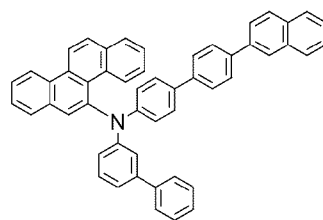
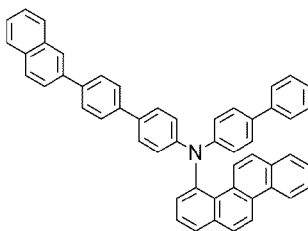
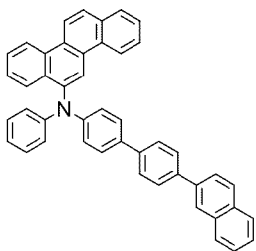
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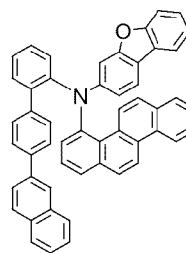
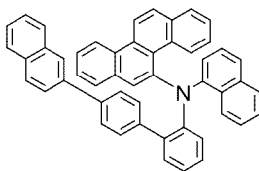
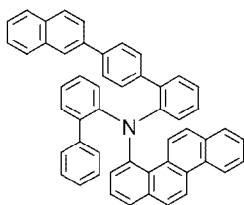
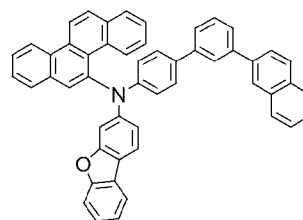
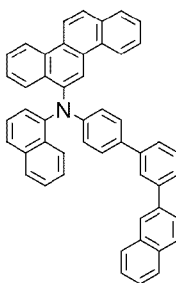
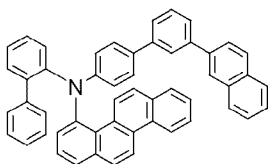
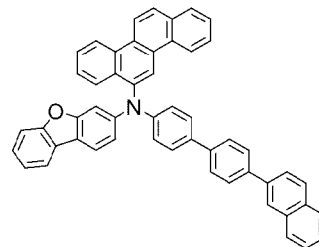
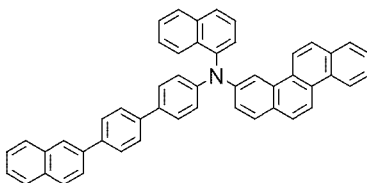
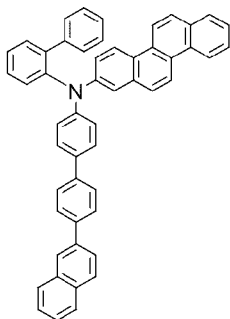
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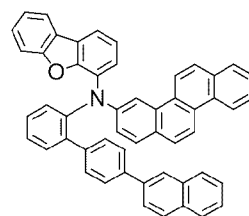
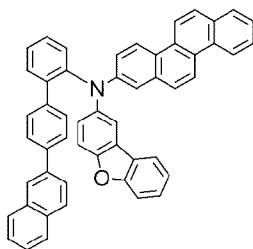
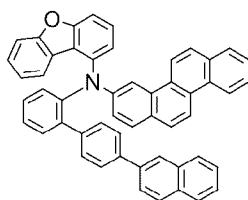
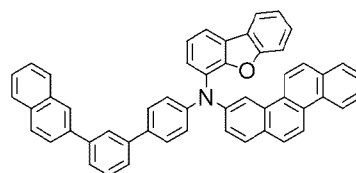
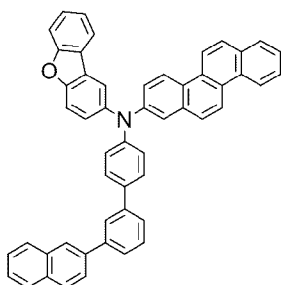
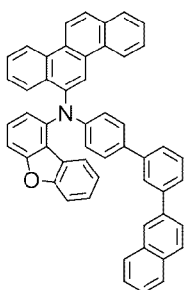
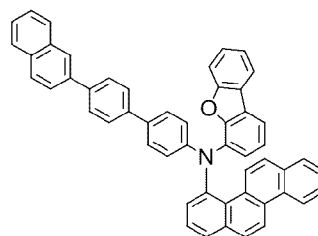
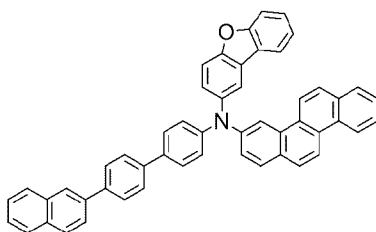
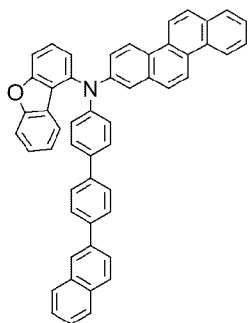
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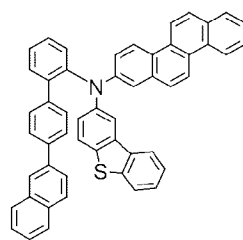
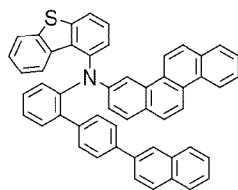
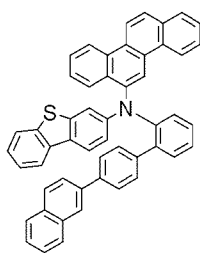
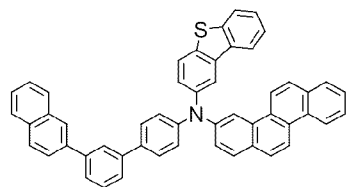
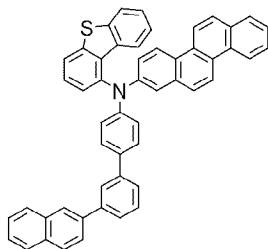
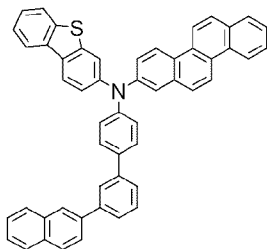
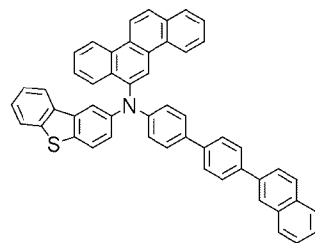
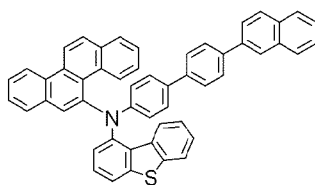
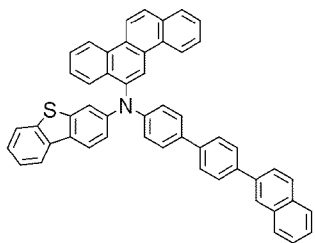
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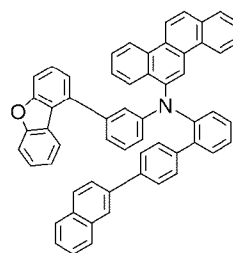
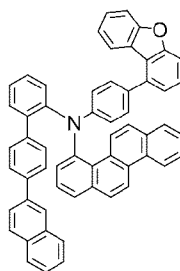
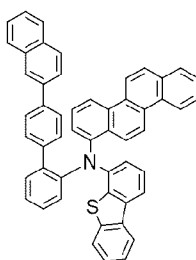
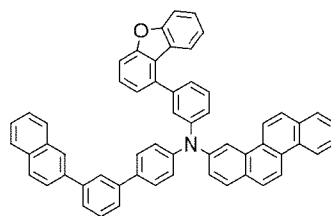
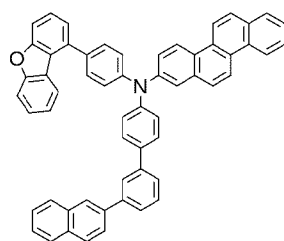
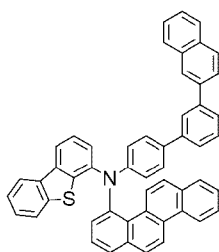
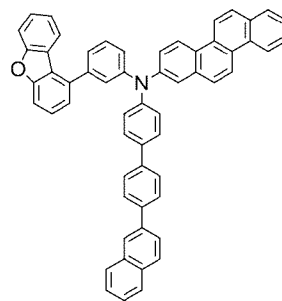
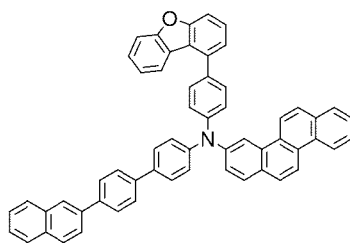
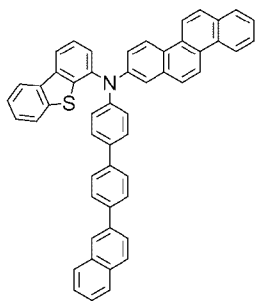
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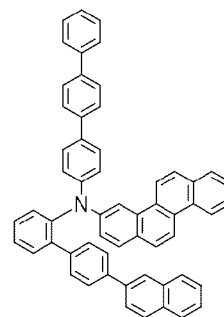
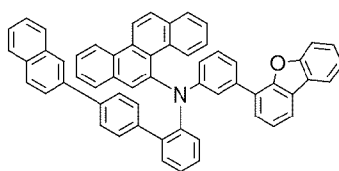
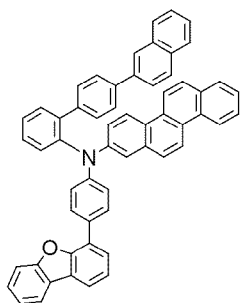
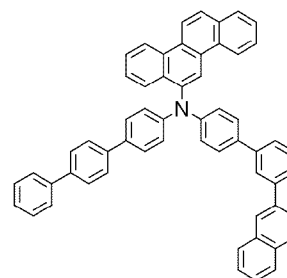
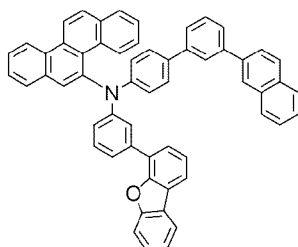
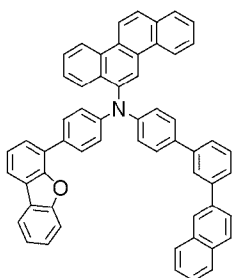
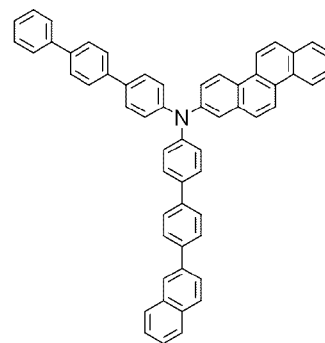
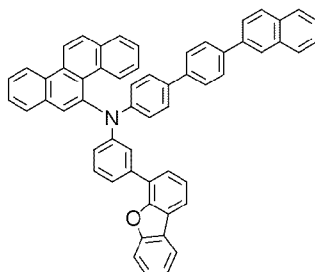
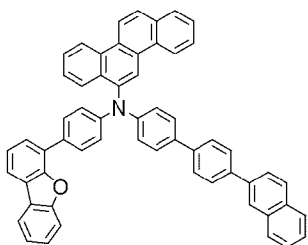
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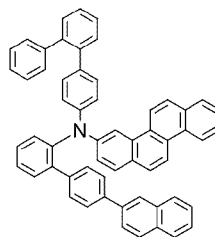
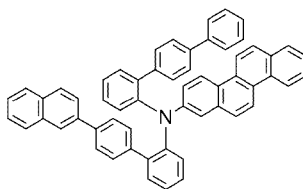
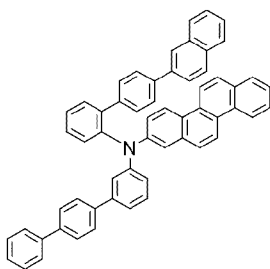
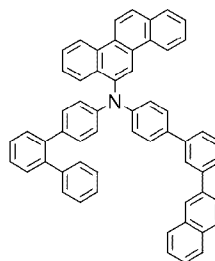
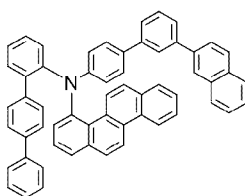
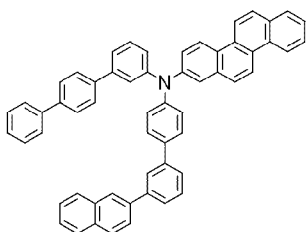
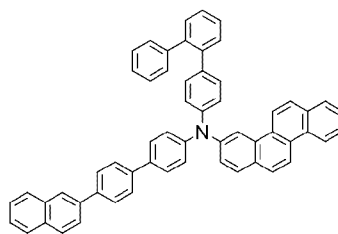
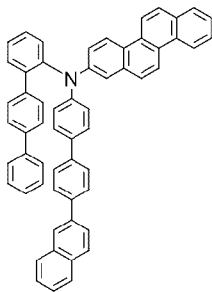
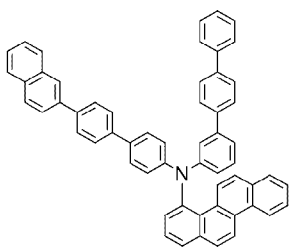
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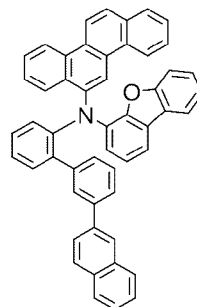
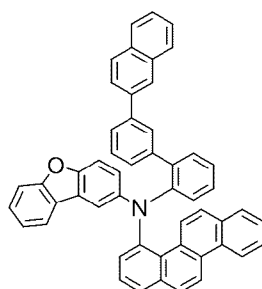
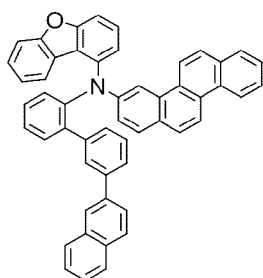
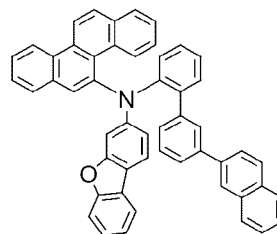
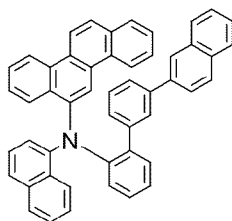
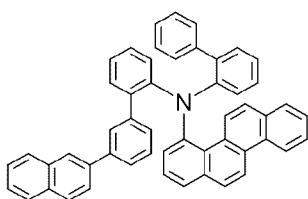
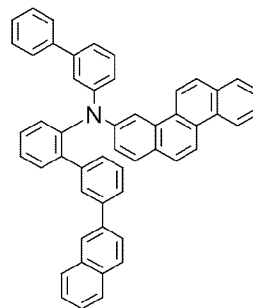
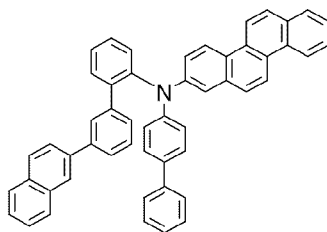
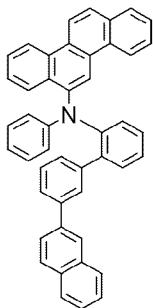
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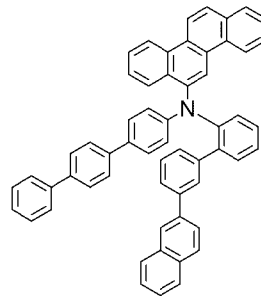
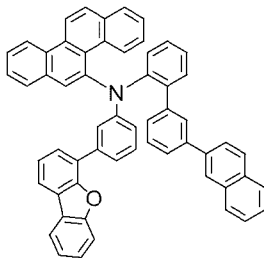
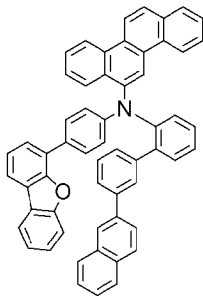
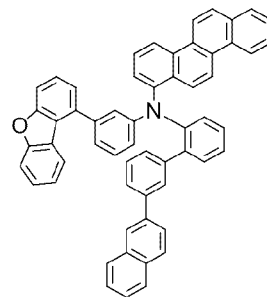
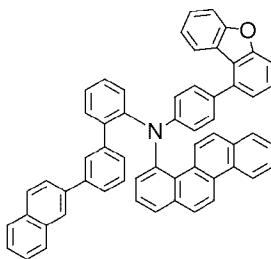
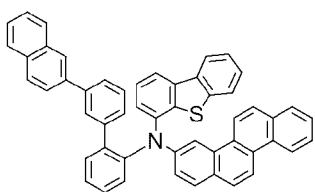
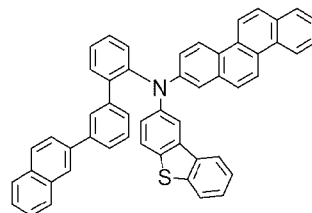
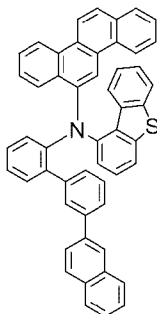
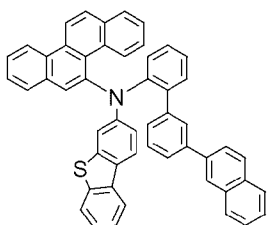
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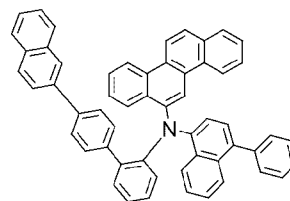
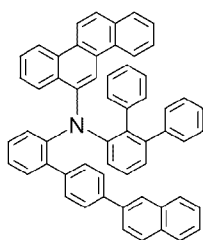
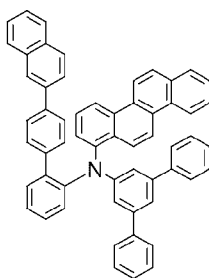
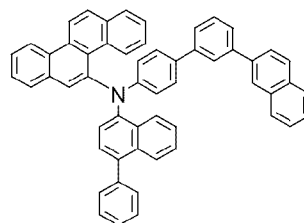
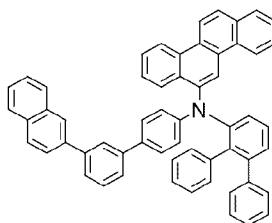
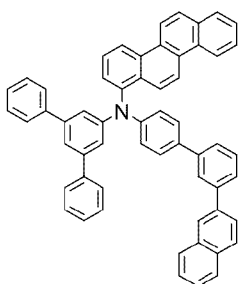
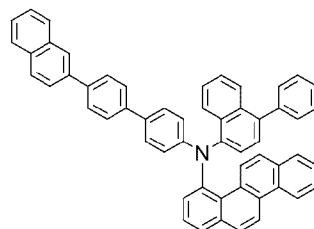
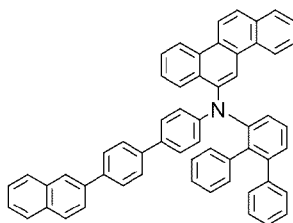
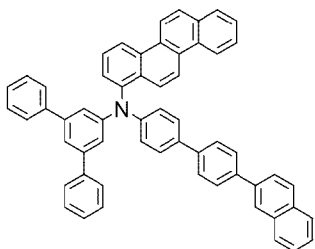
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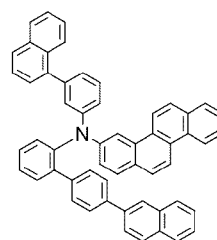
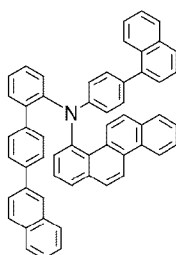
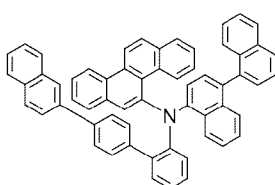
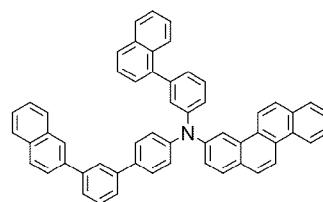
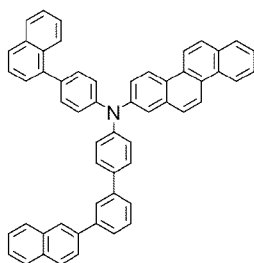
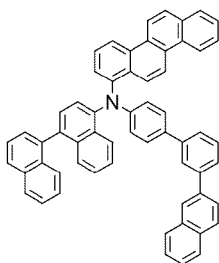
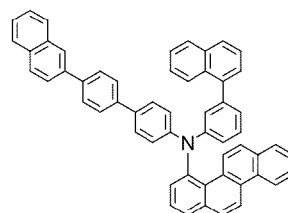
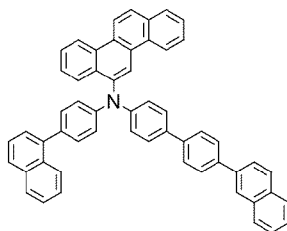
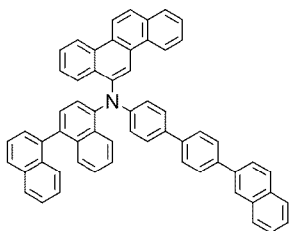
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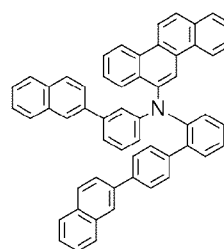
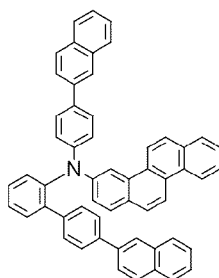
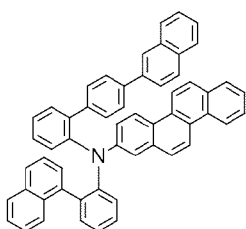
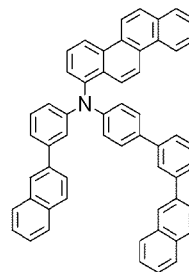
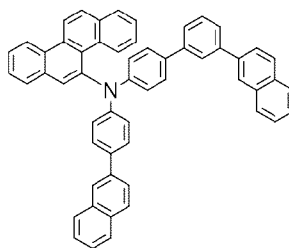
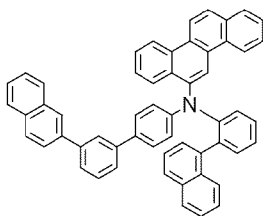
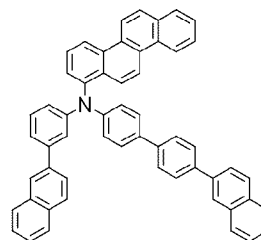
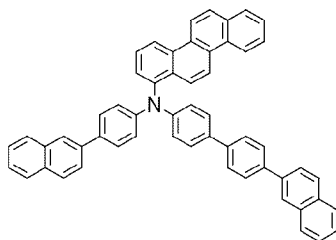
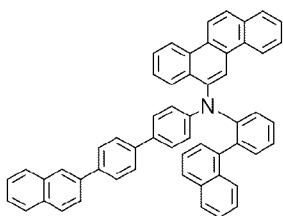
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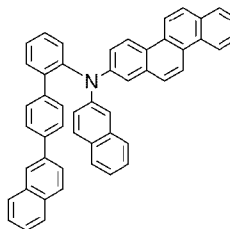
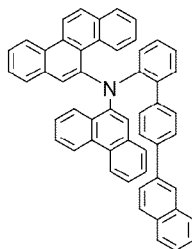
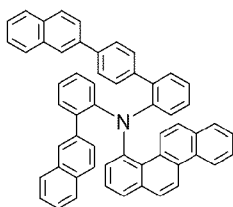
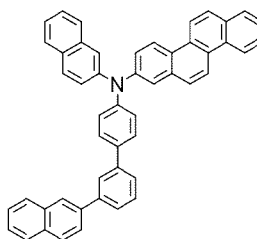
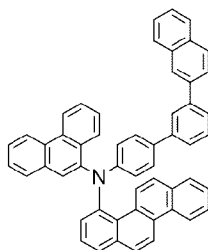
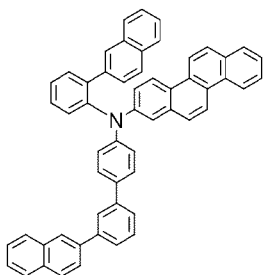
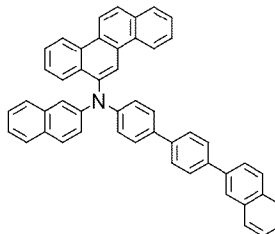
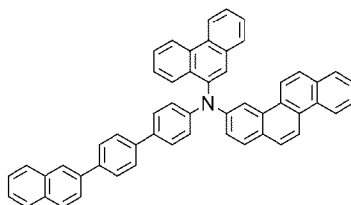
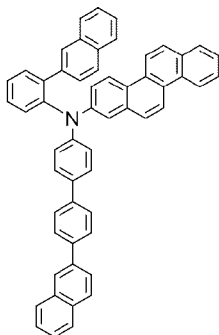
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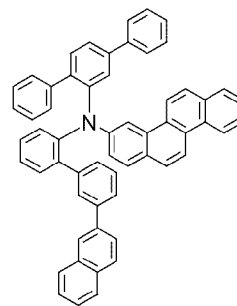
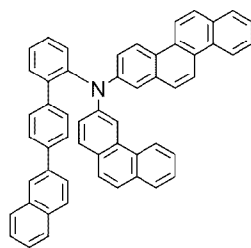
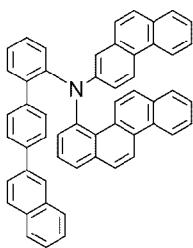
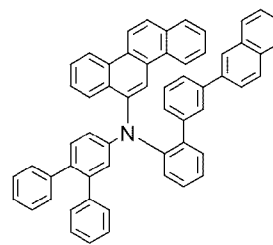
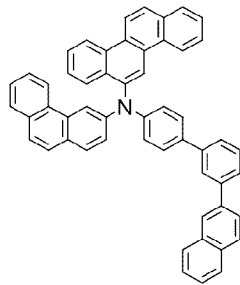
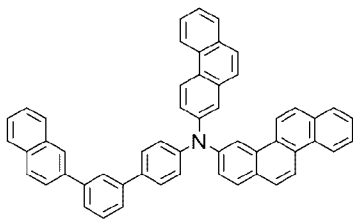
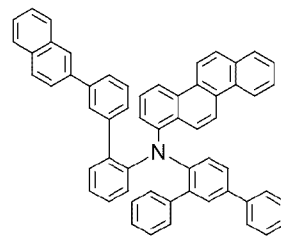
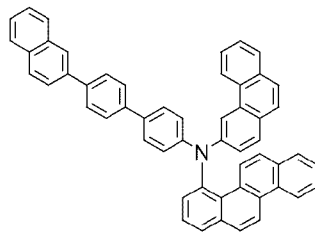
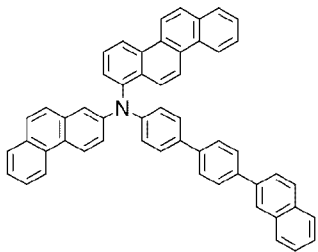
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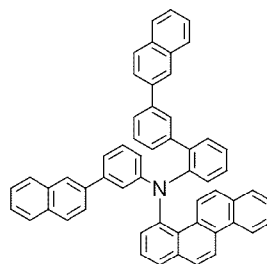
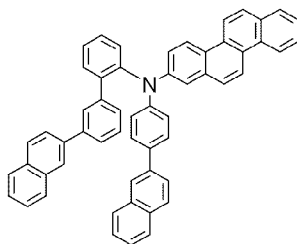
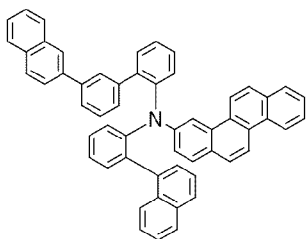
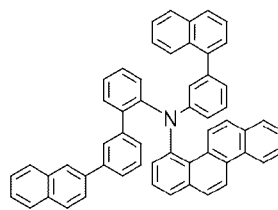
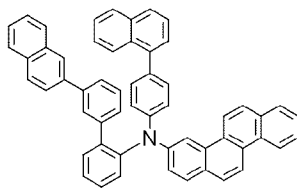
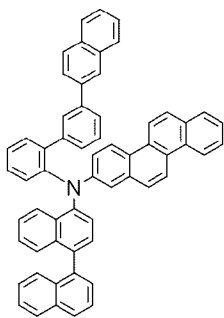
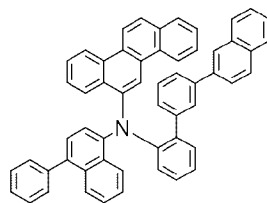
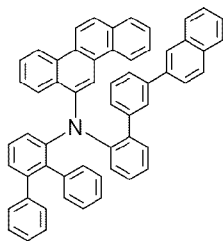
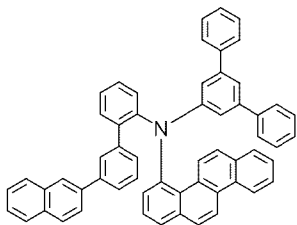
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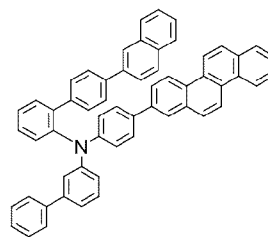
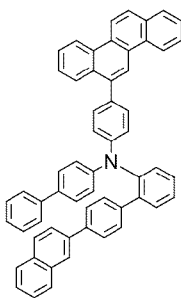
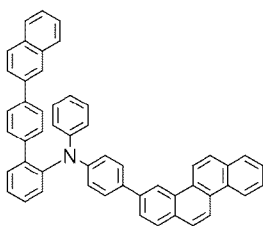
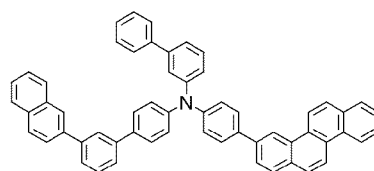
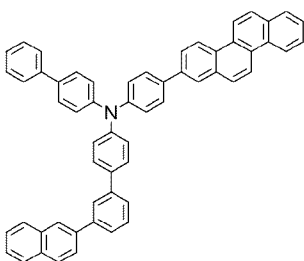
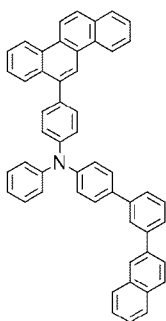
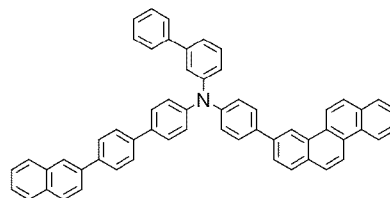
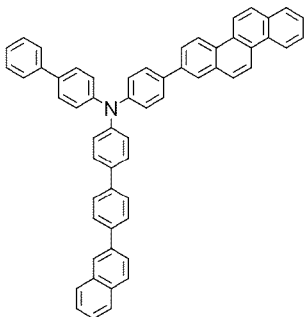
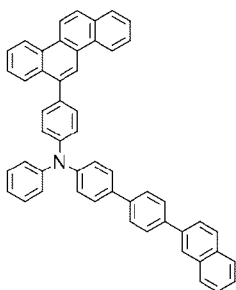
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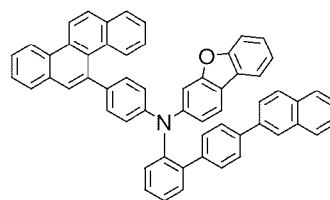
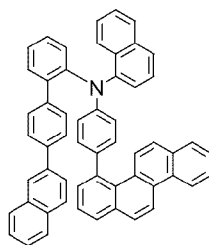
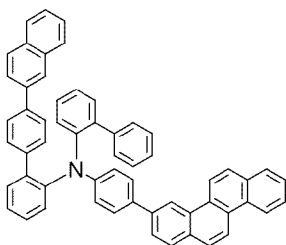
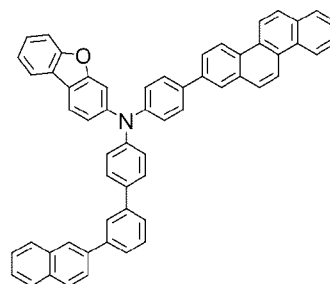
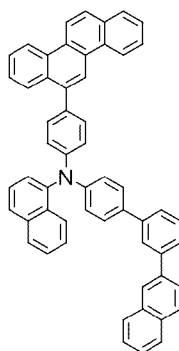
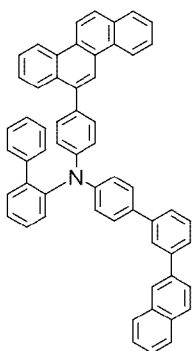
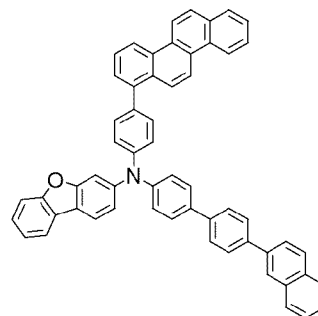
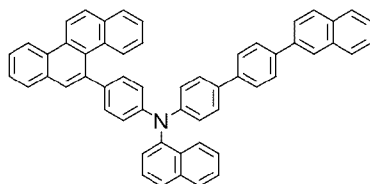
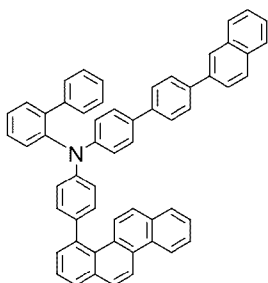
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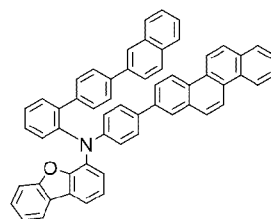
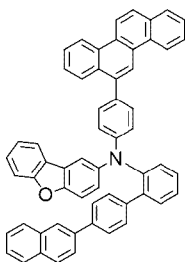
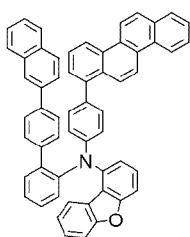
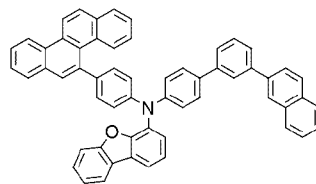
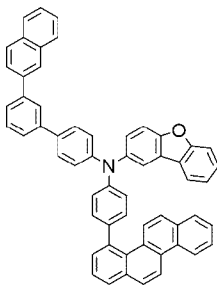
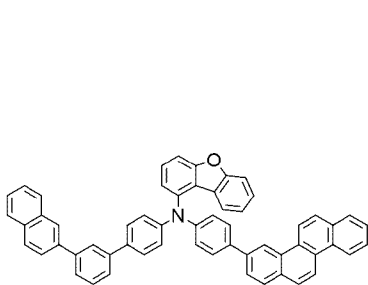
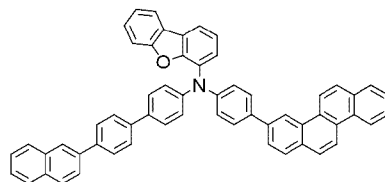
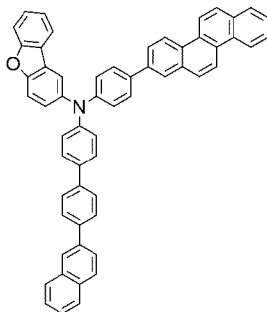
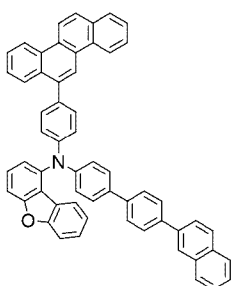
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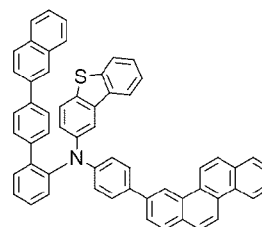
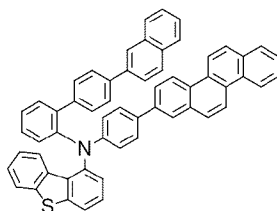
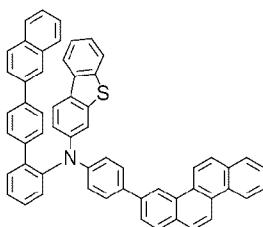
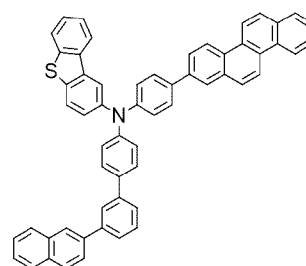
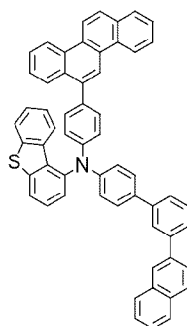
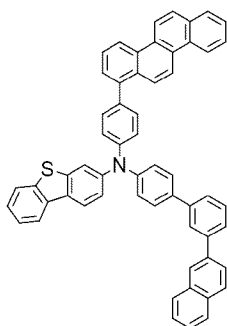
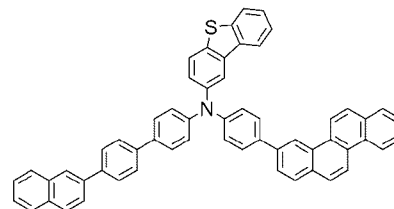
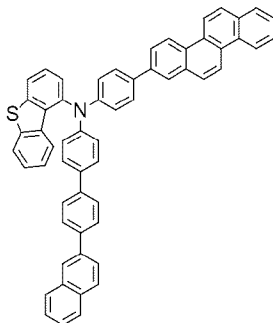
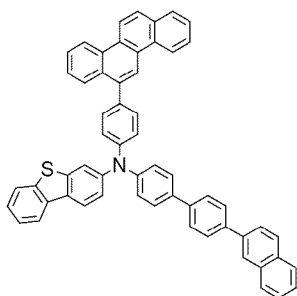
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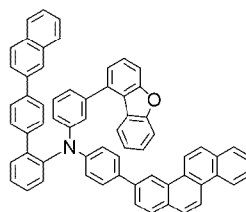
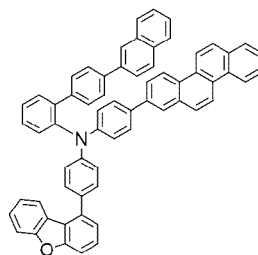
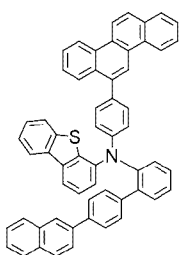
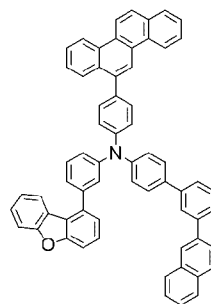
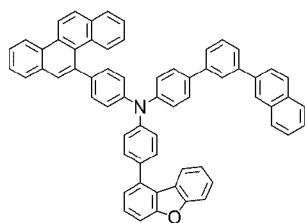
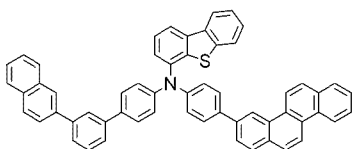
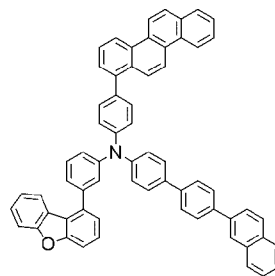
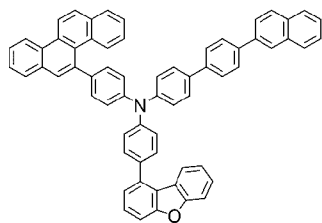
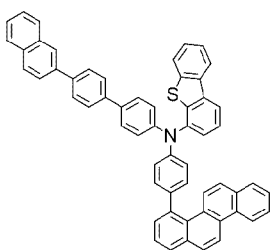
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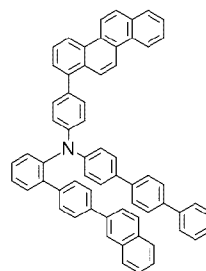
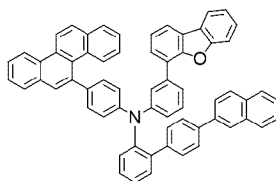
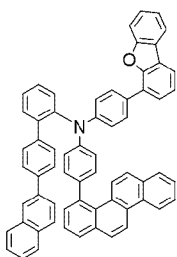
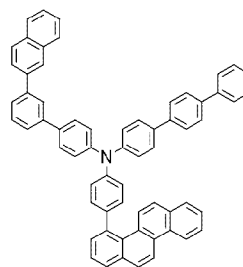
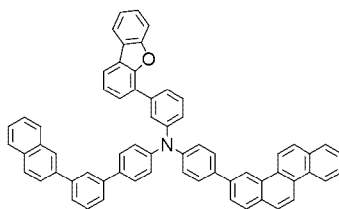
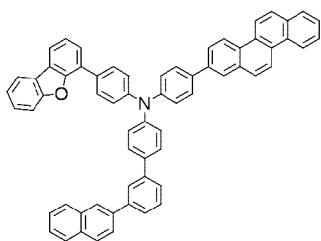
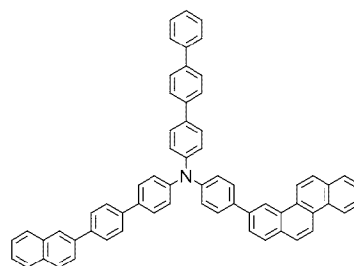
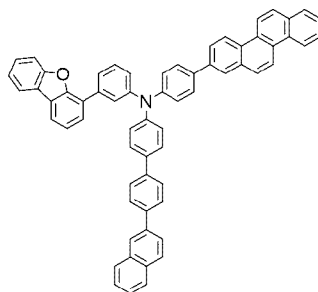
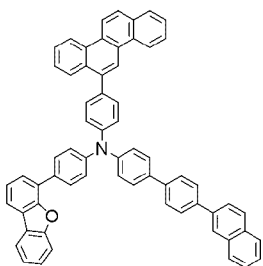
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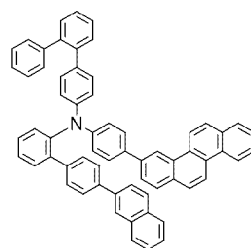
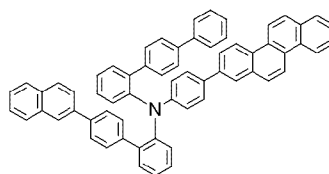
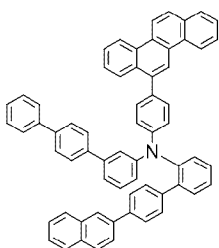
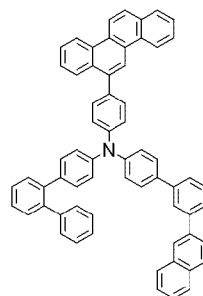
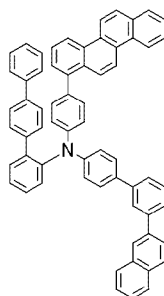
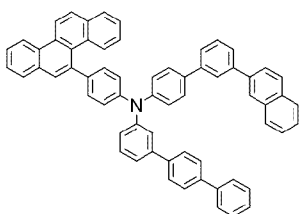
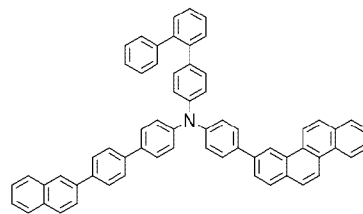
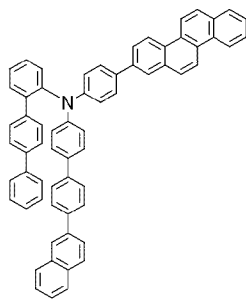
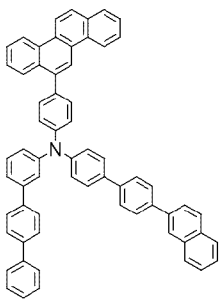
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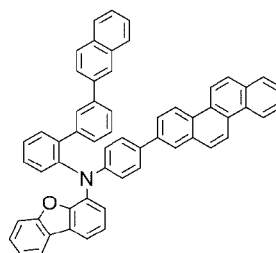
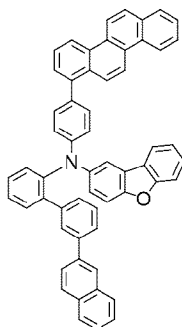
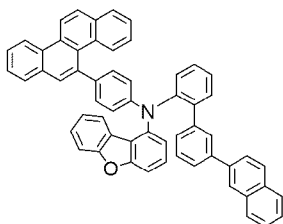
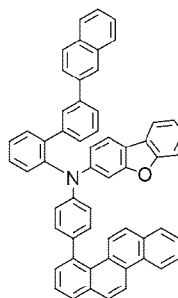
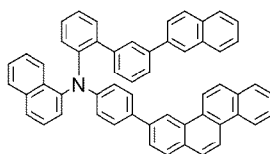
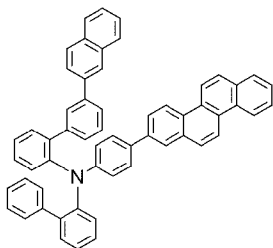
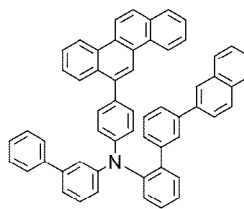
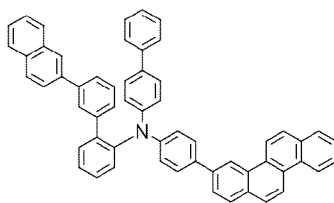
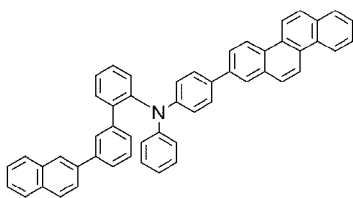
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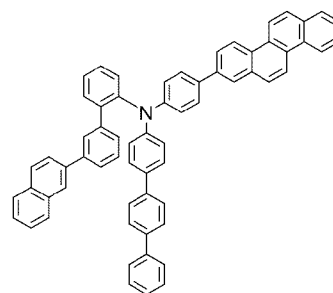
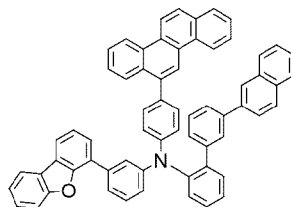
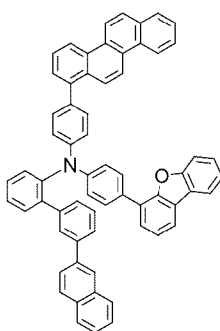
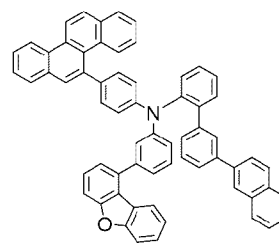
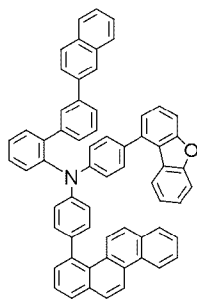
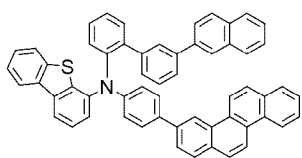
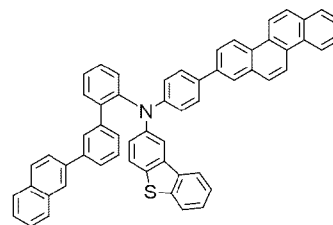
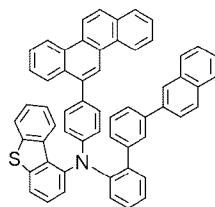
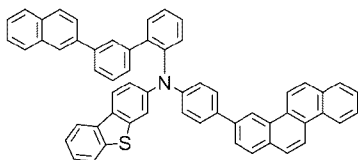
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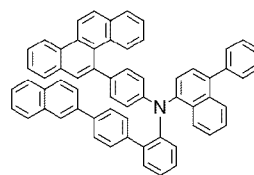
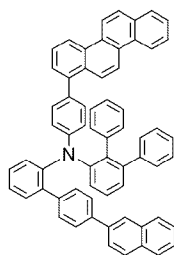
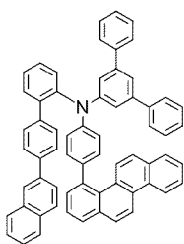
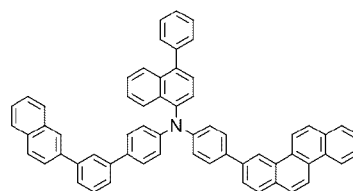
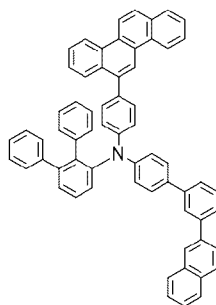
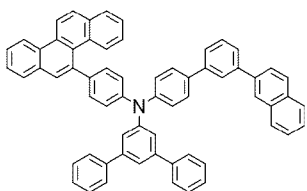
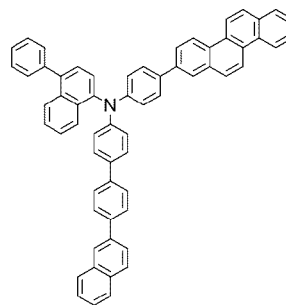
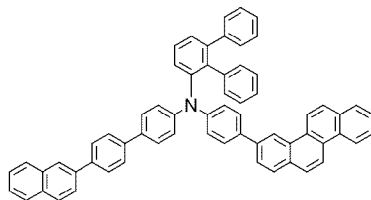
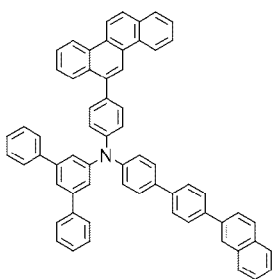
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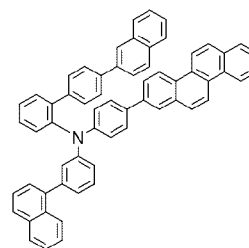
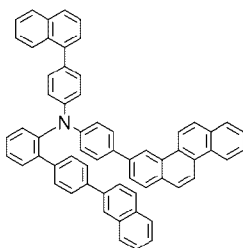
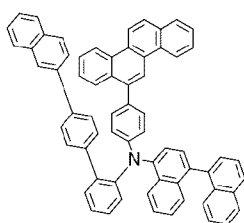
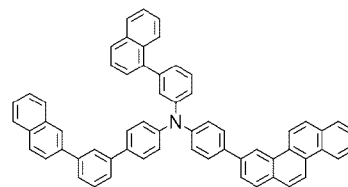
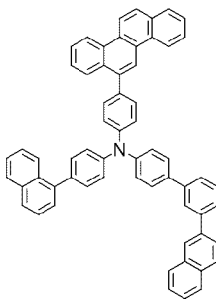
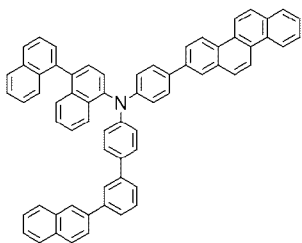
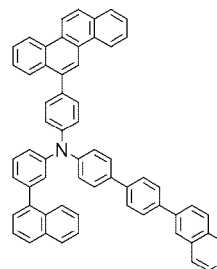
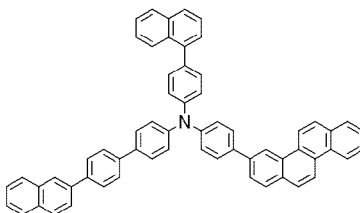
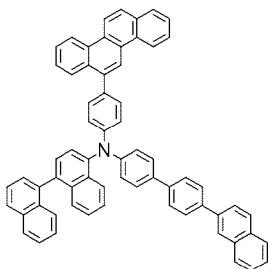
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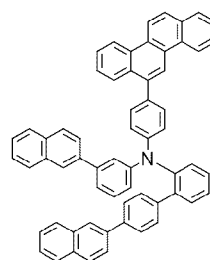
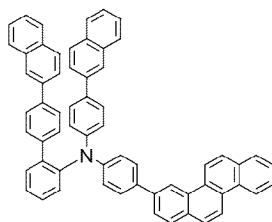
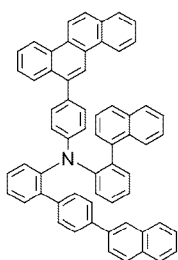
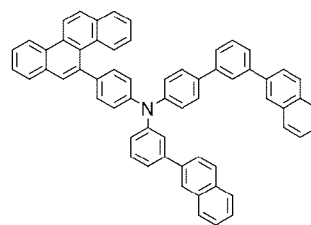
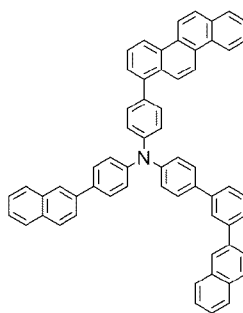
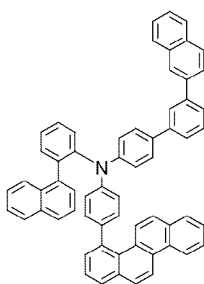
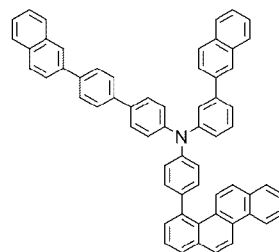
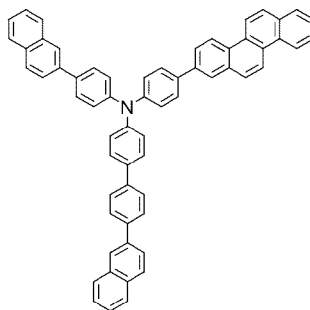
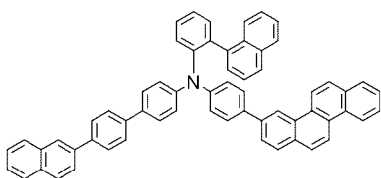
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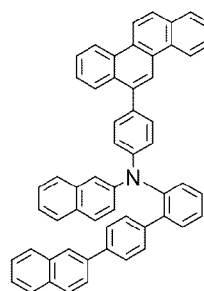
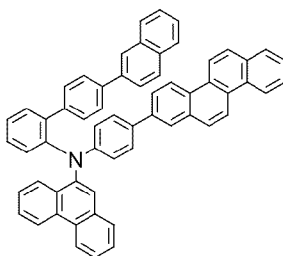
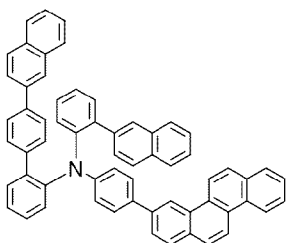
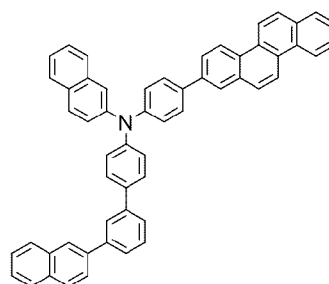
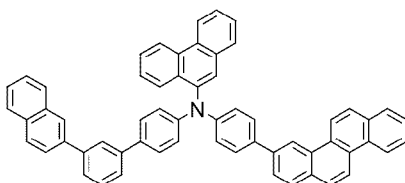
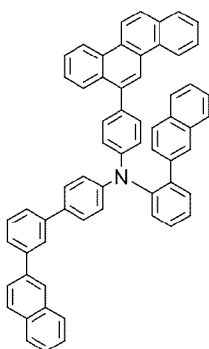
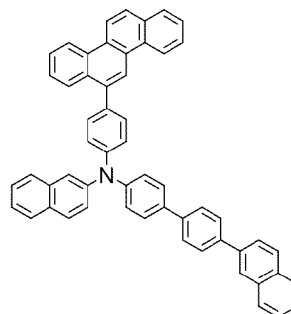
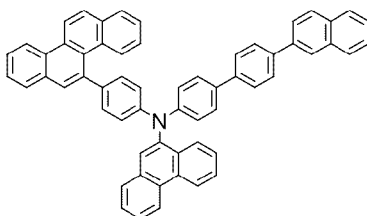
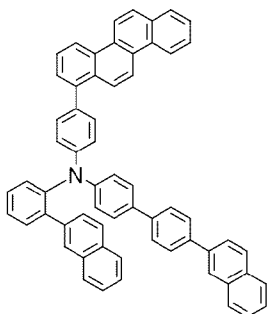
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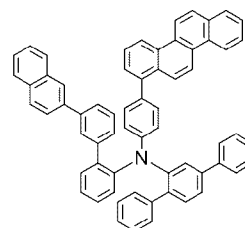
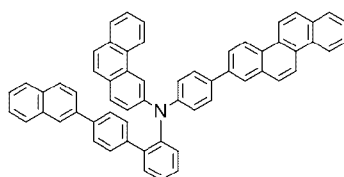
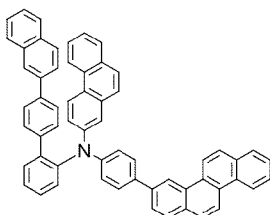
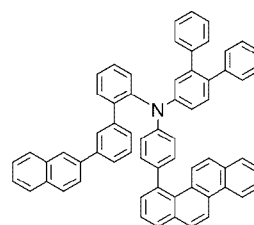
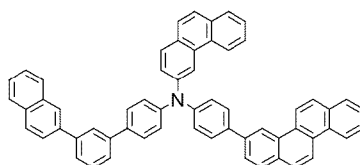
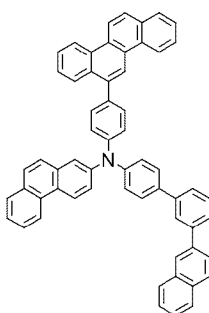
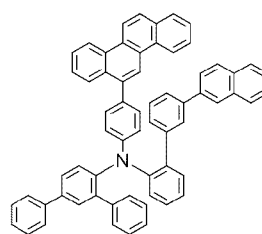
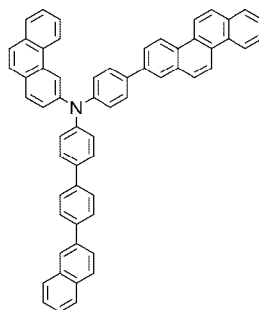
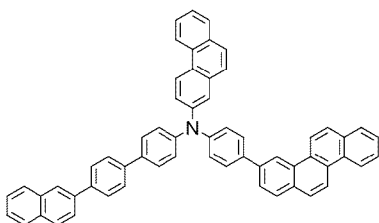
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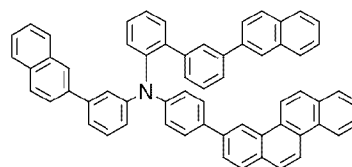
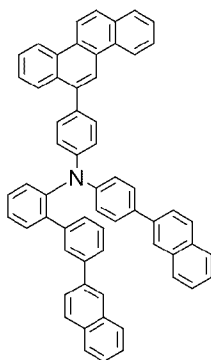
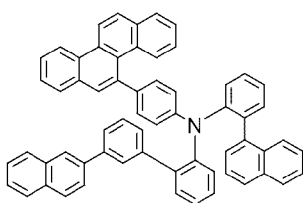
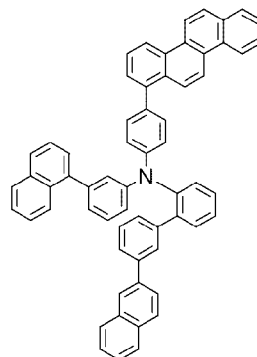
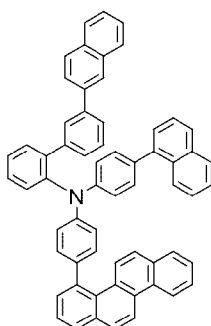
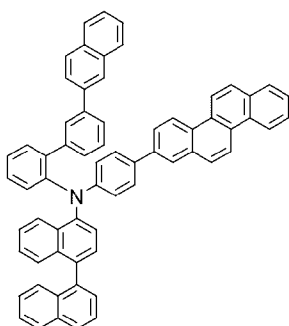
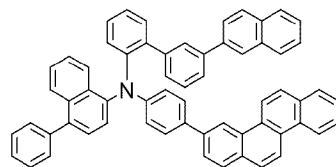
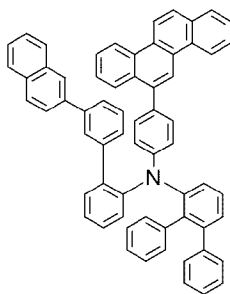
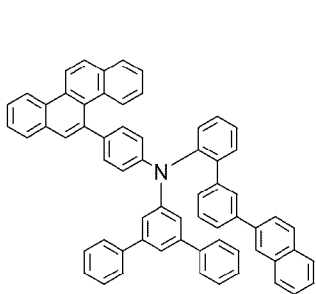
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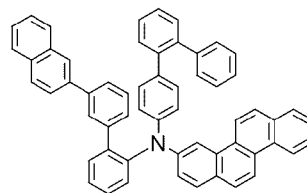
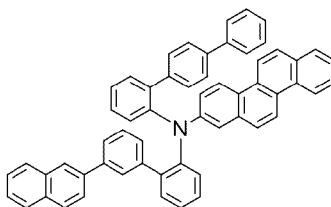
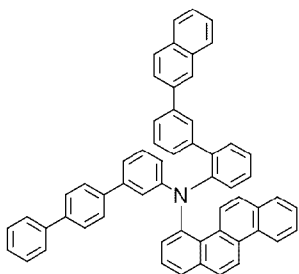
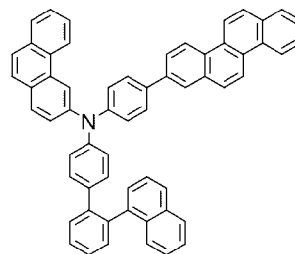
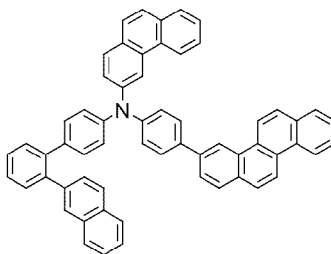
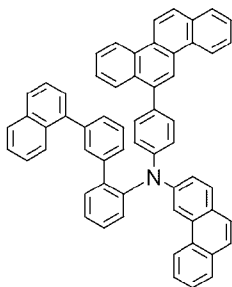
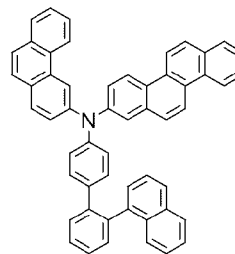
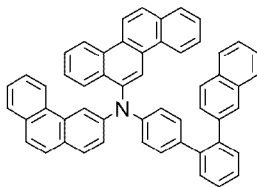
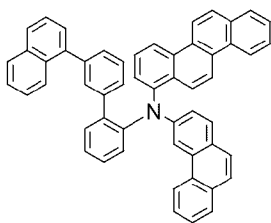
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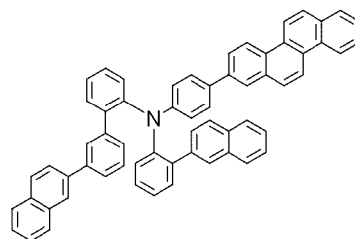
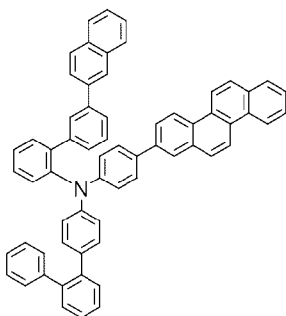
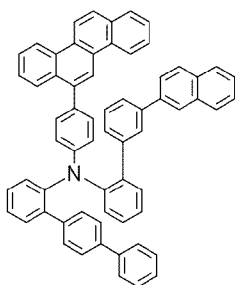
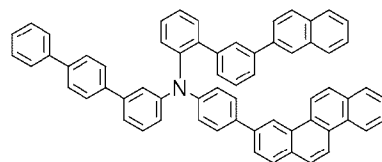
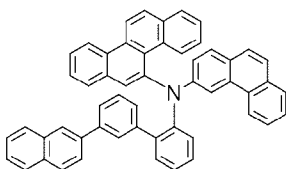
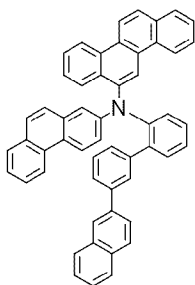
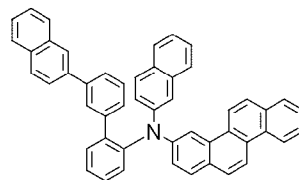
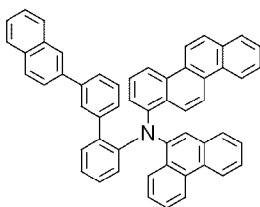
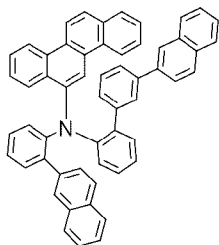
[224]



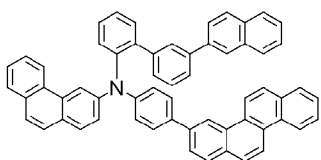
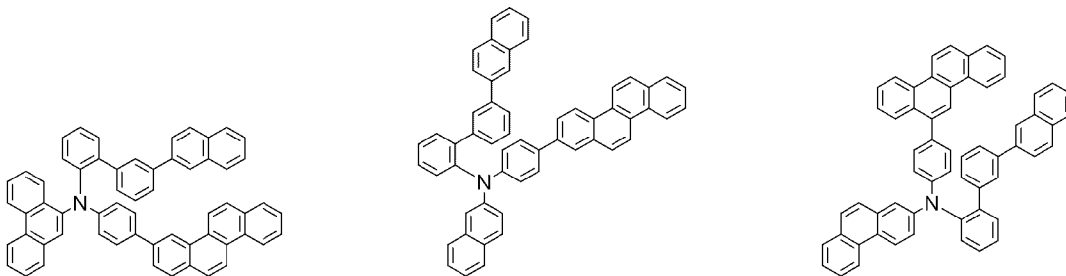
[225]



[226]



[227]



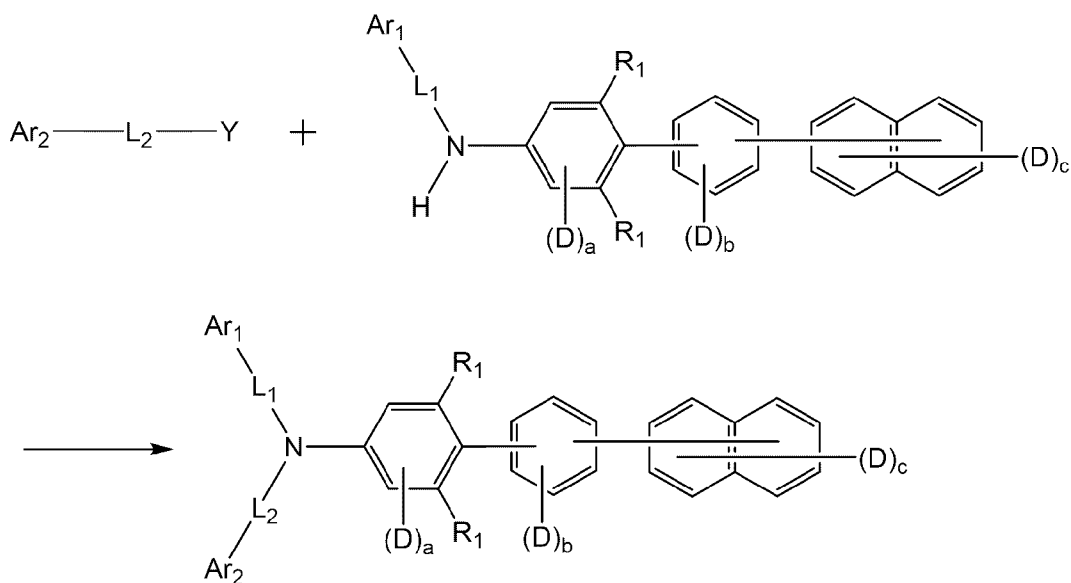
[228]

[229]

[230] 상기 화학식 1로 표시되는 화합물은 하기 반응식 1과 같은 제조 방법으로 제조할 수 있으며, 그 외 나머지 화합물도 유사하게 제조할 수 있다.

[231] [반응식 1]

[232]



[233] 상기 반응식 1에서, Ar_1 , Ar_2 , L_1 , L_2 , R_1 , D , a , b 및 c 는 상기 화학식 1에서 정의한 바와 같고, Y 는 할로젠이고, 바람직하게는 Y 는 브로모 또는 클로로이다.

[234]

[235] 상기 반응은 아민 치환 반응으로 팔라듐 촉매와 염기 존재 하에 수행하는 것이 바람직하며, 상기 반응을 위한 반응기는 당업계에 알려진 바에 따라 변경이 가능하다. 상기 제조 방법은 후술할 제조예에서 보다 구체화될 수 있다.

[236]

[237] (유기 발광 소자)

[238] 또한, 본 발명은 상기 화학식 1로 표시되는 화합물을 포함하는 유기 발광 소자를 제공한다. 일례로, 본 발명은 제1 전극; 상기 제1 전극과 대향하여 구비된 제2 전극; 및 상기 제1 전극과 상기 제2 전극 사이에 구비된 1층 이상의 유기물 층을 포함하는 유기 발광 소자로서, 상기 유기물층 중 1층 이상은 상기 화학식 1로 표시되는 화합물을 포함하는, 유기 발광 소자를 제공한다.

[239]

[240] 본 발명의 유기 발광 소자의 유기물 층은 단층 구조로 이루어질 수도 있으나, 2층 이상의 유기물층이 적층된 다층 구조로 이루어질 수 있다. 예컨대, 본 발명의 유기 발광 소자는 유기물 층으로서 정공주입층, 정공수송층, 정공수송보조층, 발광층, 전자수송층, 전자주입층 등을 포함하는 구조를 가질 수 있다. 그러나 유기 발광 소자의 구조는 이에 한정되지 않고 더 적은 수의 유기층을 포함할 수 있다.

[241]

[242] 또한, 상기 유기물 층은 발광층을 포함할 수 있고, 이때 상기 화학식 1로 표시되는 화합물을 포함하는 유기물층은 발광층일 수 있다.

[243]

[244] 다른 구현예에서, 상기 유기물층은 정공주입층, 정공수송층, 정공수송보조층, 발광층, 정공저지층 및 전자주입 및 수송층을 포함할 수 있고, 이때 상기 화합물을 포함하는 유기물층은 발광층일 수 있다.

[245]

[246] 또한, 본 발명에 따른 유기 발광 소자는, 기판 상에 양극, 1층 이상의 유기물층 및 음극이 순차적으로 적층된 구조(normal type)의 유기 발광 소자일 수 있다. 또한, 본 발명에 따른 유기 발광 소자는 기판 상에 음극, 1층 이상의 유기물층 및 양극이 순차적으로 적층된 역방향 구조(inverted type)의 유기 발광 소자일 수 있다. 예컨대, 본 발명의 일실시예에 따른 유기 발광 소자의 구조는 도 1 및 2에 예시되어 있다.

[247]

[248] 도 1은 기판(1), 양극(2), 발광층(3), 음극(4)으로 이루어진 유기 발광 소자의 예를 도시한 것이다. 이와 같은 구조에 있어서, 상기 화학식 1로 표시되는 화합물은 상기 발광층에 포함될 수 있다.

[249]

[250] 도 2는 기판(1), 양극(2), 정공주입층(5), 정공수송층(6), 정공수송보조층(7), 발광층(3), 정공저지층(8), 전자주입 및 수송층(9) 및 음극(4)로 이루어진 유기 발광 소자의 예를 도시한 것이다. 이와 같은 구조에 있어서, 상기 화학식 1로 표시되는 화합물은 상기 정공수송보조층에 포함될 수 있다.

[251]

[252] 본 발명에 따른 유기 발광 소자는, 상기 유기물 층 중 1층 이상이 상기 화학식 1로 표시되는 화합물을 포함하는 것을 제외하고는 당 기술분야에 알려져 있는 재료와 방법으로 제조될 수 있다. 또한, 상기 유기 발광 소자가 복수개의 유기물층을 포함하는 경우, 상기 유기물층은 동일한 물질 또는 다른 물질로 형성될 수 있다.

[253]

[254] 예컨대, 본 발명에 따른 유기 발광 소자는 기판 상에 제1 전극, 유기물층 및 제2 전극을 순차적으로 적층시켜 제조할 수 있다. 이때, 스퍼터링법(sputtering)이나 전자빔 증발법(e-beam evaporation)과 같은 PVD(physical Vapor Deposition)방법을 이용하여, 기판 상에 금속 또는 전도성을 가지는 금속 산화물 또는 이들의 합금을 증착시켜 양극을 형성하고, 그 위에 정공 주입층, 정공 수송층, 발광층 및 전자 수송층을 포함하는 유기물 층을 형성한 후, 그 위에 음극으로 사용할 수 있는 물질을 증착시켜 제조할 수 있다. 이와 같은 방법 외에도, 기판 상에 음극 물질부터 유기물층, 양극 물질을 차례로 증착시켜 유기 발광 소자를 만들 수 있다.

[255]

[256] 또한, 상기 화학식 1로 표시되는 화합물은 유기 발광 소자의 제조시 진공 증착법 뿐만 아니라 용액 도포법에 의하여 유기물 층으로 형성될 수 있다. 여기서, 용액 도포법이라 함은 스핀 코팅, 딥코팅, 닥터 블레이딩, 잉크젯 프린팅, 스크린 프린팅, 스프레이법, 롤 코팅 등을 의미하지만, 이들만으로 한정되는 것은 아니다.

[257]

[258] 이와 같은 방법 외에도, 기판 상에 음극 물질로부터 유기물층, 양극 물질을 차례로 증착시켜 유기 발광 소자를 제조할 수 있다(WO 2003/012890). 다만, 제조 방법이 이에 한정되는 것은 아니다.

[259]

[260] 일례로, 상기 제1 전극은 양극이고, 상기 제2 전극은 음극이거나, 또는 상기 제1 전극은 음극이고, 상기 제2 전극은 양극이다.

[261]

[262] 상기 양극 물질로는 통상 유기물 층으로 정공 주입이 원활할 수 있도록 일함수가 큰 물질이 바람직하다. 상기 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 SnO₂: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.

[263]

[264] 상기 음극 물질로는 통상 유기물층으로 전자 주입이 용이하도록 일함수가 작은 물질인 것이 바람직하다. 상기 음극 물질의 구체적인 예로는 마그네슘, 칼슘, 나트륨, 칼륨, 티타늄, 인듐, 이트륨, 리튬, 가돌리늄, 알루미늄, 은, 주석 및 납과 같

은 금속 또는 이들의 합금; LiF/Al 또는 LiO_2/Al 과 같은 다층 구조 물질 등이 있으나, 이들에만 한정되는 것은 아니다.

[265]

[266] 상기 정공주입층은 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 유기물 층의 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 한정되는 것은 아니다.

[267]

[268] 상기 정공수송층은 정공주입층으로부터 정공을 수취하여 발광층까지 정공을 수송하는 층으로, 정공 수송 물질로 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.

[269]

[270] 한편, 전자차단층은 상기 정공수송층 상에 형성되어, 바람직하게는 발광층에 접하여 구비되어, 정공이동도를 조절하고, 전자의 과다한 이동을 방지하여 정공-전자간 결합 확률을 높여줌으로써 유기 발광 소자의 효율을 개선하는 역할을 하는 층을 의미한다. 상기 전자차단층은 전자저지물질을 포함하고, 이러한 전자저지물질의 예로 아릴아민 계열의 유기물 등을 사용할 수 있으나, 이에 한정되는 것은 아니다.

[271]

[272] 상기 정공수송보조층은 정공수송층과 발광층 사이에 위치한 층이다. 상기 정공수송보조층을 포함함으로써, 정공수송층으로부터 발광층으로 정공이 보다 원활하게 수송되면서 엑시톤이 발광층 내에 가두어져 발광 누수가 방지되어, 유기 발광 소자가 우수한 발광 효율을 갖는 효과가 있다. 바람직하게는, 상기 화학식 1로 표시되는 화합물이 정공수송보조 재료로 사용될 수 있다.

[273]

[274] 상기 발광 물질로는 정공수송층과 전자수송층으로부터 정공과 전자를 각각 수송받아 결합시킴으로써 가시광선 영역의 빛을 낼 수 있는 물질로서, 형광이나 인광에 대한 양자 효율이 좋은 물질이 바람직하다. 구체적인 예로 8-히드록시-

퀴놀린 알루미늄 착물(Alq_3); 카르바졸 계열 화합물; 이량체화 스티릴(dimerized styryl) 화합물; BAIq ; 10-히드록시벤조 퀴놀린-금속 화합물; 벤족사졸, 벤즈티아졸 및 벤즈이미다졸 계열의 화합물; 폴리(p-페닐렌비닐렌)(PPV) 계열의 고분자; 스피로(spiro) 화합물; 폴리플루오렌, 루브렌 등이 있으나, 이들에만 한정되는 것은 아니다.

[275]

[276] 상기 발광층은 호스트 재료 및 도펀트 재료를 포함할 수 있다. 호스트 재료는 축합 방향족환 유도체 또는 헤테로환 함유 화합물 등이 있다. 구체적으로 축합 방향족환 유도체로는 안트라센 유도체, 피렌 유도체, 나프탈렌 유도체, 펜타센 유도체, 페난트렌 화합물, 플루오란텐 화합물 등이 있고, 헤테로환 함유 화합물로는 카바졸 유도체, 디벤조퓨란 유도체, 래더형 퓨란 화합물, 피리미딘 유도체 등이 있으나, 이에 한정되지 않는다.

[277]

[278] 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, 사이클로알킬기 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.

[279]

[280] 상기 정공저지층은 발광층 상에 형성되어, 바람직하게는 발광층에 접하여 구비되어, 전자이동도를 조절하고 정공의 과도한 이동을 방지하여 정공-전자간 결합 확률을 높여줌으로써 유기 발광 소자의 효율을 개선하는 역할을 하는 층을 의미한다. 상기 정공저지층은 정공저지물질들을 포함하고, 이러한 정공저지물질의 예로 트리아진을 포함한 아진류유도체; 트리아졸 유도체; 옥사디아졸 유도체; 페난트롤린 유도체; 포스핀옥사이드 유도체 등의 전자흡인기가 도입된 화합물을 사용할 수 있으나, 이에 한정되는 것은 아니다.

[281]

[282] 상기 전자 주입 및 수송층은 전극으로부터 전자를 주입하고, 수취된 전자를 발광층까지 수송하는 전자수송층 및 전자주입층의 역할을 동시에 수행하는 층으로, 상기 발광층 또는 상기 정공저지층 상에 형성된다. 이러한 전자 주입 및 수송 물질로는 음극으로부터 전자를 잘 주입 받아 발광층으로 옮겨줄 수 있는 물질로서, 전자에 대한 이동성이 큰 물질이 적합하다. 이러한 전자 주입 및 수송층 물질로 상기 화학식 1로 표시되는 화합물을 사용할 수 있다. 추가적인 전자 주입 및

수송물질의 예로는 8-히드록시퀴놀린의 Al 착물; Alq₃를 포함한 착물; 유기 라디칼 화합물; 히드록시플라본-금속 착물; 트리아진 유도체 등이 있으나, 이에 한정되는 것은 아니다. 또는 플루오레논, 안트라퀴노다이메탄, 다이페노퀴논, 티오피란 다이옥사이드, 옥사졸, 옥사다이하졸, 트리아졸, 이미다졸, 페릴렌테트라카복실산, 플루오레닐리덴 메탄, 안트론 등과 그들의 유도체, 금속 착체 화합물, 또는 질소 함유 5원환 유도체 등과 함께 사용할 수도 있으나, 이에 한정되는 것은 아니다.

[283]

[284] 상기 전자 주입 및 수송층은 전자주입층 및 전자수송층과 같은 별개의 층으로도 형성될 수 있다. 이와 같은 경우, 전자 수송층은 상기 발광층 또는 상기 정공지층 상에 형성되고, 상기 전자 수송층에 포함되는 전자 수송 물질로는 상술한 전자 주입 및 수송 물질이 사용될 수 있다. 또한, 전자 주입층은 상기 전자 수송층 상에 형성되고, 상기 전자 주입층에 포함되는 전자 주입 물질로는 LiF, NaCl, CsF, Li₂O, BaO, 플루오레논, 안트라퀴노다이메탄, 다이페노퀴논, 티오피란 다이옥사이드, 옥사졸, 옥사다이하졸, 트리아졸, 이미다졸, 페릴렌테트라카복실산, 플루오레닐리덴 메탄, 안트론 등과 그들의 유도체, 금속 착체 화합물 및 질소 함유 5원환 유도체 등이 사용될 수 있다.

[285]

[286] 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-하이드록시퀴놀리나토)클로로갈륨, 비스(2-메틸-8-하이드록시퀴놀리나토)(o-크레졸라토)갈륨, 비스(2-메틸-8-하이드록시퀴놀리나토)(1-나프톨라토)알루미늄, 비스(2-메틸-8-하이드록시퀴놀리나토)(2-나프톨라토)갈륨 등이 있으나, 이에 한정되는 것은 아니다.

[287]

[288] 본 발명에 따른 유기 발광 소자는 배면 발광(bottom emission) 소자, 전면 발광(top emission) 소자, 또는 양면 발광 소자일 수 있으며, 특히 상대적으로 높은 발광 효율이 요구되는 배면 발광 소자일 수 있다.

[289]

[290] 또한, 본 발명에 따른 화합물은 유기 발광 소자 외에도 유기 태양 전지 또는 유기 트랜지스터에 포함될 수 있다.

[291]

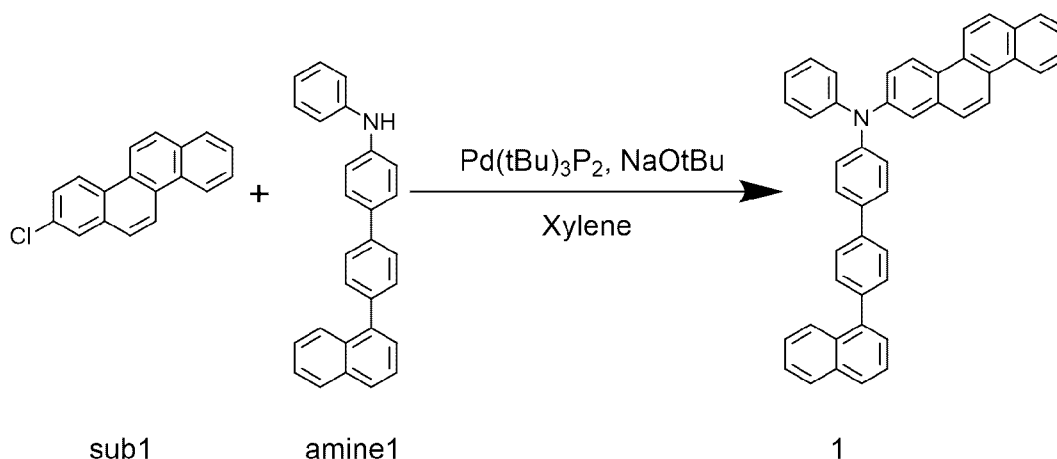
[292] 상기 화학식 1로 표시되는 화합물 및 이를 포함하는 유기 발광 소자의 제조는 이하 실시예에서 구체적으로 설명한다. 그러나 하기 실시예는 본 발명을 예시하기 위한 것이며, 본 발명의 범위가 이들에 의하여 한정되는 것은 아니다.

[293]

[294] [실시예]

[295] 합성예 1

[296]

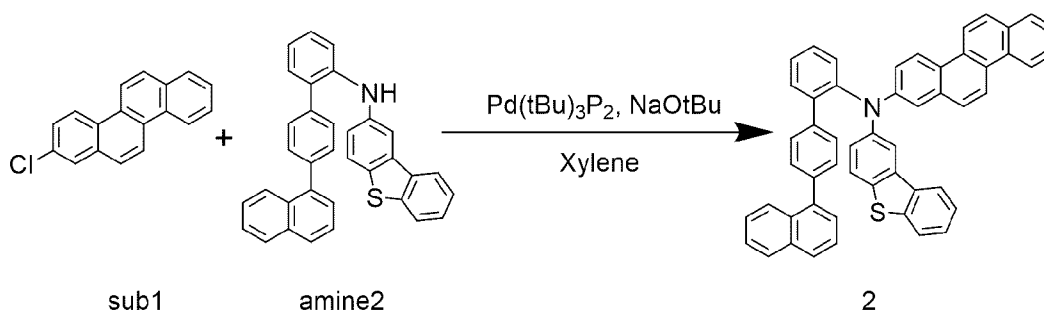


[297] 질소 분위기에서 sub1 (15 g, 57.1mmol), amine1 (22.3g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 1 19.5g을 얻었다. (수율 57%, MS: [M+H]⁺=599)

[298]

[299] 합성예 2

[300]

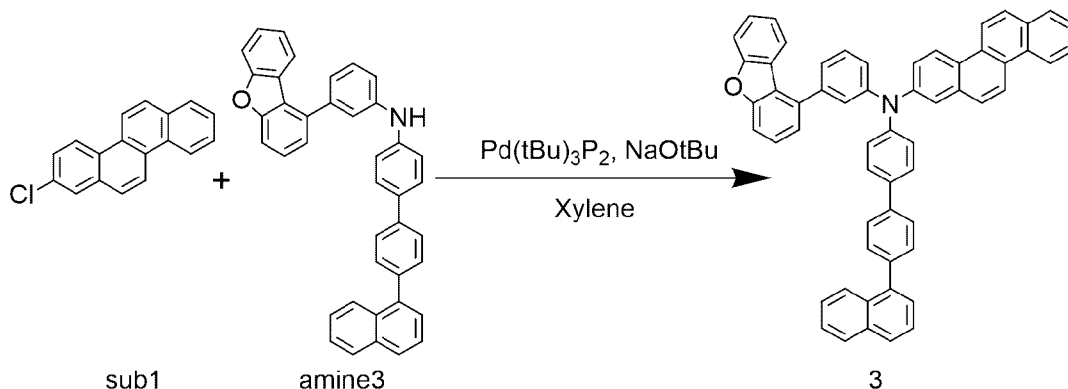


[301] 질소 분위기에서 sub1 (15 g, 57.1mmol), amine2 (28.6g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 2 24.1g을 얻었다. (수율 60%, MS: [M+H]⁺=705)

[302]

[303] **합성 예 3**

[304]

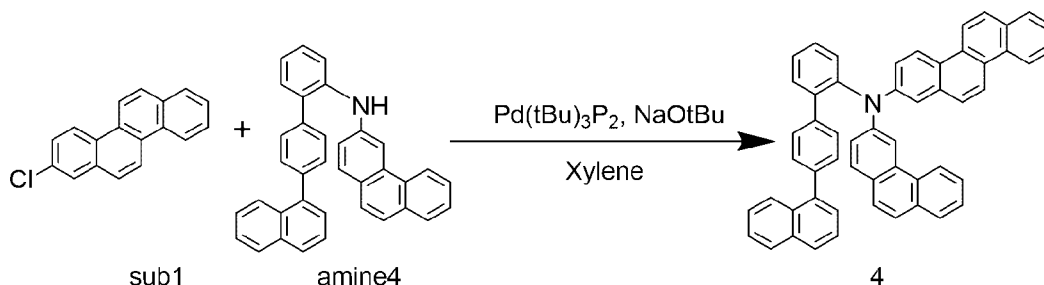


[305] 질소 분위기에서 sub1 (15 g, 57.1mmol), amine3 (32.2g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 3 26.2g을 얻었다. (수율 60%, MS: [M+H]⁺=765)

[306]

[307] **합성 예 4**

[308]

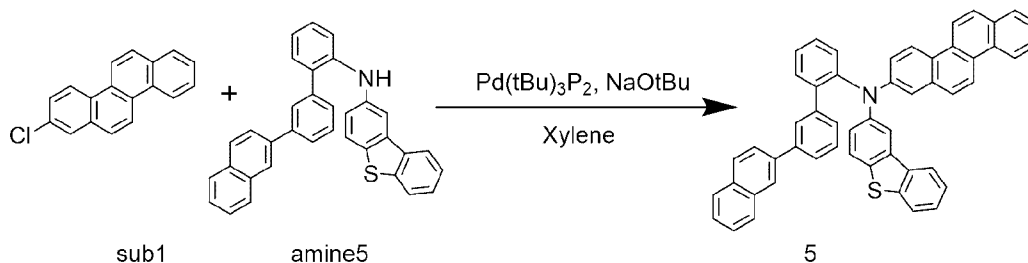


[309] 질소 분위기에서 sub1 (15 g, 57.1mmol), amine4 (28.3g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 4 20.7g을 얻었다. (수율 52%, MS: [M+H]⁺=699)

[310]

[311] **합성 예 5**

[312]

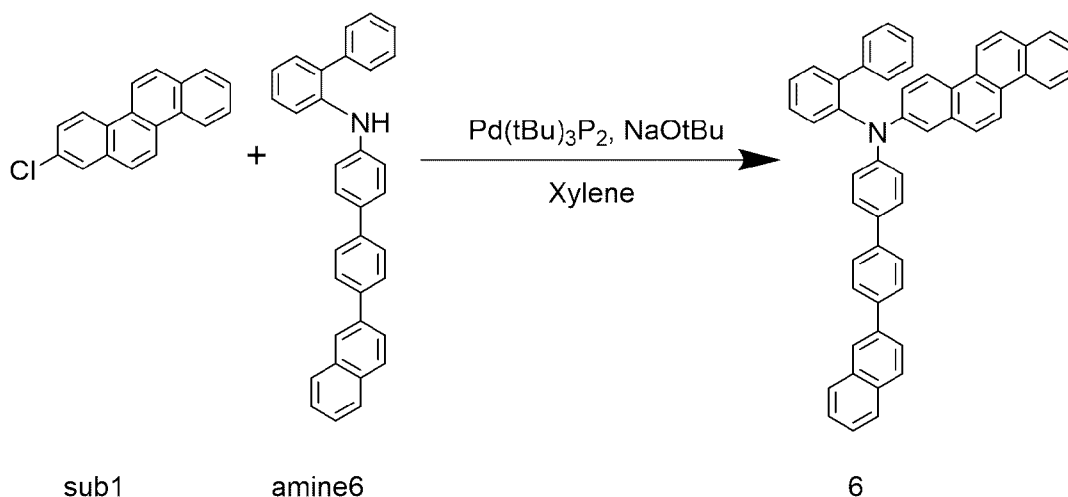


[313] 질소 분위기에서 sub1 (15 g, 57.1mmol), amine5 (28.6g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 5 26.1g을 얻었다. (수율 65%, MS: [M+H]⁺=705)

[314]

[315] 합성예 6

[316]

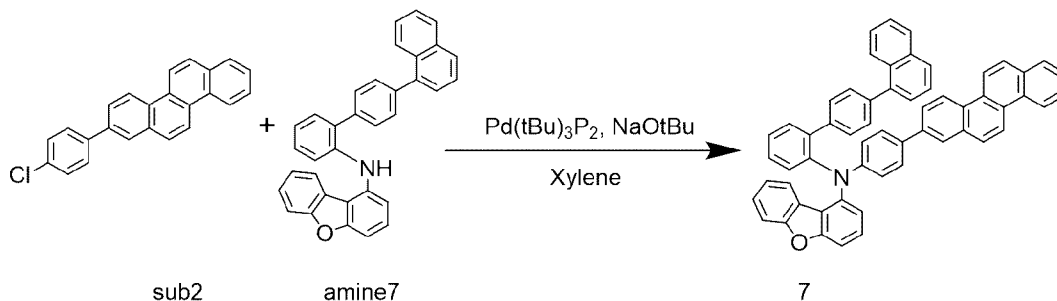


[317] 질소 분위기에서 sub1 (15 g, 57.1mmol), amine6 (26.8g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 6 19.6g을 얻었다. (수율 51%, MS: [M+H]⁺=675)

[318]

[319] 합성예 7

[320]

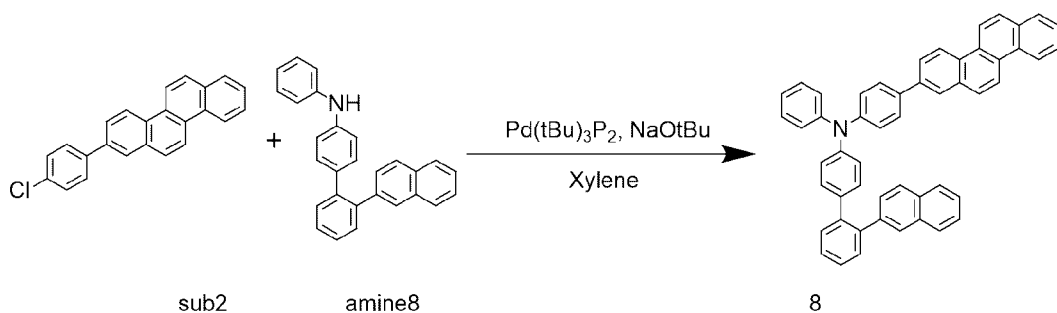


[321] 질소 분위기에서 sub2 (15 g, 44.3mmol), amine7 (21.5g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 7 19.6g을 얻었다. (수율 58%, MS: [M+H]⁺=765)

[322]

[323] 합성예 8

[324]

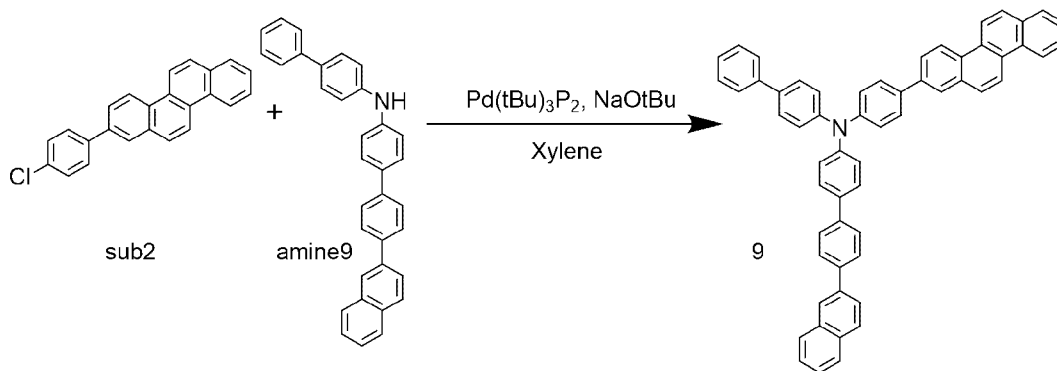


[325] 질소 분위기에서 sub2 (15 g, 44.3mmol), amine8 (17.3g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 8 18.5g을 얻었다. (수율 62%, MS: [M+H]⁺=675)

[326]

[327] 합성예 9

[328]

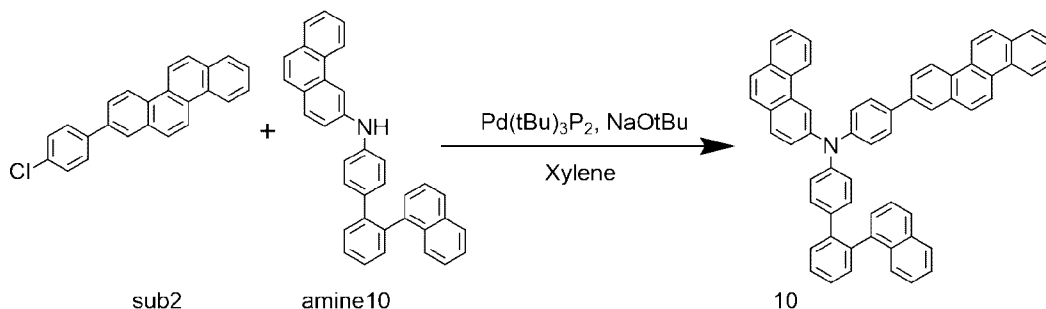


[329] 질소 분위기에서 sub2 (15 g, 44.3mmol), amine9 (20.8g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 9 17.3g을 얻었다. (수율 52%, MS: $[\text{M}+\text{H}]^+=751$)

[330]

[331] 합성 예 10

[332]

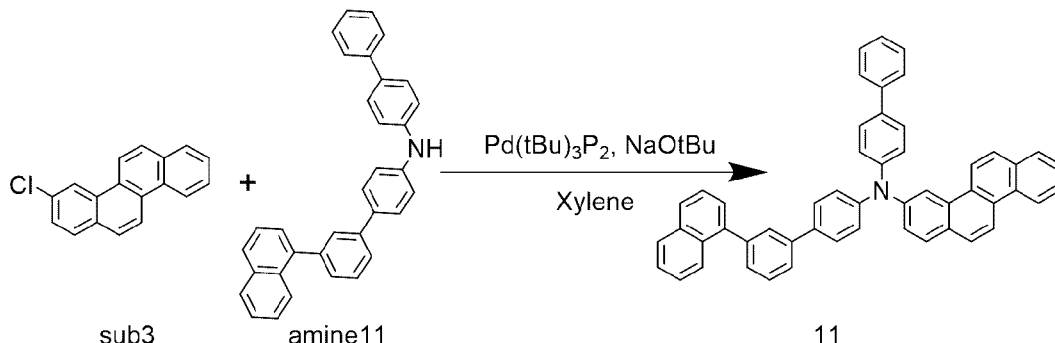


[333] 질소 분위기에서 sub2 (15 g, 44.3mmol), amine10 (21.9g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 10 18.2g을 얻었다. (수율 53%, MS: $[\text{M}+\text{H}]^+=775$)

[334]

[335] 합성 예 11

[336]

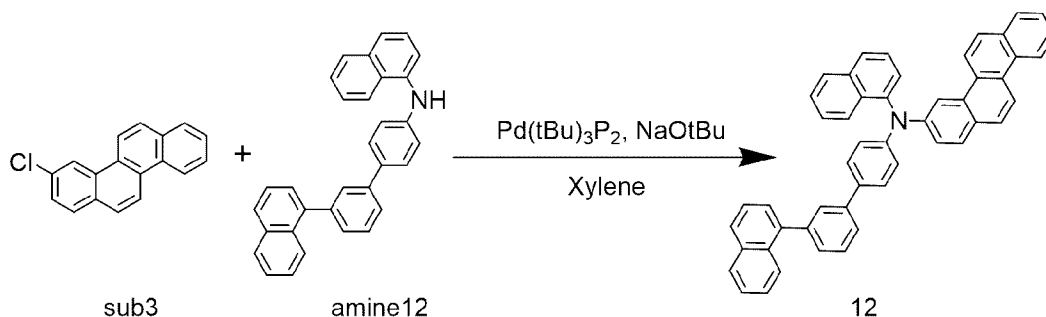


[337] 질소 분위기에서 sub3 (15 g, 57.1mmol), amine11 (26.8g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 11 21.5g을 얻었다. (수율 56%, MS: $[M+H]^+=675$)

[338]

[339] 합성 예 12

[340]

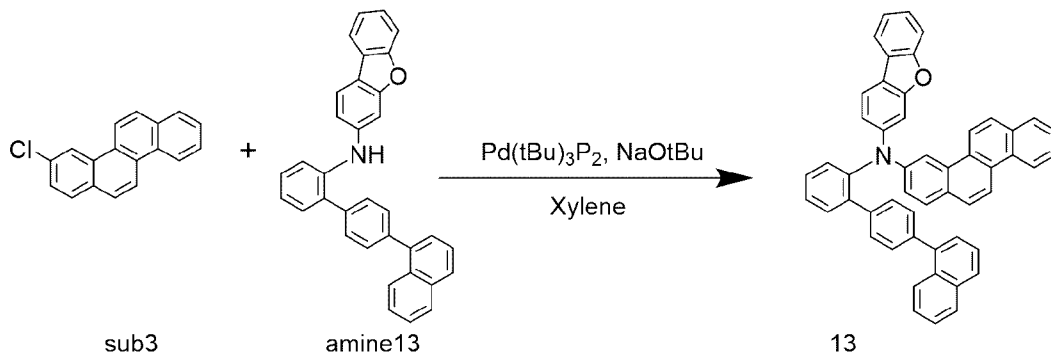


[341] 질소 분위기에서 sub3 (15 g, 57.1mmol), amine12 (25.3g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 12 24.4g을 얻었다. (수율 66%, MS: $[M+H]^+=649$)

[342]

[343] 합성 예 13

[344]

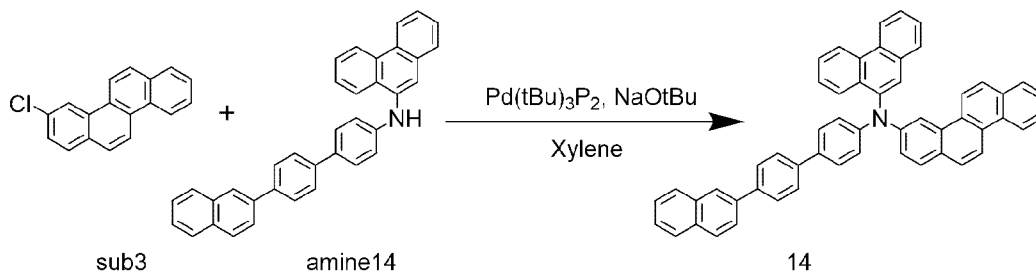


[345] 질소 분위기에서 sub3 (15 g, 57.1mmol), amine13 (27.7g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 13 25.9g을 얻었다. (수율 66%, MS: $[M+H]^+=689$)

[346]

[347] 합성 예 14

[348]

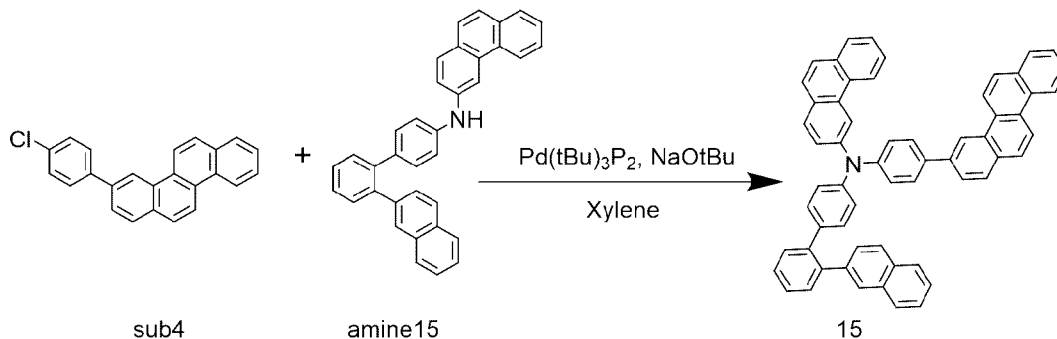


[349] 질소 분위기에서 sub3 (15 g, 57.1mmol), amine14 (28.3g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 14 27.5g을 얻었다. (수율 69%, MS: $[M+H]^+=699$)

[350]

[351] 합성 예 15

[352]

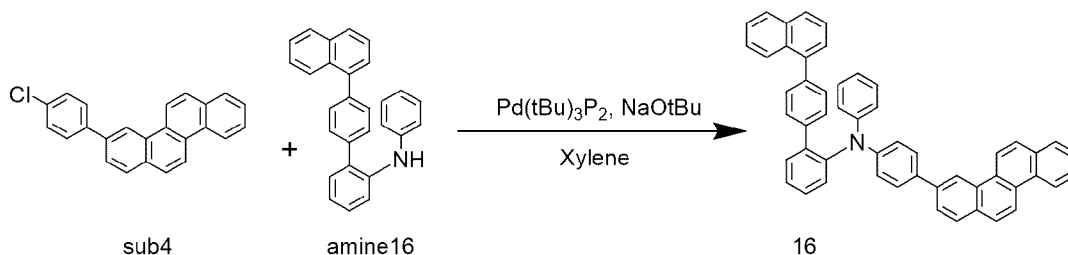


[353] 질소 분위기에서 sub4 (15 g, 44.3mmol), amine15 (21.9g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 15 19.5g을 얻었다. (수율 57%, MS: [M+H]⁺= 775)

[354]

[355] 합성 예 16

[356]

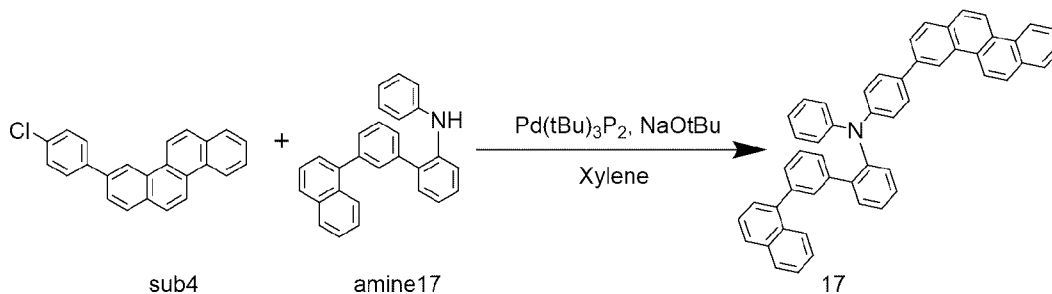


[357] 질소 분위기에서 sub4 (15 g, 44.3mmol), amine16 (17.3g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 16 19.1g을 얻었다. (수율 64%, MS: [M+H]⁺= 675)

[358]

[359] 합성 예 17

[360]

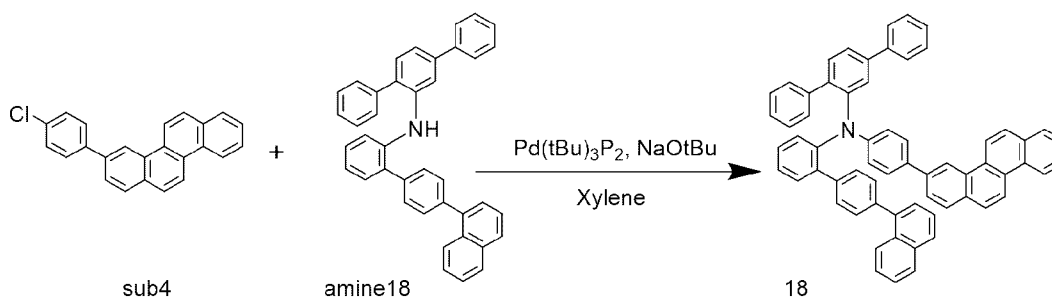


[361] 질소 분위기에서 sub4 (15 g, 44.3mmol), amine17 (17.3g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 17 18.8g을 얻었다. (수율 63%, MS: $[M+H]^+=675$)

[362]

[363] 합성 예 18

[364]

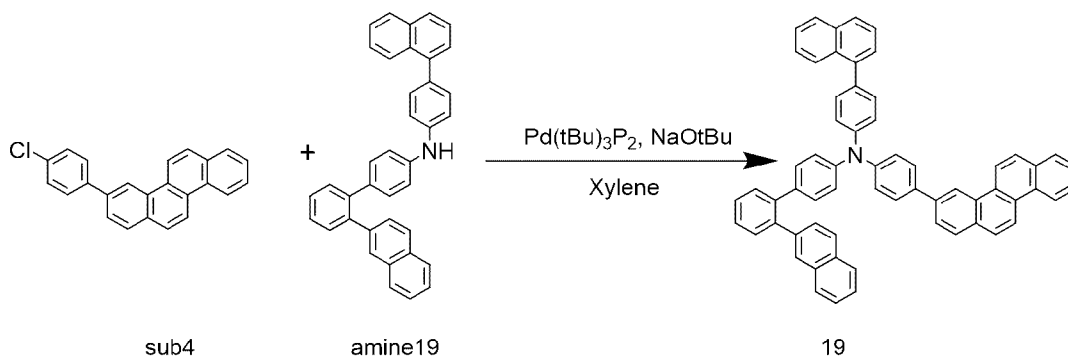


[365] 질소 분위기에서 sub4 (15 g, 44.3mmol), amine18 (24.3g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 18 21.9g을 얻었다. (수율 60%, MS: $[M+H]^+=827$)

[366]

[367] 합성 예 19

[368]

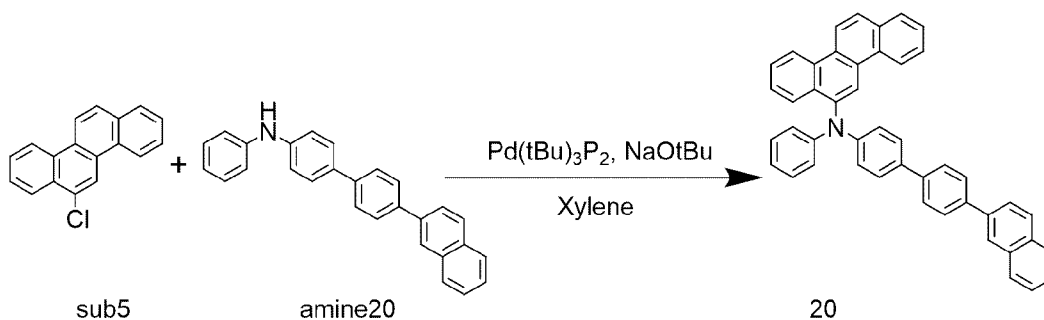


[369] 질소 분위기에서 sub4 (15 g, 44.3mmol), amine19 (23.1g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 19 20.9g을 얻었다. (수율 59%, MS: $[M+H]^+=801$)

[370]

[371] 합성 예 20

[372]

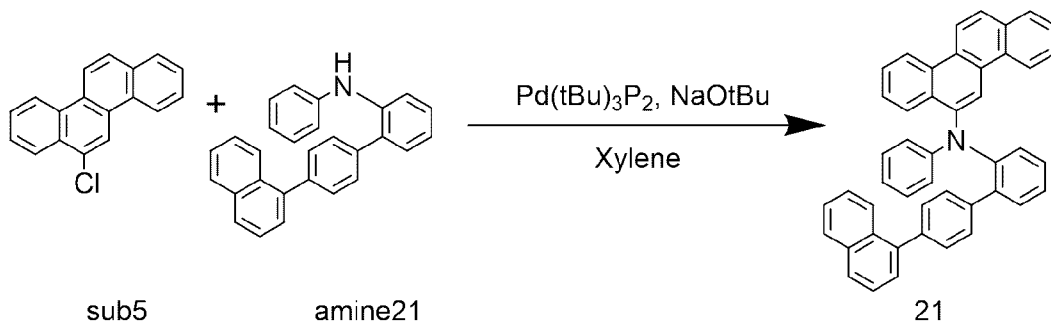


[373] 질소 분위기에서 sub5 (15 g, 57.1mmol), amine20 (22.3g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 20 18.1g을 얻었다. (수율 53%, MS: $[M+H]^+=599$)

[374]

[375] 합성 예 21

[376]

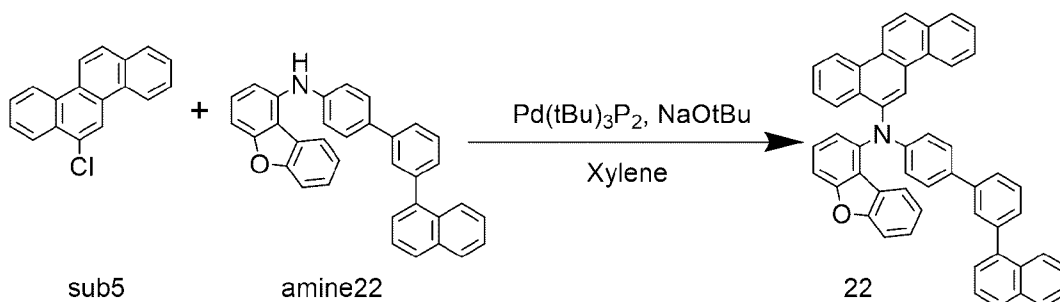


[377] 질소 분위기에서 sub5 (15 g, 57.1mmol), amine21 (22.3g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 21 21.5g을 얻었다. (수율 63%, MS: $[M+H]^+=599$)

[378]

[379] 합성 예 22

[380]

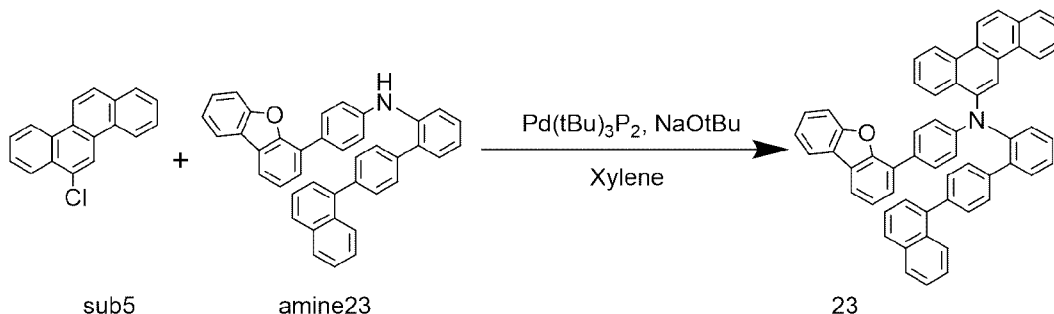


[381] 질소 분위기에서 sub5 (15 g, 57.1mmol), amine22 (27.7g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 22 22.4g을 얻었다. (수율 57%, MS: $[M+H]^+=689$)

[382]

[383] 합성 예 23

[384]

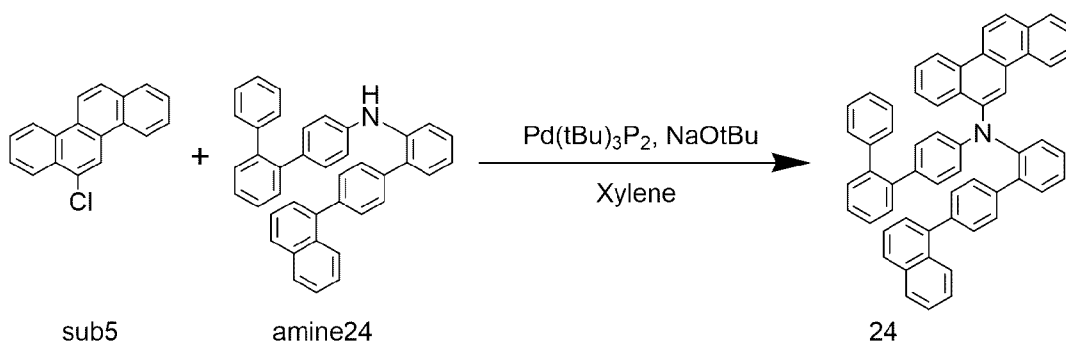


[385] 질소 분위기에서 sub5 (15 g, 57.1mmol), amine23 (32.2g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 23 25.3g을 얻었다. (수율 58%, MS: $[M+H]^+ = 765$)

[386]

[387] 합성 예 24

[388]

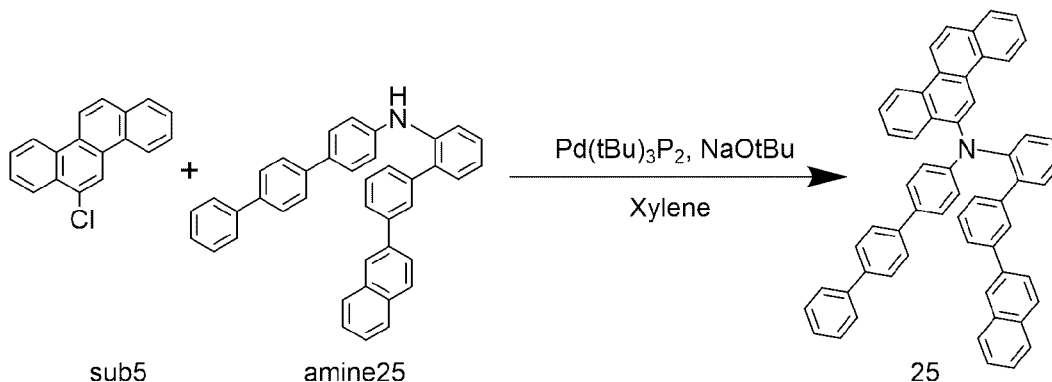


[389] 질소 분위기에서 sub5 (15 g, 57.1mmol), amine24 (31.4g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 24 24.4g을 얻었다. (수율 57%, MS: $[M+H]^+ = 751$)

[390]

[391] 합성 예 25

[392]

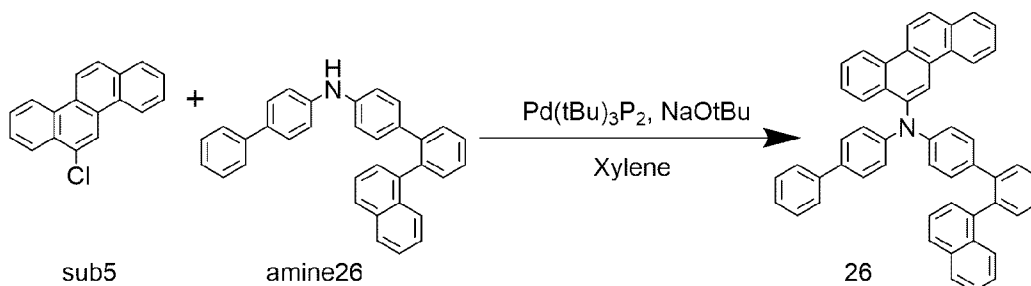


[393] 질소 분위기에서 sub5 (15 g, 57.1mmol), amine25 (31.4g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 25 28.7g을 얻었다. (수율 67%, MS: $[M+H]^+=751$)

[394]

[395] 합성 예 26

[396]

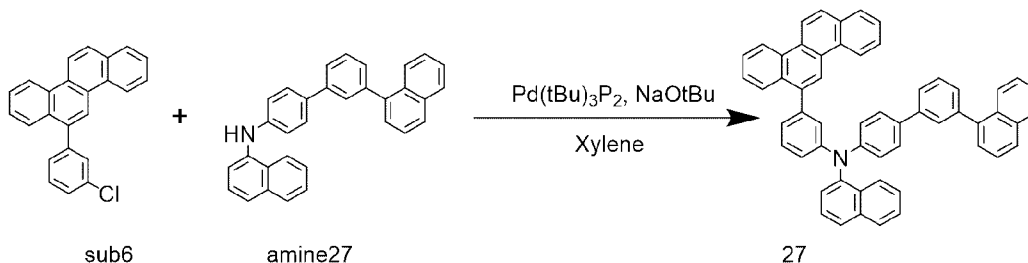


[397] 질소 분위기에서 sub5 (15 g, 57.1mmol), amine26 (26.8g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 26 20.4g을 얻었다. (수율 53%, MS: $[M+H]^+=675$)

[398]

[399] 합성 예 27

[400]

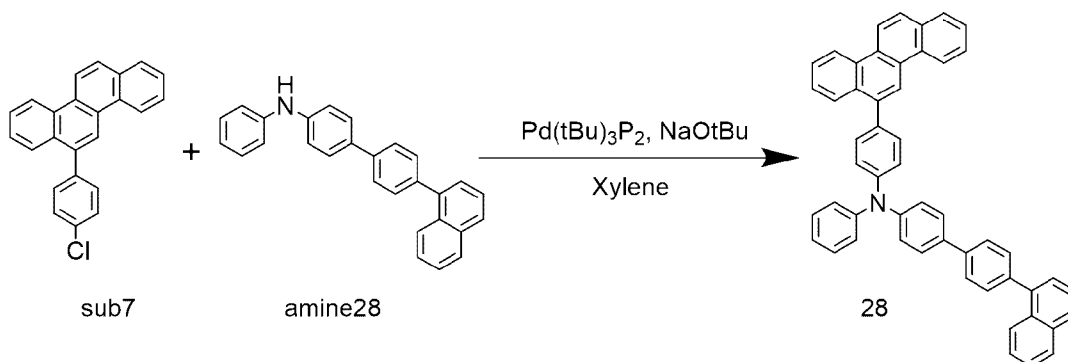


[401] 질소 분위기에서 sub6 (15 g, 44.3mmol), amine27 (19.6g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 27 16g을 얻었다. (수율 50%, MS: [M+H]⁺=725)

[402]

[403] 합성예 28

[404]

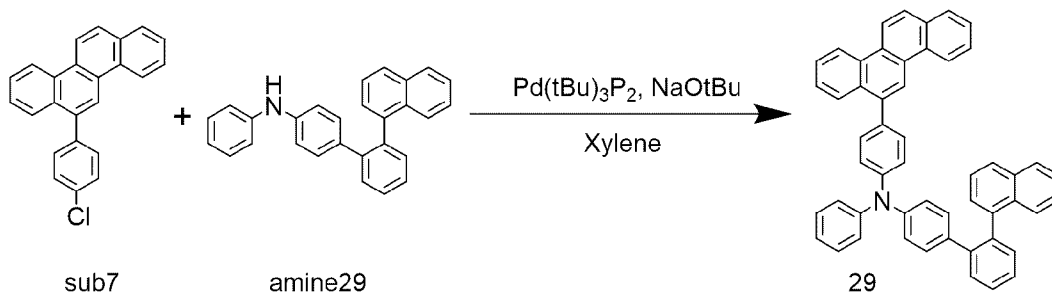


[405] 질소 분위기에서 sub7 (15 g, 44.3mmol), amine28 (17.3g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 28 20g을 얻었다. (수율 67%, MS: [M+H]⁺=675)

[406]

[407] 합성예 29

[408]

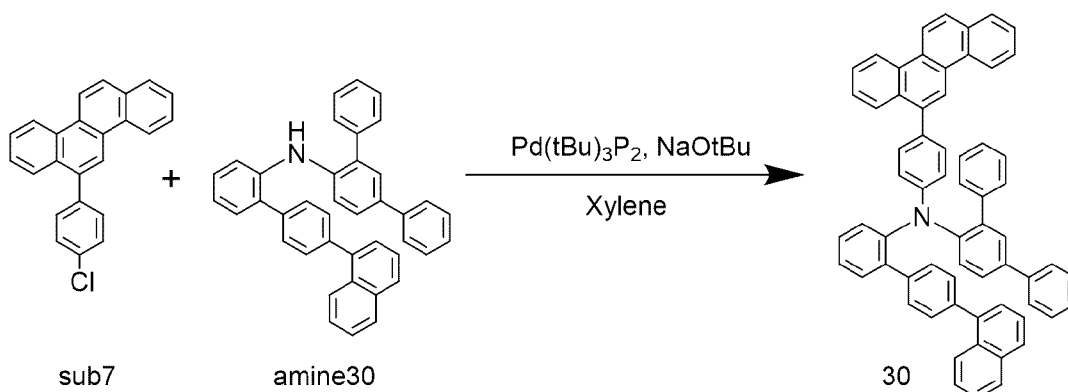


[409] 질소 분위기에서 sub7 (15 g, 44.3mmol), amine29 (17.3g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 29 20g을 얻었다. (수율 67%, MS: $[M+H]^+=675$)

[410]

[411] 합성 예 30

[412]

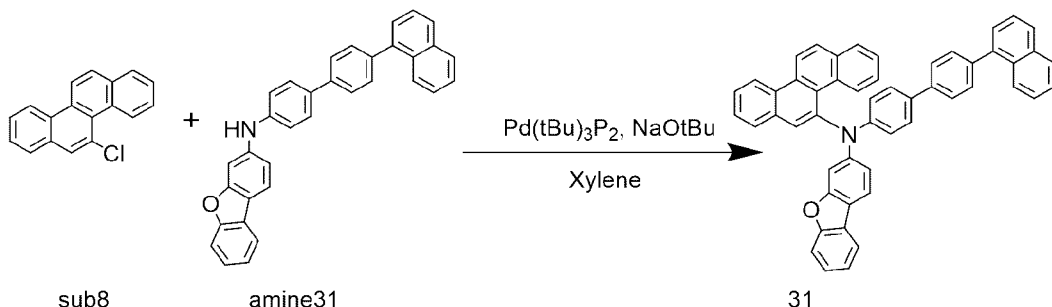


[413] 질소 분위기에서 sub7 (15 g, 44.3mmol), amine30 (24.3g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 30 22.3g을 얻었다. (수율 61%, MS: $[M+H]^+=827$)

[414]

[415] 합성 예 31

[416]

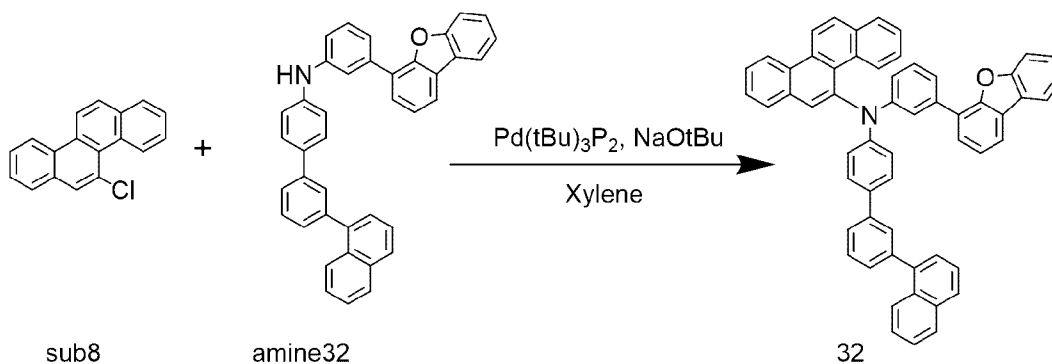


[417] 질소 분위기에서 sub8 (15 g, 57.1mmol), amine31 (27.7g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 31 21.6g을 얻었다. (수율 55%, MS: [M+H]⁺= 689)

[418]

[419] 합성 예 32

[420]

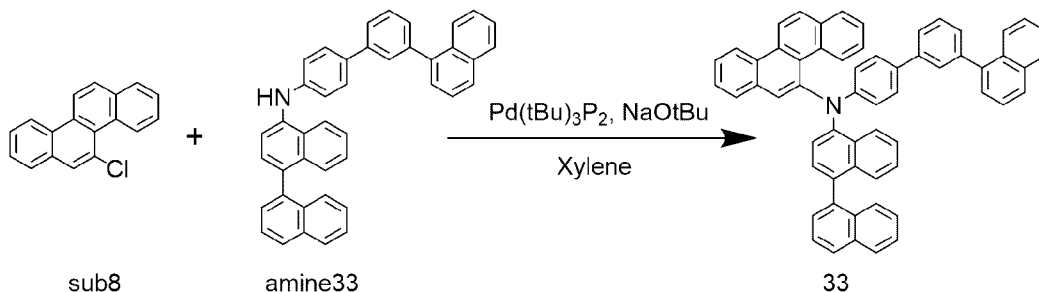


[421] 질소 분위기에서 sub8 (15 g, 57.1mmol), amine32 (32.2g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 32 25.3g을 얻었다. (수율 58%, MS: [M+H]⁺= 765)

[422]

[423] 합성 예 33

[424]

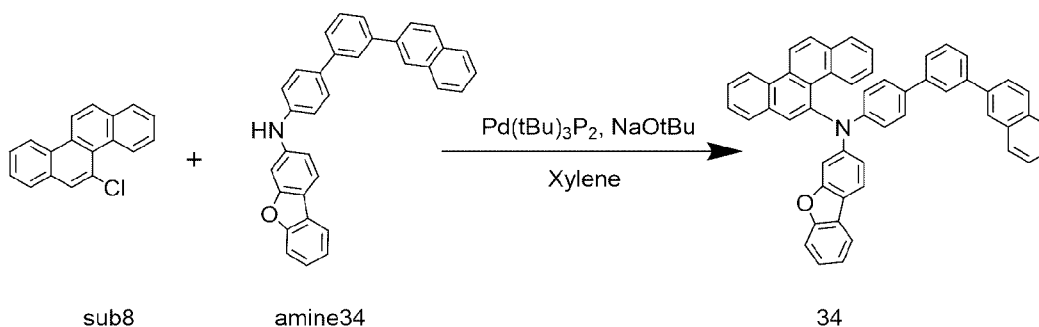


[425] 질소 분위기에서 sub8 (15 g, 57.1mmol), amine33 (32.8g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 33 27.4g을 얻었다. (수율 62%, MS: $[\text{M}+\text{H}]^+=775$)

[426]

[427] 합성 예 34

[428]

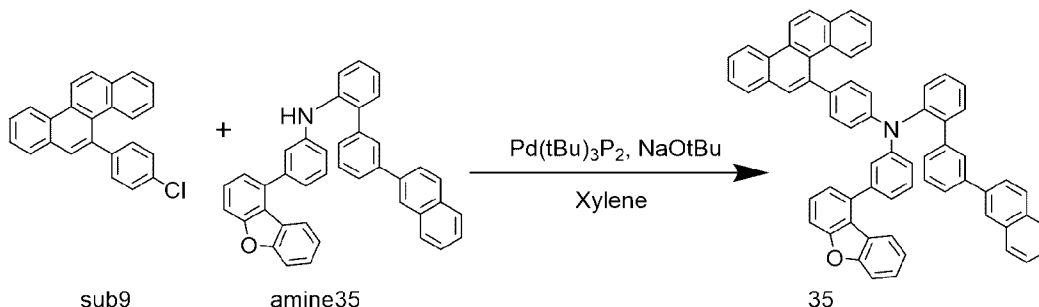


[429] 질소 분위기에서 sub8 (15 g, 57.1mmol), amine34 (27.7g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 34 23.6g을 얻었다. (수율 60%, MS: $[\text{M}+\text{H}]^+=689$)

[430]

[431] 합성 예 35

[432]

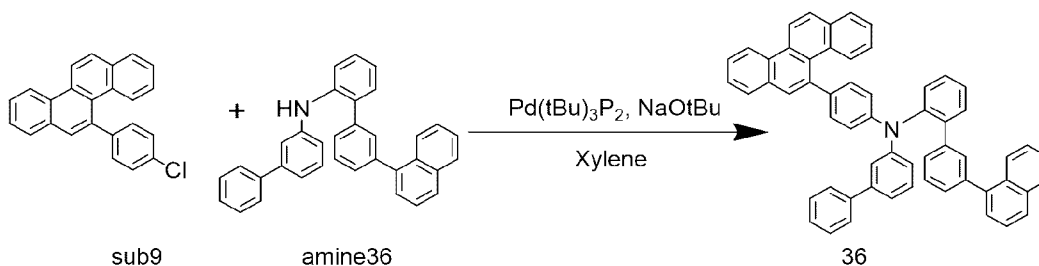


[433] 질소 분위기에서 sub9 (15 g, 44.3mmol), amine35 (25g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 35 23.4g을 얻었다. (수율 63%, MS: $[M+H]^+=841$)

[434]

[435] 합성 예 36

[436]

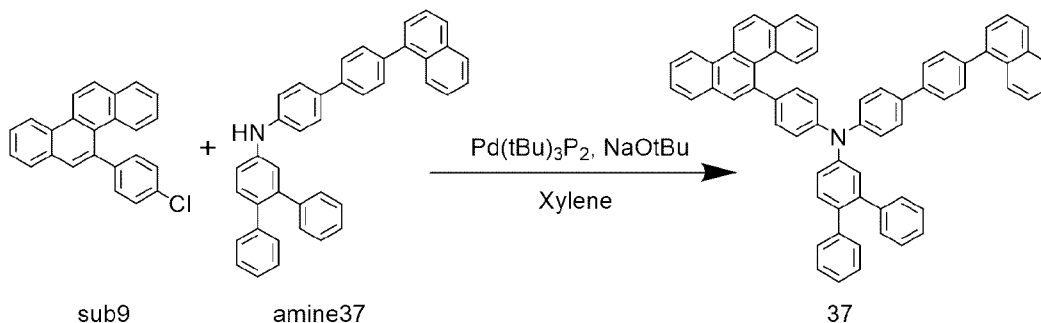


[437] 질소 분위기에서 sub9 (15 g, 44.3mmol), amine36 (20.8g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 36 18.3g을 얻었다. (수율 55%, MS: $[M+H]^+=751$)

[438]

[439] 합성 예 37

[440]

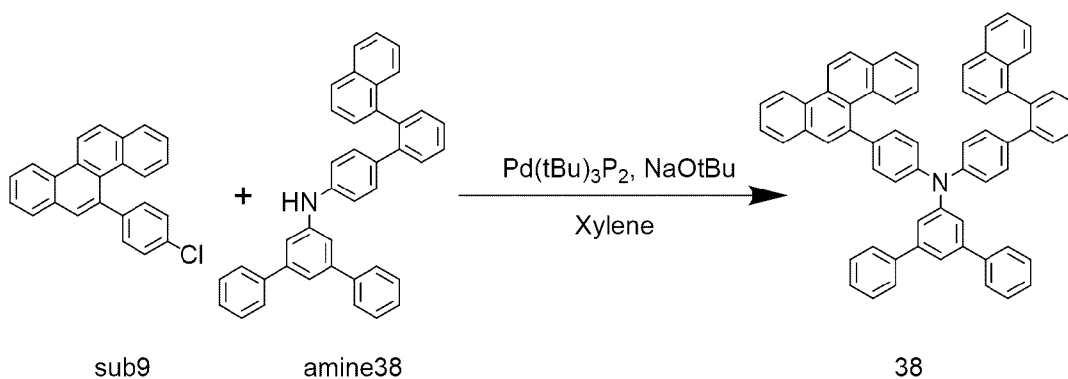


[441] 질소 분위기에서 sub9 (15 g, 44.3mmol), amine37 (24.3g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 37 24.5g을 얻었다. (수율 67%, MS: $[M+H]^+ = 827$)

[442]

[443] 합성 예 38

[444]

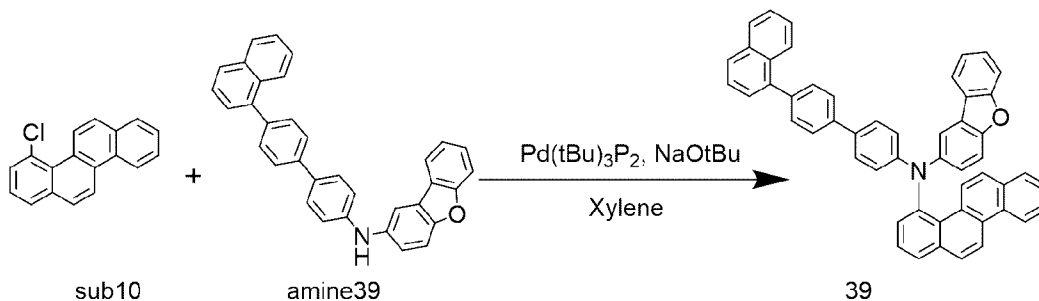


[445] 질소 분위기에서 sub9 (15 g, 44.3mmol), amine38 (24.3g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 38 18.3g을 얻었다. (수율 50%, MS: $[M+H]^+ = 827$)

[446]

[447] 합성 예 39

[448]

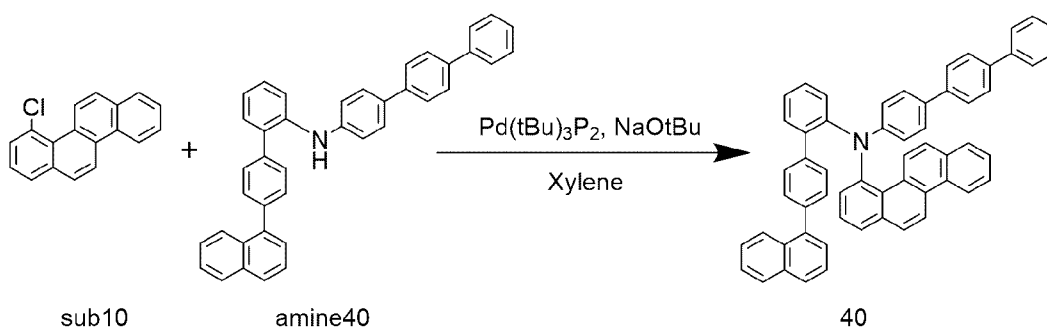


[449] 질소 분위기에서 sub10 (15 g, 57.1mmol), amine39 (27.7g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 39 20.4g을 얻었다. (수율 52%, MS: [M+H]⁺= 689)

[450]

[451] 합성예 40

[452]

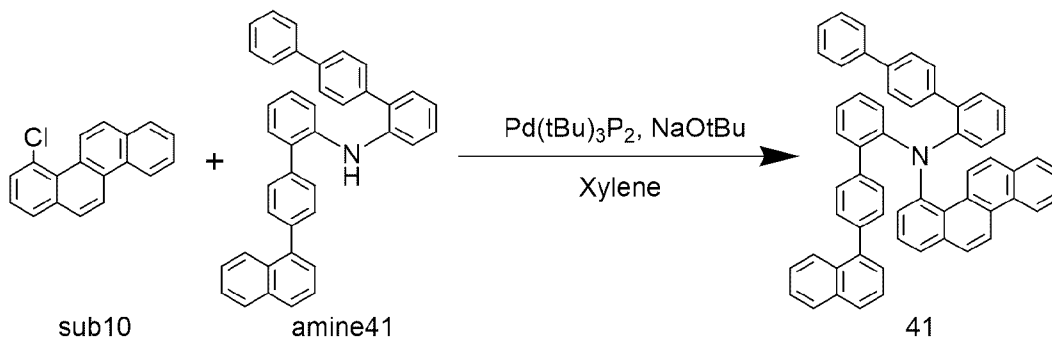


[453] 질소 분위기에서 sub10 (15 g, 57.1mmol), amine40 (31.4g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 40 29.5g을 얻었다. (수율 69%, MS: [M+H]⁺= 751)

[454]

[455] 합성예 41

[456]

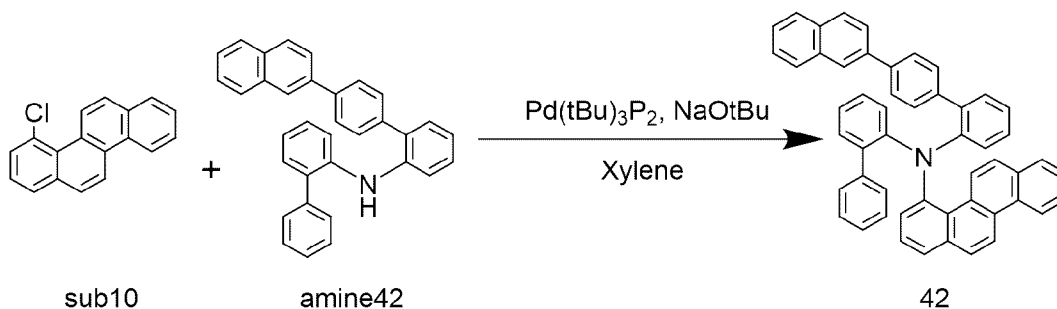


[457] 질소 분위기에서 sub10 (15 g, 57.1mmol), amine41 (31.4g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 41 22.3g을 얻었다. (수율 52%, MS: [M+H]⁺= 751)

[458]

[459] 합성예 42

[460]

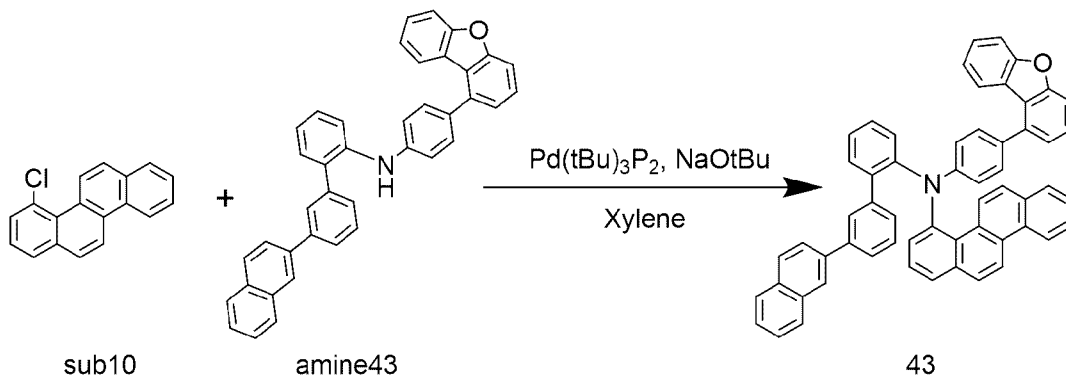


[461] 질소 분위기에서 sub10 (15 g, 57.1mmol), amine42 (26.8g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 42 19.2g을 얻었다. (수율 50%, MS: [M+H]⁺= 675)

[462]

[463] 합성예 43

[464]

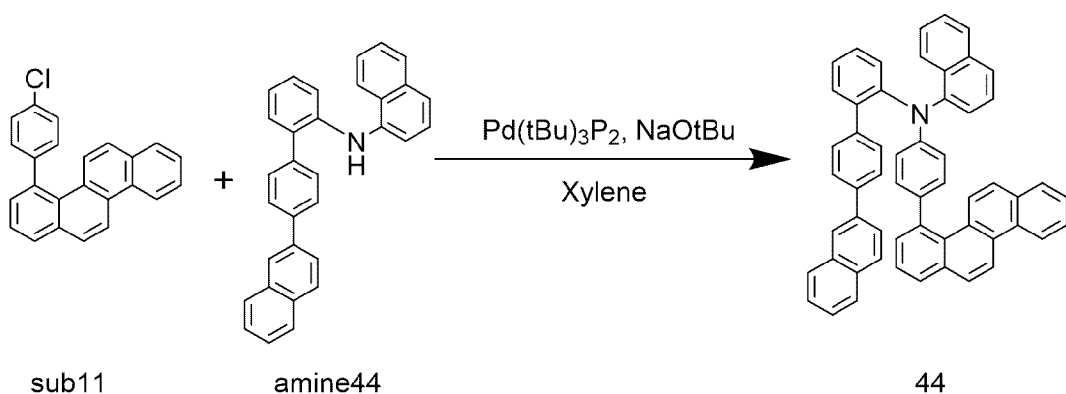


[465] 질소 분위기에서 sub10 (15 g, 57.1mmol), amine43 (32.2g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 43 25.7g을 얻었다. (수율 59%, MS: [M+H]⁺ = 765)

[466]

[467] 합성예 44

[468]

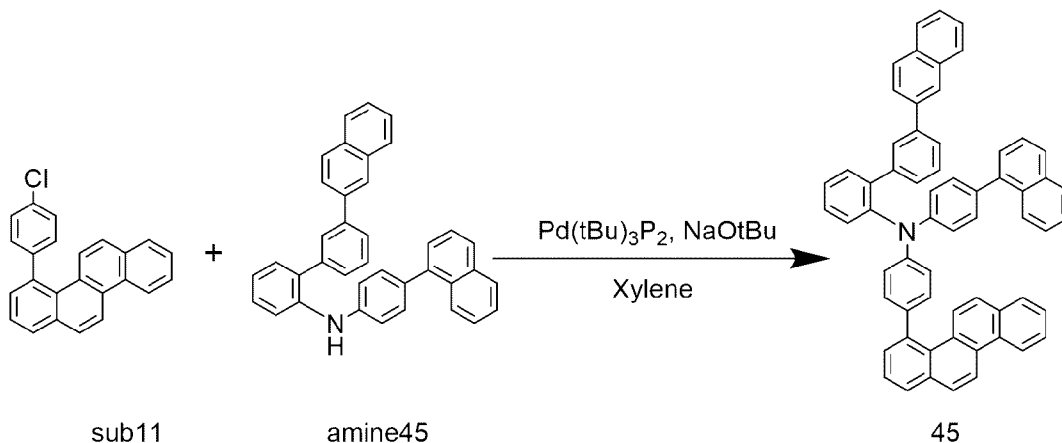


[469] 질소 분위기에서 sub11 (15 g, 44.3mmol), amine44 (19.6g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 44 16.7g을 얻었다. (수율 52%, MS: [M+H]⁺ = 725)

[470]

[471] 합성예 45

[472]

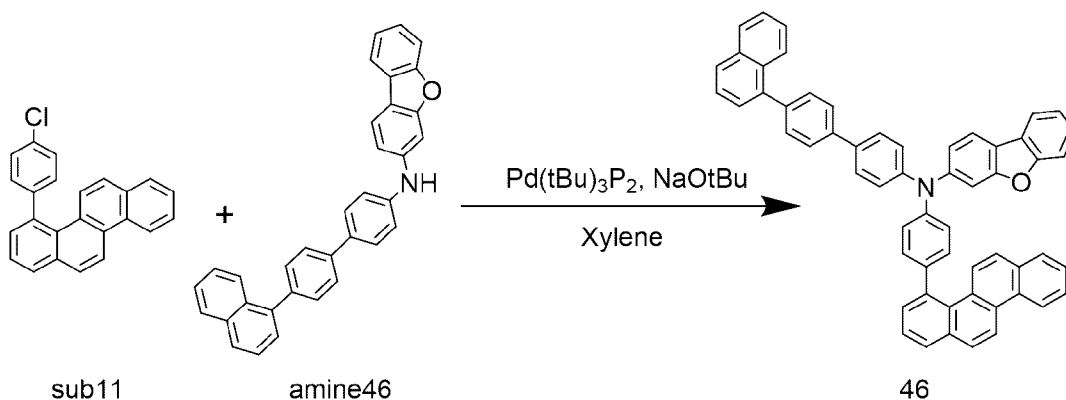


[473] 질소 분위기에서 sub11 (15 g, 44.3mmol), amine45 (23.1g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 45 20.2g을 얻었다. (수율 57%, MS: [M+H]⁺= 801)

[474]

[475] 합성예 46

[476]

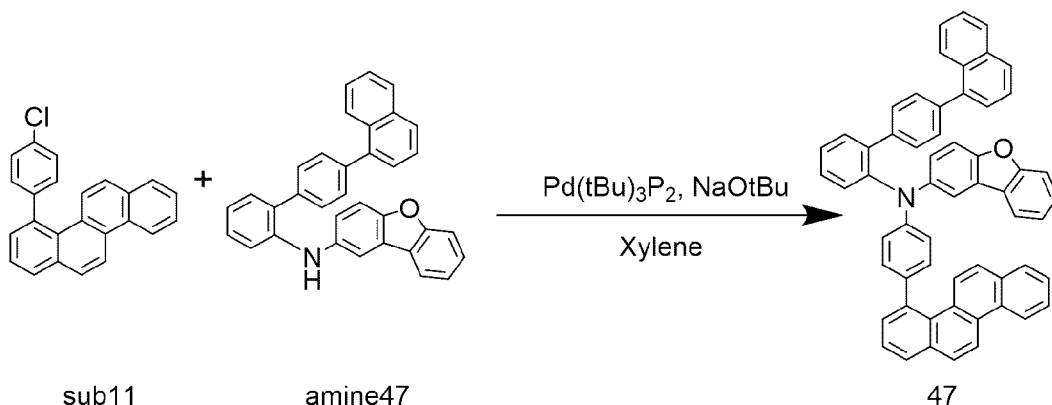


[477] 질소 분위기에서 sub11 (15 g, 44.3mmol), amine46 (21.5g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 46 20g을 얻었다. (수율 59%, MS: [M+H]⁺= 765)

[478]

[479] 합성 예 47

[480]

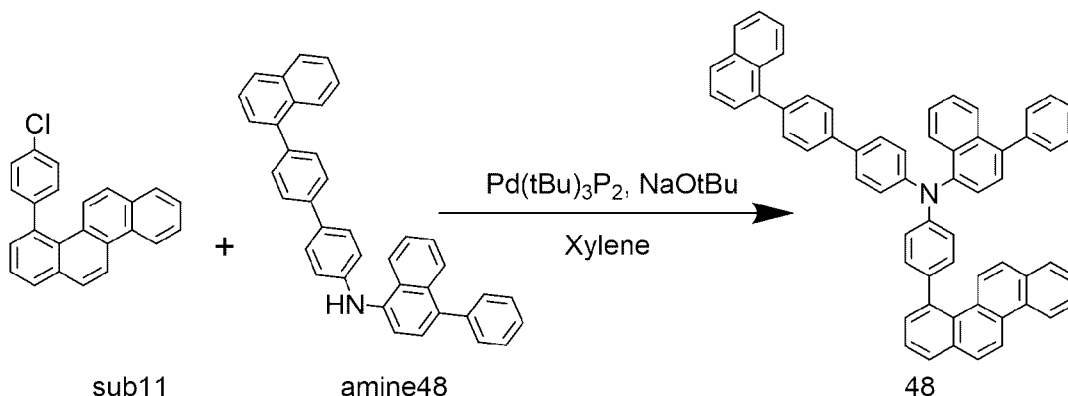


[481] 질소 분위기에서 sub11 (15 g, 44.3mmol), amine47 (21.5g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 47 16.9g을 얻었다. (수율 50%, MS: [M+H]⁺= 765)

[482]

[483] 합성 예 48

[484]

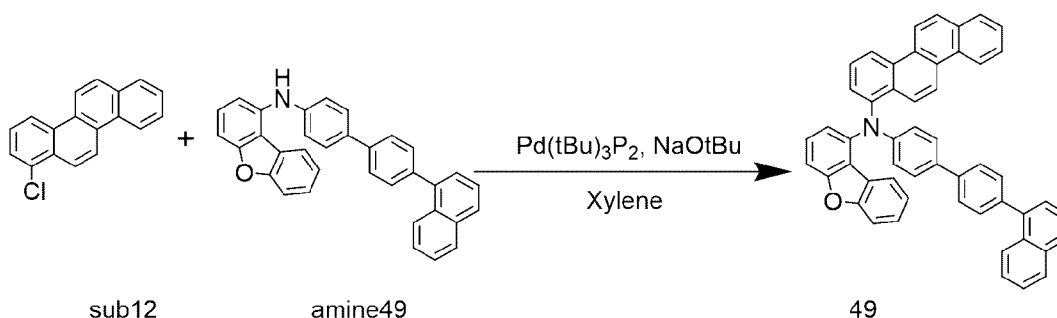


[485] 질소 분위기에서 sub11 (15 g, 44.3mmol), amine48 (23.1g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 48 23.7g을 얻었다. (수율 67%, MS: [M+H]⁺= 801)

[486]

[487] 합성 예 49

[488]

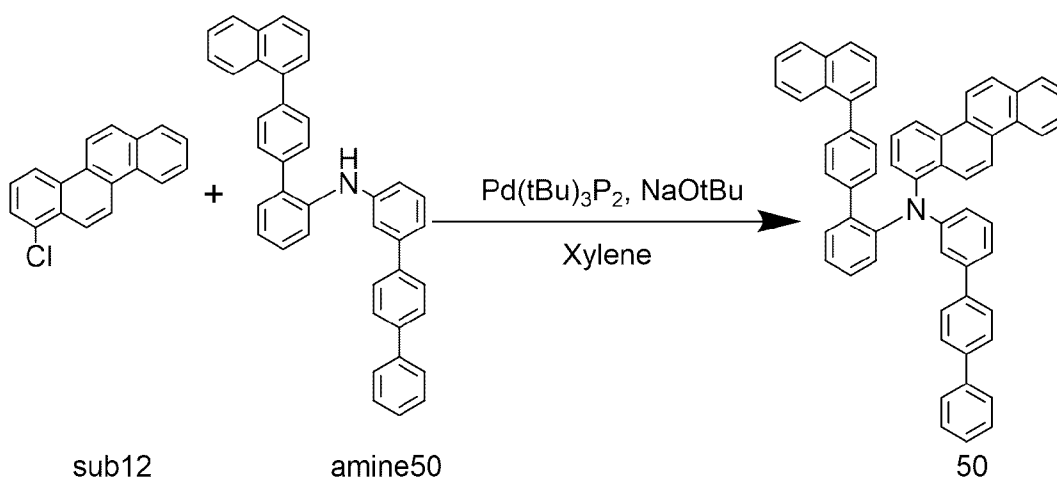


[489] 질소 분위기에서 sub12 (15 g, 57.1mmol), amine49 (27.7g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 49 25.5g을 얻었다. (수율 65%, MS: [M+H]⁺= 689)

[490]

[491] 합성 예 50

[492]

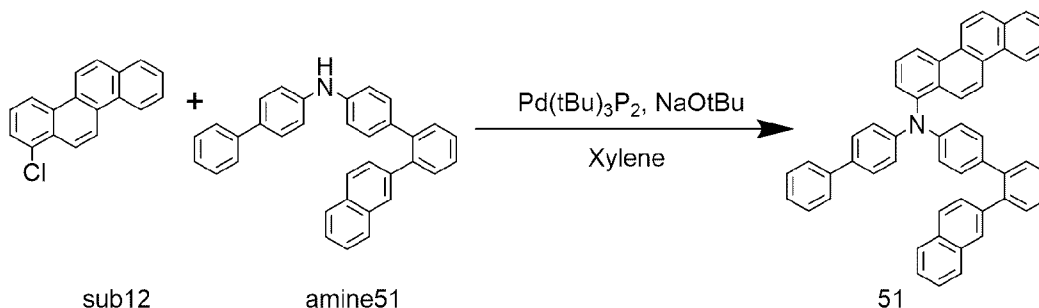


[493] 질소 분위기에서 sub12 (15 g, 57.1mmol), amine50 (31.4g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 50 22.3g을 얻었다. (수율 52%, MS: [M+H]⁺= 751)

[494]

[495] 합성 예 51

[496]

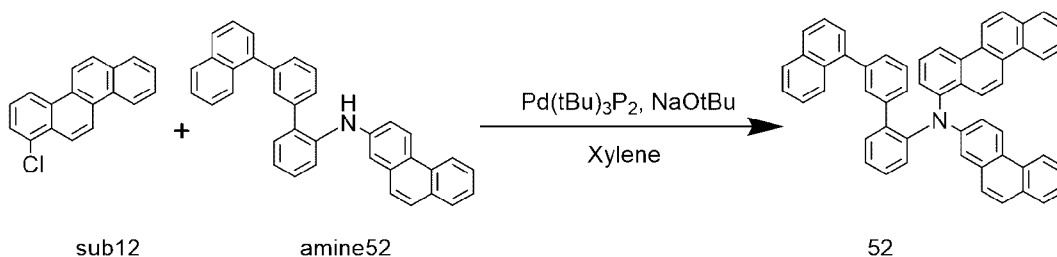


[497] 질소 분위기에서 sub12 (15 g, 57.1mmol), amine51 (26.8g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 51 25.4g을 얻었다. (수율 66%, MS: [M+H]⁺= 675)

[498]

[499] 합성 예 52

[500]

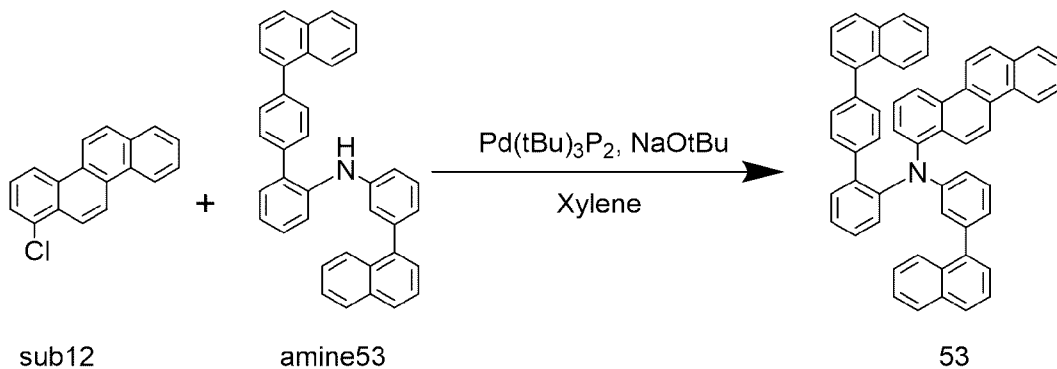


[501] 질소 분위기에서 sub12 (15 g, 57.1mmol), amine52 (28.3g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 52 25.5g을 얻었다. (수율 64%, MS: [M+H]⁺= 699)

[502]

[503] 합성 예 53

[504]

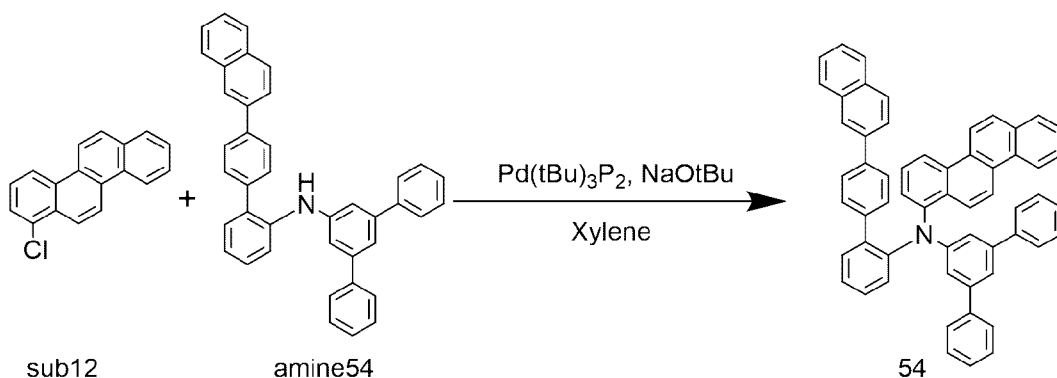


[505] 질소 분위기에서 sub12 (15 g, 57.1mmol), amine53 (29.8g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 53 28.9g을 얻었다. (수율 70%, MS: [M+H]⁺= 725)

[506]

[507] 합성예 54

[508]

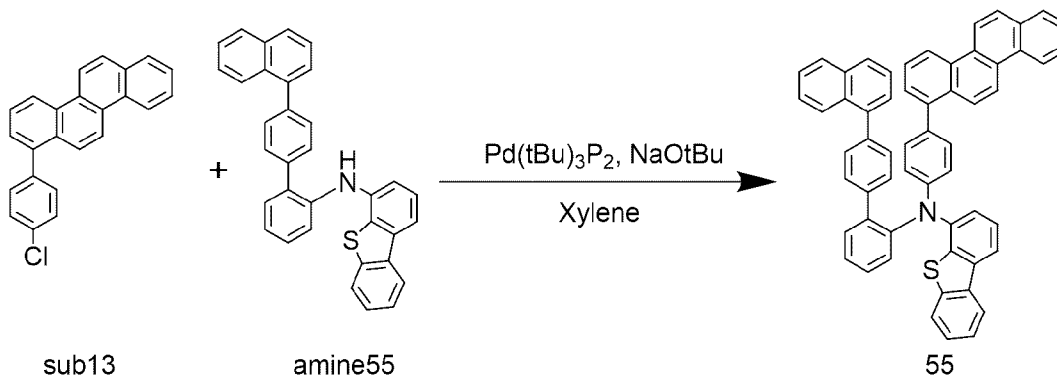


[509] 질소 분위기에서 sub12 (15 g, 57.1mmol), amine54 (31.4g, 59.9 mmol), sodium tert-butoxide (8.2 g, 85.6 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.3 g, 0.6 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 54 23.1g을 얻었다. (수율 54%, MS: [M+H]⁺= 751)

[510]

[511] 합성예 55

[512]

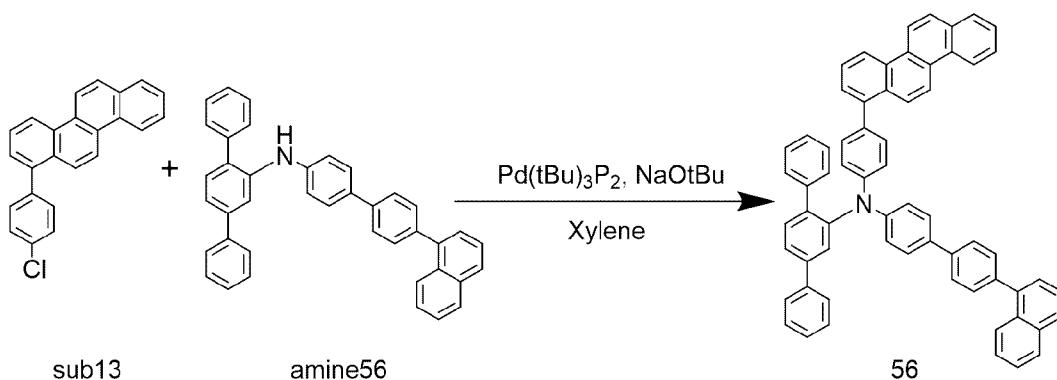


[513] 질소 분위기에서 sub13 (15 g, 44.3mmol), amine55 (22.2g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 55 17.6g을 얻었다. (수율 51%, MS: [M+H]⁺= 781)

[514]

[515] 합성예 56

[516]

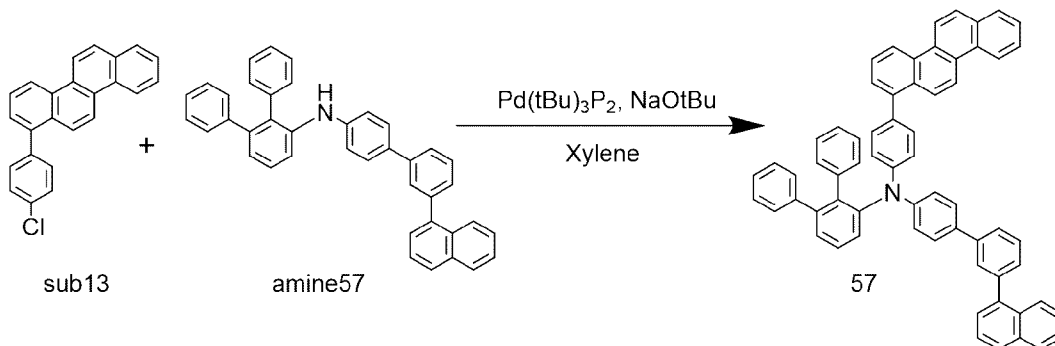


[517] 질소 분위기에서 sub13 (15 g, 44.3mmol), amine56 (24.3g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 56 20.5g을 얻었다. (수율 56%, MS: [M+H]⁺= 827)

[518]

[519] 합성예 57

[520]



[521] 질소 분위기에서 sub13 (15 g, 44.3mmol), amine57 (24.3g, 46.5 mmol), sodium tert-butoxide (6.4 g, 66.4 mmol)을 Xylene 300ml에 넣고 교반 및 환류했다. 이 후 bis(tri-tert-butylphosphine)palladium(0) (0.2 g, 0.4 mmol)을 투입했다. 5시간 후 반응이 종결되어서 상온으로 식히고 감압하여 용매를 제거했다. 이 후 화합물을 다시 클로로포름에 완전히 녹이고 물로 2회 세척 후에 유기층을 분리하여 무수황산마그네슘 처리 후 여과하여 여액을 감압 증류했다. 농축한 화합물을 실리카 겔 컬럼 크로마토그래피로 정제해서 화합물 57 19g을 얻었다. (수율 52%, MS: [M+H]⁺= 827)

[522]

[523] 실시예 1

[524] ITO(Indium Tin Oxide)가 1,000Å의 두께로 박막 코팅된 유리 기판을 세제를 녹인 증류수에 넣고 초음파로 세척하였다. 이때, 세제로는 피셔사(Fischer Co.) 제품을 사용하였으며, 증류수로는 밀러포어사(Millipore Co.) 제품의 필터(Filter)로 2차로 걸러진 증류수를 사용하였다. ITO를 30분간 세척한 후 증류수로 2회 반복하여 초음파 세척을 10분간 진행하였다. 증류수 세척이 끝난 후, 이소프로필알콜, 아세톤, 메탄올의 용제로 초음파 세척을 하고 건조시킨 후 플라즈마 세정기로 수송시켰다. 또한, 산소 플라즈마를 이용하여 상기 기판을 5분간 세정한 후 진공 증착기로 기판을 수송시켰다.

[525]

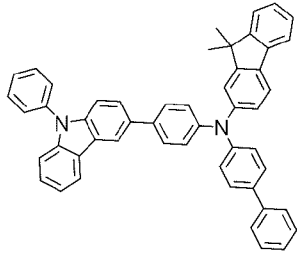
[526] 이렇게 준비된 ITO 투명 전극 위에 정공주입층으로 하기 HI-1 화합물을 1100Å의 두께로 형성하되 하기 A-1 화합물을 1.5% 농도로 p-doping 했다. 상기 정공주입층 위에 하기 HT-1 화합물을 진공 증착 하여 막 두께 800Å의 정공수송층을 형성했다. 이어서 정공수송보조층으로 본 발명의 화합물 1을 100Å의 두께로 열 진공 증착 하였다. 이어서, 발광층으로 하기 화학식 BH-1 및 BD-1로 표시되는 화합물을 25:1의 중량비로 250Å의 두께로 진공 증착 하였다.

[527]

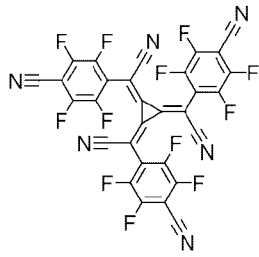
[528] 이어서, 정공저지층으로 하기 화학식 HB-1으로 표시되는 화합물을 50Å의 두께로 진공 증착 하였다. 이어서, 전자 주입 및 수송을 동시에 하는 전자주입 및 수송층으로 하기 화학식 ET-1로 표시되는 화합물과 하기 LiQ로 표시되는 화합물을 1:1의 중량비로 310Å의 두께로 열 진공 증착 하였다. 상기 전자주입 및 수송층 위

에 순차적으로 12Å의 두께로 리튬플로라이드(LiF)와 1000Å 두께로 알루미늄을 증착하여 음극을 형성하여, 유기 발광 소자를 제조하였다.

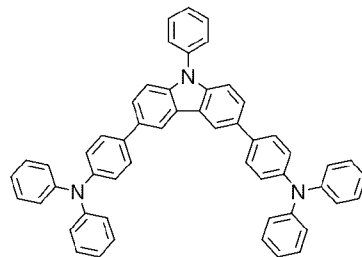
[529]



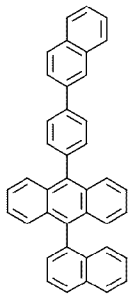
HI-1



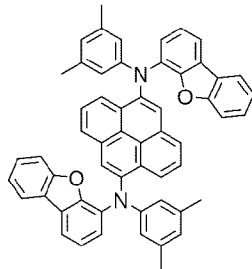
A-1



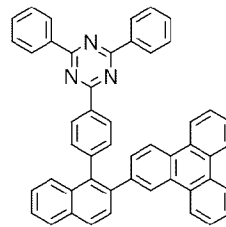
HT-1



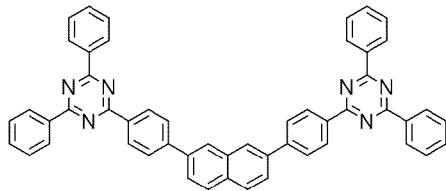
BH-1



BD-1



HB-1



ET-1



LiQ

[530]

[531] 실시예 2 내지 57

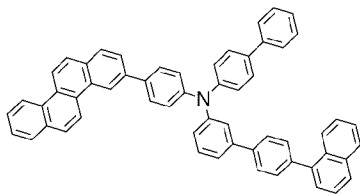
[532] 화합물 1 대신 하기 표 1에 기재된 화합물을 사용하는 것을 제외하고는, 상기 실시예 1과 동일한 방법으로 유기 발광 소자를 제조하였다.

[533]

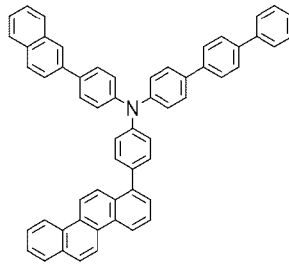
[534] 비교예 1 내지 8

[535] 화합물 1 대신 하기 표 1에 기재된 화합물을 사용한 것을 제외하고는 실시예 1과 동일한 방법으로 유기 발광 소자를 제조하였다. 하기 표 1에서, 화합물 C-1 내지 C-8은 하기와 같다.

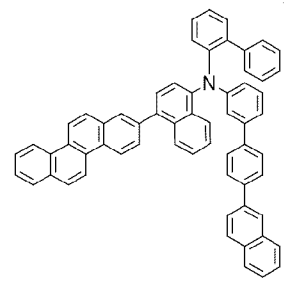
[536]



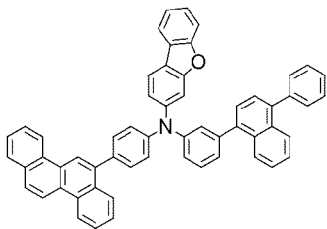
C-1



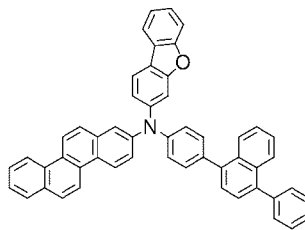
C-2



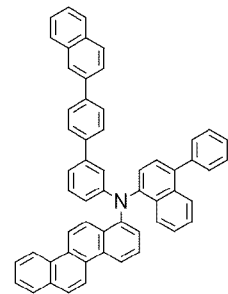
C-3



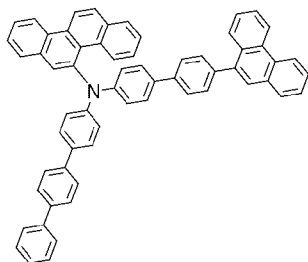
C-4



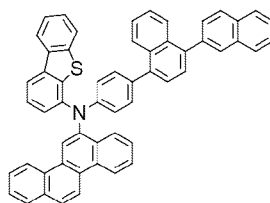
C-5



C-6



C-7



C-8

[537]

[538] 실험예

[539] 실시예 1 내지 57 및 비교예 1 내지 8에서 제조한 유기 발광 소자에 대하여 15 mA/cm²의 전류를 인가하였을 때, 전압, 효율을 측정하고 그 결과를 하기 표 1에 나타내었다. 수명T95는 휘도가 초기 휘도(1000 nit)에서 95%로 감소되는 데 소요되는 시간을 의미한다

[540]

[541] [표1]

	화합물	전압(V)	효율(cd/A)	수명T 95(hr)	발광색
실험예 1	화합물 1	3.34	5.24	172	청색

실험예 2	화합물 2	3.30	5.28	180	청색
실험예 3	화합물 3	3.30	5.32	162	청색
실험예 4	화합물 4	3.37	5.27	175	청색
실험예 5	화합물 5	3.37	5.20	163	청색
실험예 6	화합물 6	3.29	5.23	166	청색
실험예 7	화합물 7	3.33	5.28	196	청색
실험예 8	화합물 8	3.34	5.19	206	청색
실험예 9	화합물 9	3.35	5.26	196	청색
실험예 10	화합물 10	3.32	5.26	215	청색
실험예 11	화합물 11	3.22	5.15	161	청색
실험예 12	화합물 12	3.21	5.06	163	청색
실험예 13	화합물 13	3.23	5.18	168	청색
실험예 14	화합물 14	3.23	5.10	160	청색
실험예 15	화합물 15	3.29	5.05	211	청색
실험예 16	화합물 16	3.28	5.03	212	청색
실험예 17	화합물 17	3.36	5.12	220	청색
실험예 18	화합물 18	3.31	5.17	215	청색
실험예 19	화합물 19	3.30	5.11	209	청색
실험예 20	화합물 20	3.48	5.31	175	청색
실험예 21	화합물 21	3.49	5.29	162	청색
실험예 22	화합물 22	3.51	5.27	170	청색
실험예 23	화합물 23	3.50	5.27	161	청색
실험예 24	화합물 24	3.43	5.32	179	청색
실험예 25	화합물 25	3.40	5.24	178	청색
실험예 26	화합물 26	3.46	5.21	169	청색
실험예 27	화합물 27	3.35	5.29	162	청색
실험예 28	화합물 28	3.35	5.15	204	청색
실험예 29	화합물 29	3.29	5.17	218	청색
실험예 30	화합물 30	3.34	5.06	213	청색
실험예 31	화합물 31	3.29	5.22	173	청색

실험예 32	화합물 32	3.37	5.20	164	청색
실험예 33	화합물 33	3.33	5.32	166	청색
실험예 34	화합물 34	3.30	5.31	172	청색
실험예 35	화합물 35	3.28	5.18	215	청색
실험예 36	화합물 36	3.34	5.13	206	청색
실험예 37	화합물 37	3.38	5.04	197	청색
실험예 38	화합물 38	3.34	5.03	208	청색
실험예 39	화합물 39	3.26	5.07	171	청색
실험예 40	화합물 40	3.22	5.05	169	청색
실험예 41	화합물 41	3.26	5.14	179	청색
실험예 42	화합물 42	3.17	5.08	178	청색
실험예 43	화합물 43	3.38	5.25	172	청색
실험예 44	화합물 44	3.26	5.23	227	청색
실험예 45	화합물 45	3.19	5.22	230	청색
실험예 46	화합물 46	3.17	5.21	229	청색
실험예 47	화합물 47	3.21	5.24	243	청색
실험예 48	화합물 48	3.17	5.23	249	청색
실험예 49	화합물 49	3.31	5.19	175	청색
실험예 50	화합물 50	3.36	5.19	171	청색
실험예 51	화합물 51	3.33	5.20	168	청색
실험예 52	화합물 52	3.30	5.27	179	청색
실험예 53	화합물 53	3.38	5.19	165	청색
실험예 54	화합물 54	3.45	5.34	196	청색
실험예 55	화합물 55	3.34	5.10	200	청색
실험예 56	화합물 56	3.37	5.16	197	청색
실험예 57	화합물 57	3.28	5.02	219	청색
비교예 1	C-1	3.58	4.75	143	청색
비교예 2	C-2	3.65	4.75	141	청색
비교예 3	C-3	3.60	4.85	146	청색
비교예 4	C-4	3.65	4.73	137	청색

비교예 5	C-5	3.57	4.71	123	청색
비교예 6	C-6	3.64	4.91	124	청색
비교예 7	C-7	3.60	4.91	126	청색
비교예 8	C-8	3.60	4.70	121	청색

[542] 상기 표 1에서 확인할 수 있는 바와 같이, 본 발명의 화합물을 사용한 유기 발광 소자는 비교예 화합물을 사용한 유기 발광 소자 대비 구동 전압, 효율 및 수명 면에서 개선된 효과를 나타내는 것을 확인할 수 있다. 이는, 본 발명의 화합물은 유기 발광 소자의 발광층내 형성된 엑시톤의 안정성에 기여하기 때문이라 판단된다.

[543]

[544] [부호의 설명]

[545] 1: 기판 2: 양극

[546] 3: 발광층 4: 음극

[547] 5: 정공주입층 6: 정공수송층

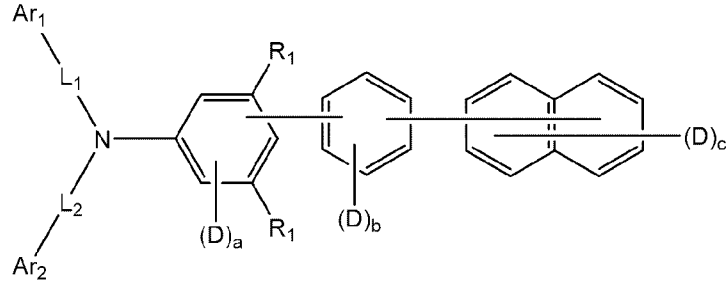
[548] 7: 정공수송보조층 8: 정공저지층

[549] 9: 전자주입 및 수송층

청구범위

[청구항 1] 하기 화학식 1로 표시되는 화합물:

[화학식 1]



상기 화학식 1에서,

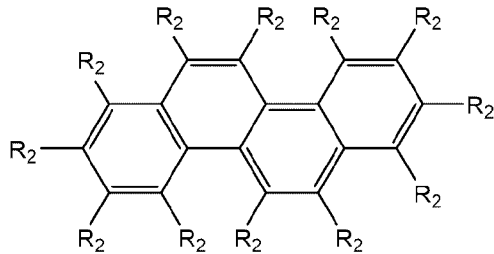
L_1 및 L_2 는 각각 독립적으로, 단일 결합, 또는 치환 또는 비치환된 C_{6-60} 아릴렌이고,

R_1 은 각각 독립적으로, 수소, 또는 중수소이고,

Ar_1 은 치환 또는 비치환된 C_{6-60} 아릴, 또는 치환 또는 비치환된 N, O 및 S로 구성되는 군으로부터 선택되는 어느 하나 이상의 헤테로원자를 포함하는 C_{2-60} 헤테로아릴이되, 단, Ar_1 에서 치환 또는 비치환된 디메틸플루오레닐, 디페닐플루오레닐, 및 스피로비플루오레닐은 제외되고,

Ar_2 는 하기 화학식 2로 표시되는 치환기이고,

[화학식 2]



상기 화학식 2에서,

R_2 중 하나는 L_2 와 결합하고, 나머지는 각각 독립적으로, 수소, 또는 중수소이고,

D 는 중수소이고,

a 는 0 내지 2의 정수이고,

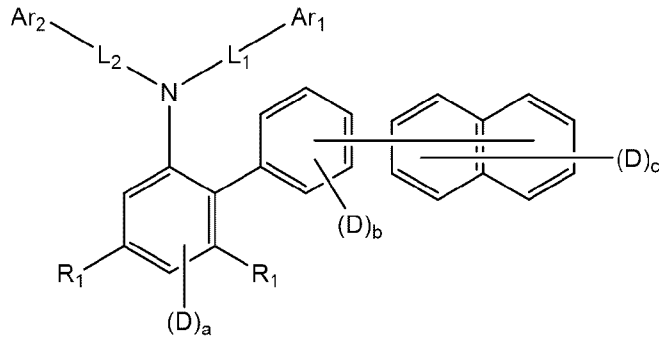
b 는 0 내지 4의 정수이고,

c 는 0 내지 7의 정수이다.

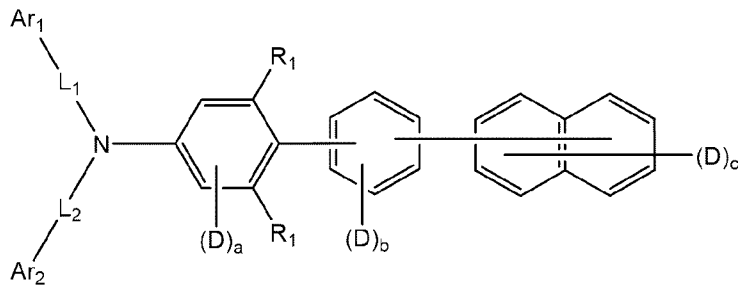
[청구항 2] 제1항에 있어서,

상기 화학식 1은 하기 화학식 1-1 또는 1-2로 표시되는, 화합물:

[화학식 1-1]



[화학식 1-2]



상기 화학식 1-1 및 1-2에서,

L_1 , L_2 , R_1 , Ar_1 , Ar_2 , D , a , b 및 c 는 제1항에서 정의한 바와 같다.

[청구항 3]

제1항에 있어서,

L_1 및 L_2 는 각각 독립적으로, 단일 결합, 또는 비치환되거나 1개 이상의 중수소로 치환된 페닐렌인, 화합물.

[청구항 4]

제1항에 있어서,

L_1 및 L_2 는 모두 단일 결합이거나;

L_1 은 단일 결합이고, L_2 는 비치환되거나 1개 이상의 중수소로 치환된 페닐렌이거나;

L_1 은 비치환되거나 1개 이상의 중수소로 치환된 페닐렌이고, L_2 는 단일 결합이거나; 또는

L_1 및 L_2 는 모두 비치환되거나 1개 이상의 중수소로 치환된 페닐렌인, 화합물.

[청구항 5]

제1항에 있어서,

Ar_1 은 페닐, 비페닐릴, 터터페닐릴, 나프틸, 페닐 나프틸, 나프틸 페닐, 나프틸 나프틸, 페난트릴, 디벤조푸라닐 또는 디벤조티오페닐이고,

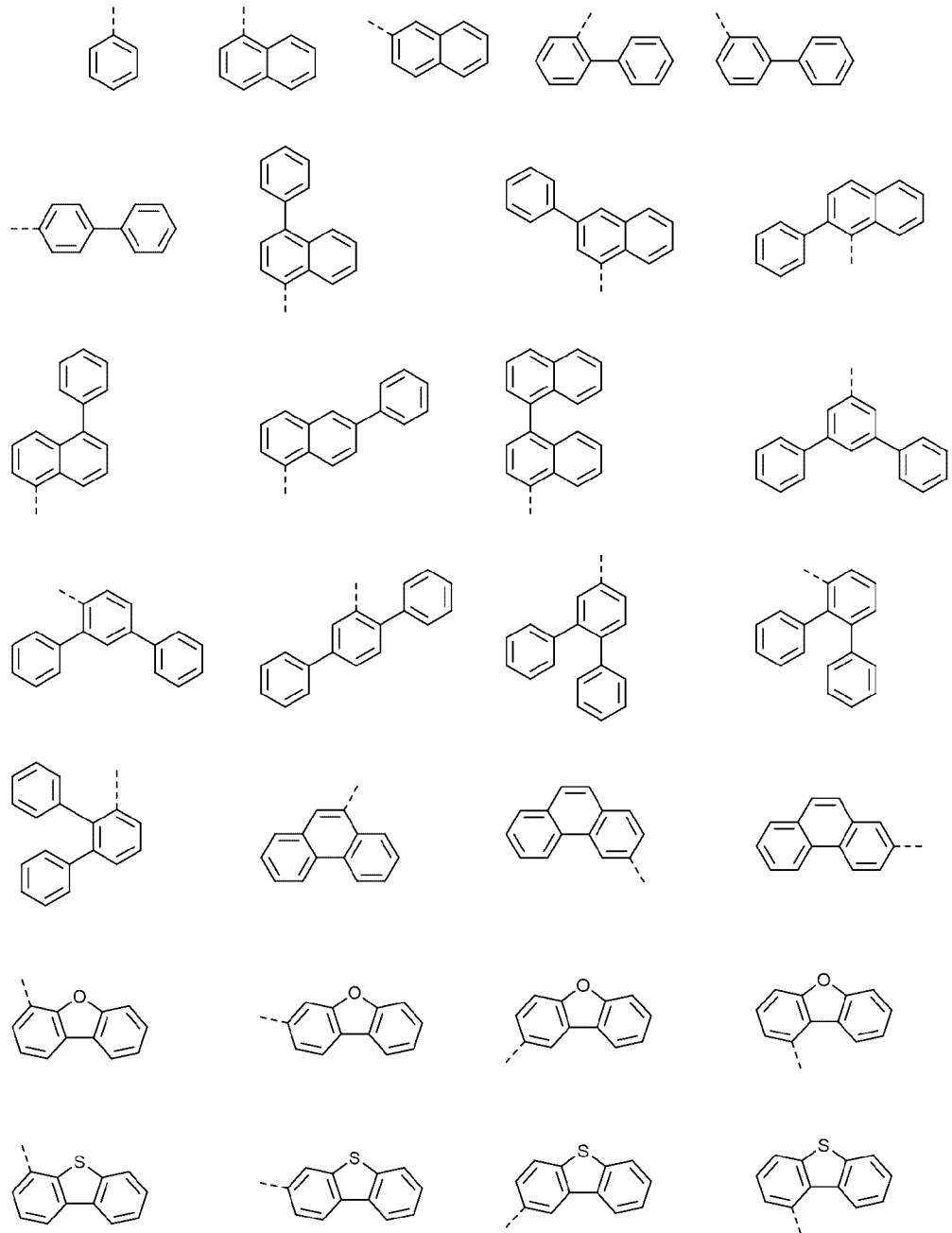
상기 Ar_1 은 비치환되거나 1개 이상의 중수소로 치환되는, 화합물.

[청구항 6]

제1항에 있어서,

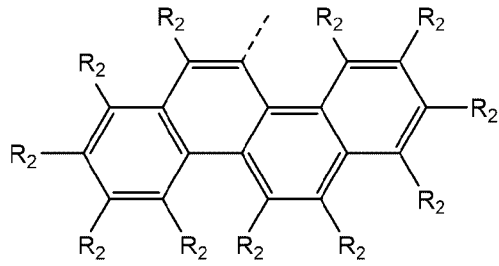
Ar_1 은 하기로 구성되는 군 및 이들의 중수소화된 구조로부터 선택되는 어느 하나인,

화합물:

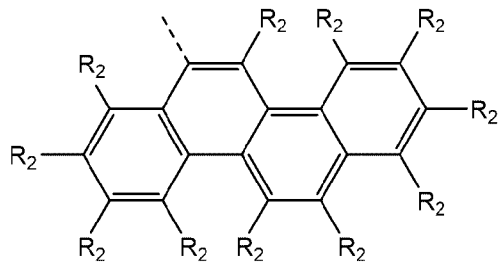


[청구항 7]

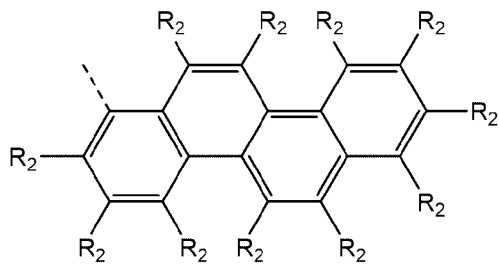
제1항에 있어서,
 화학식 2는 하기 화학식 2-1 내지 2-6 중 어느 하나로 표시되는,
 화합물:
 [화학식 2-1]



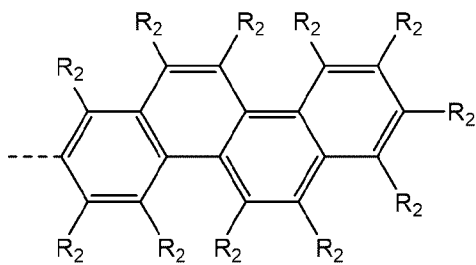
[화]학식 2-2]



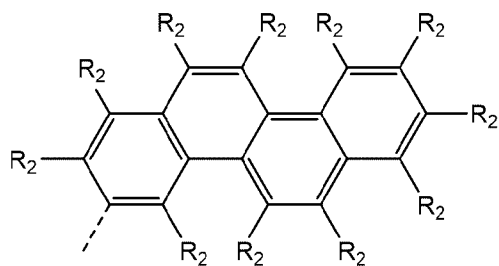
[화]학식 2-3]



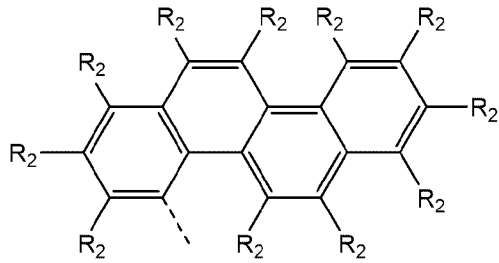
[화]학식 2-4]



[화]학식 2-5]



[화]학식 2-6]



상기 화학식 2-1 내지 2-6에서,

R_2 는 각각 독립적으로, 수소, 또는 중수소이다.

[청구항 8]

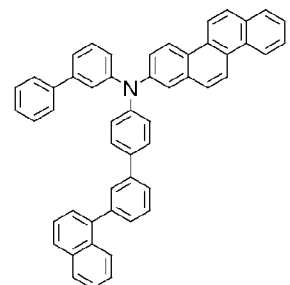
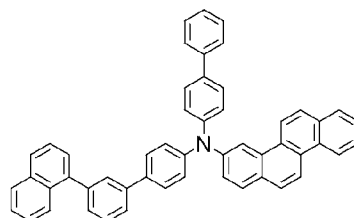
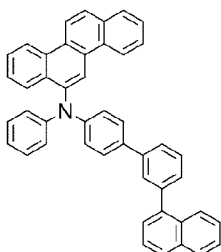
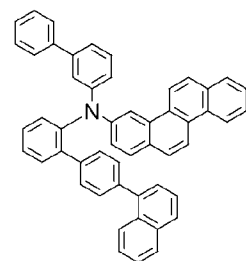
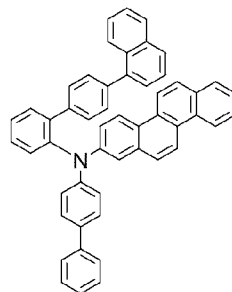
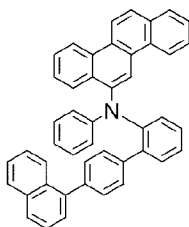
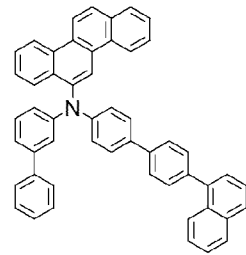
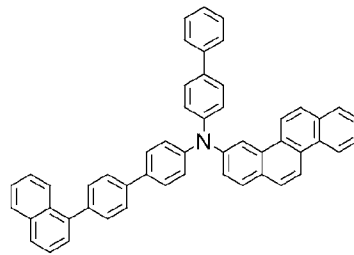
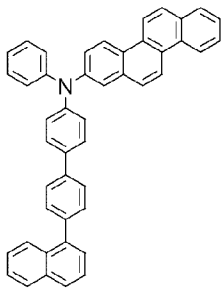
제1항에 있어서,

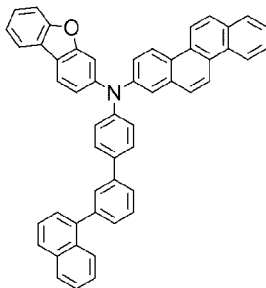
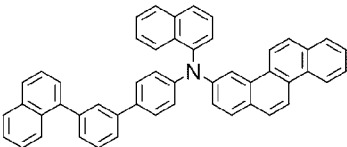
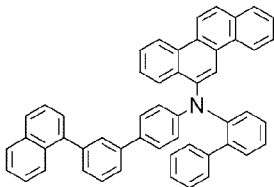
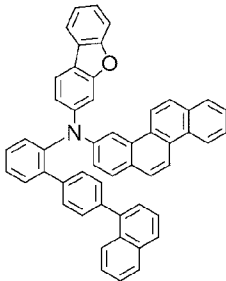
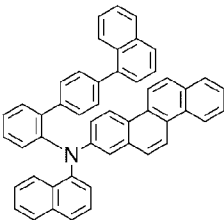
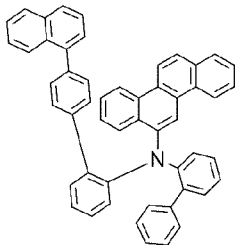
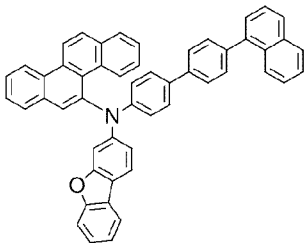
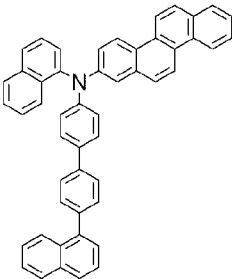
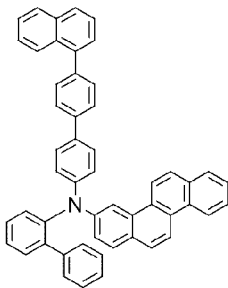
R_2 중 하나는 L_2 와 결합하고, 나머지는 모두 수소이거나, 또는 모두 중수소인,
화합물.

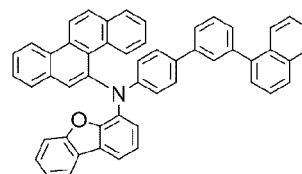
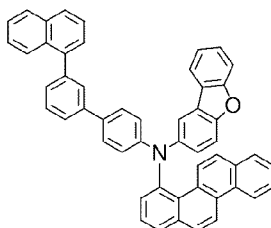
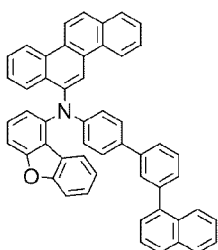
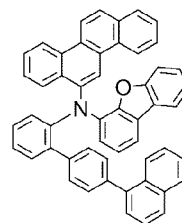
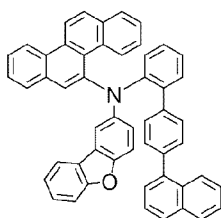
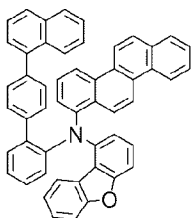
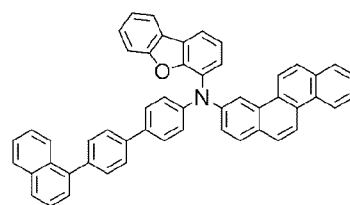
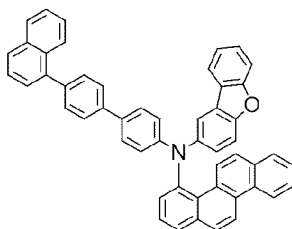
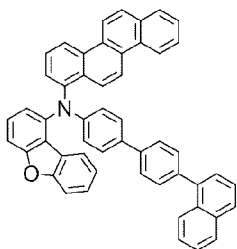
[청구항 9]

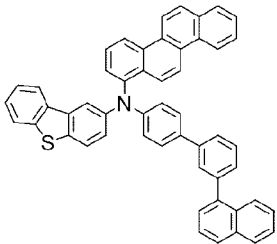
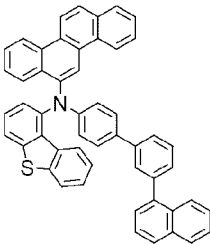
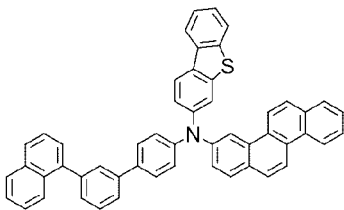
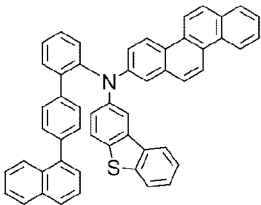
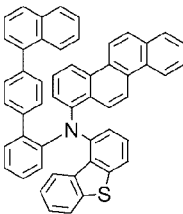
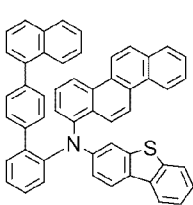
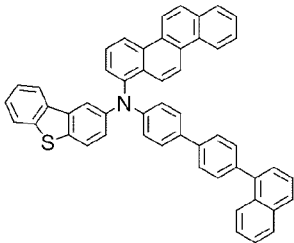
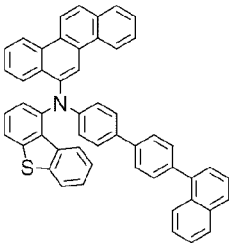
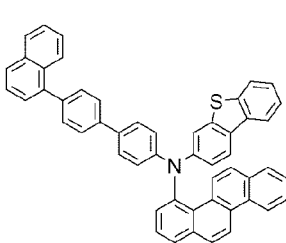
제1항에 있어서,

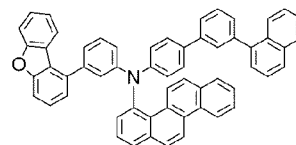
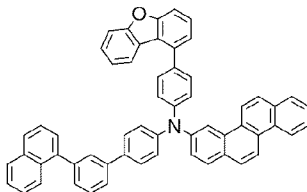
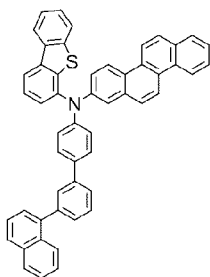
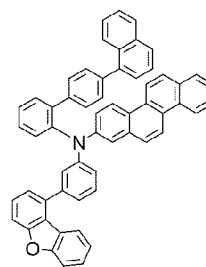
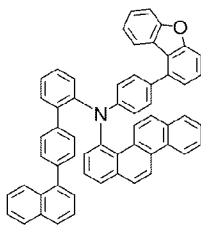
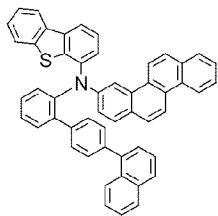
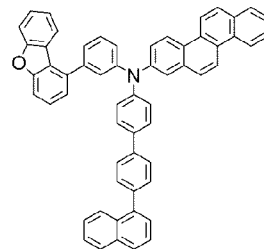
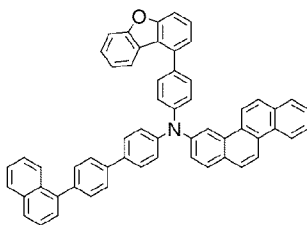
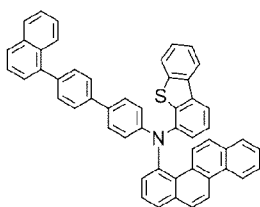
상기 화학식 1로 표시되는 화합물은 하기 화합물로 구성되는 군으로부터 선택되는 어느 하나인,
화합물:

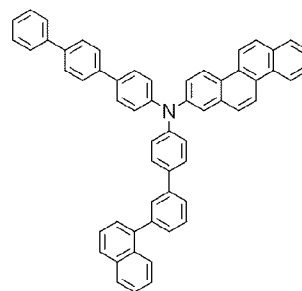
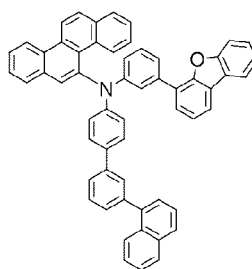
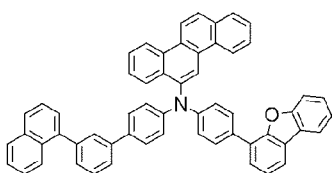
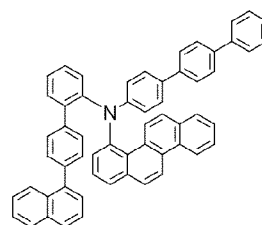
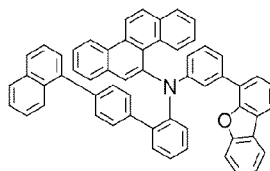
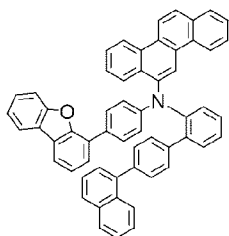
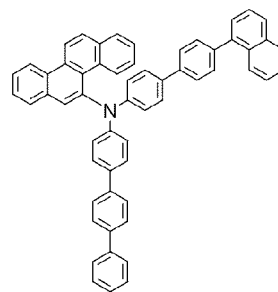
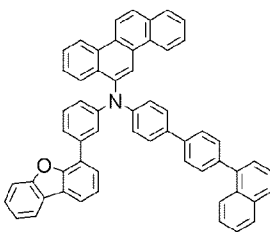
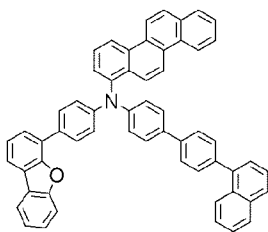


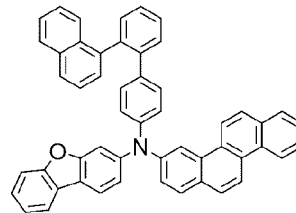
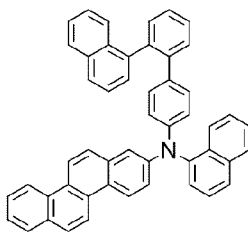
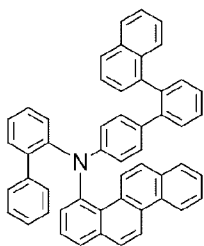
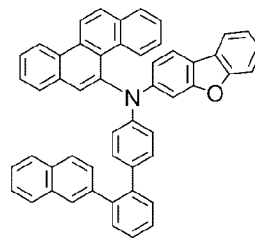
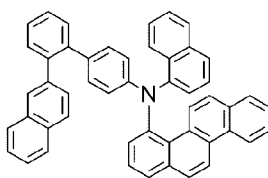
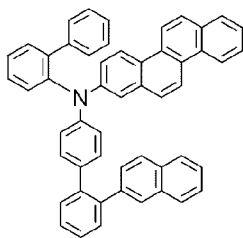
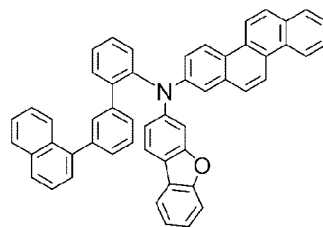
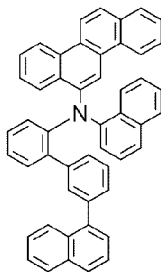
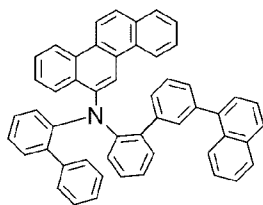


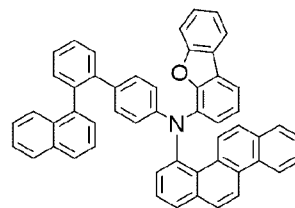
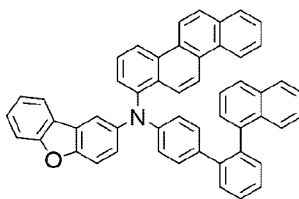
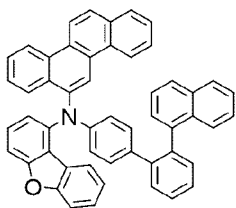
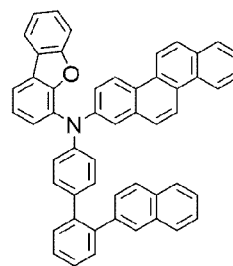
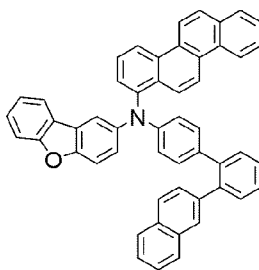
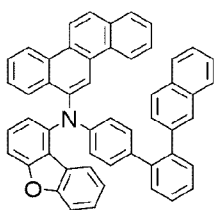
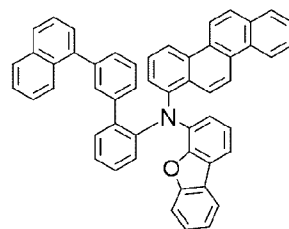
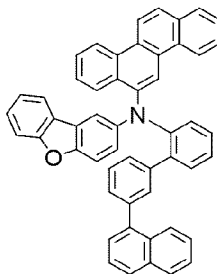
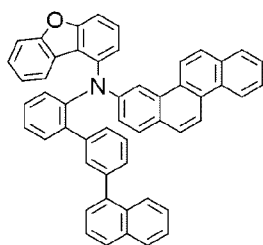


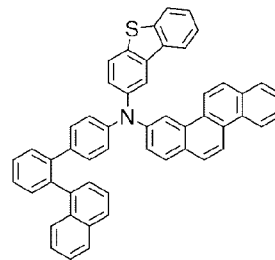
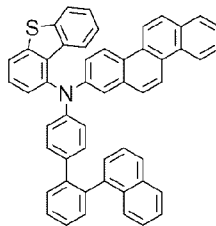
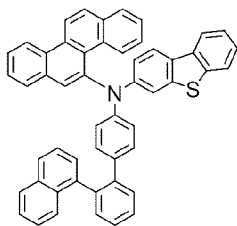
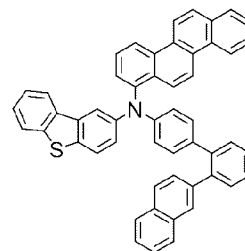
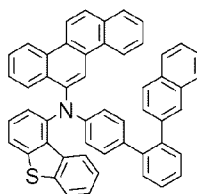
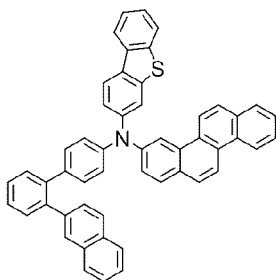
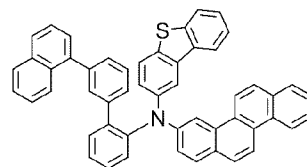
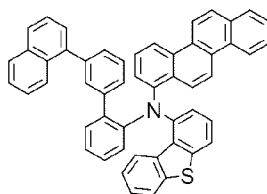
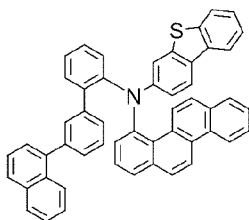


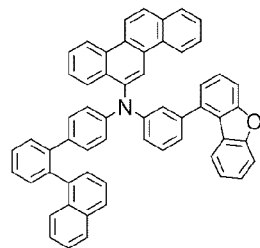
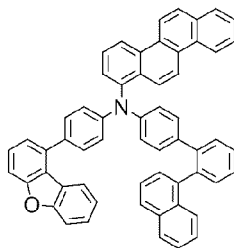
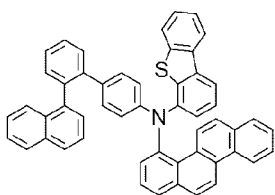
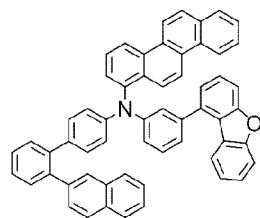
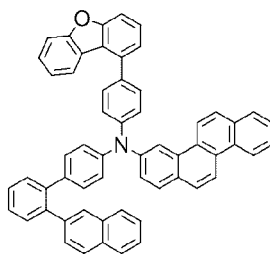
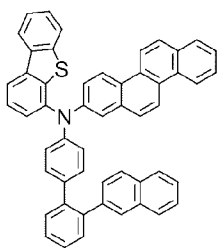
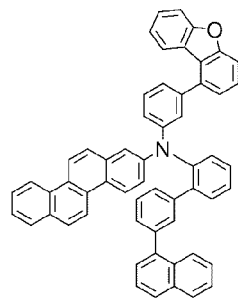
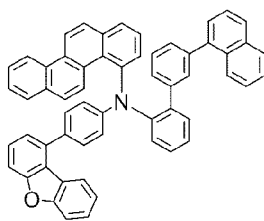
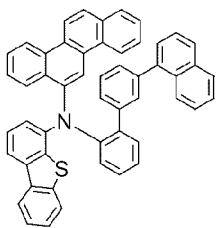


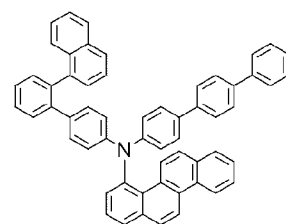
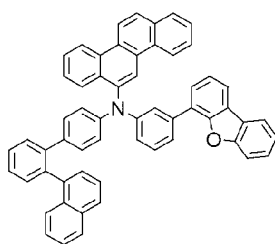
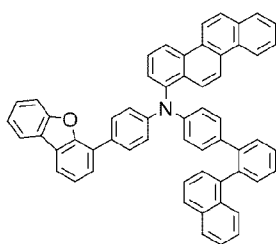
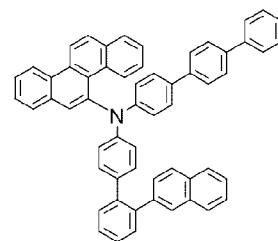
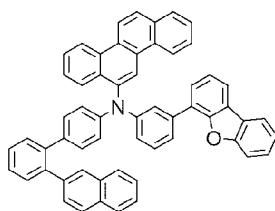
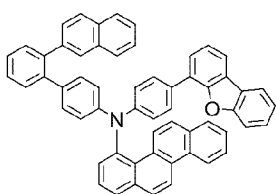
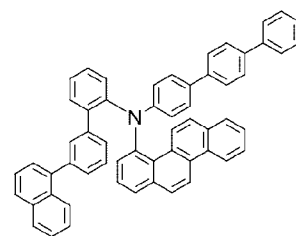
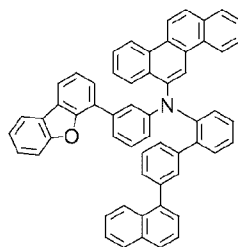
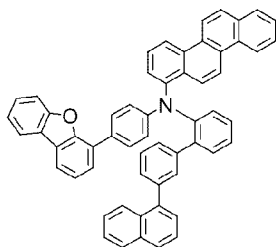


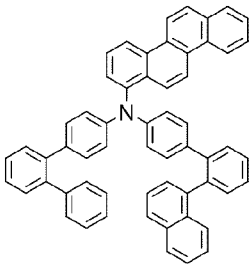
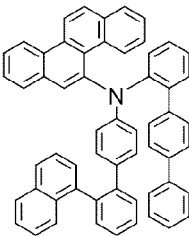
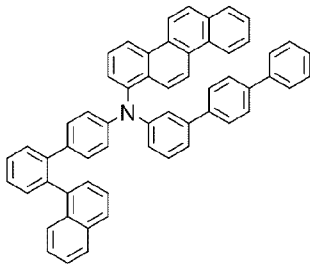
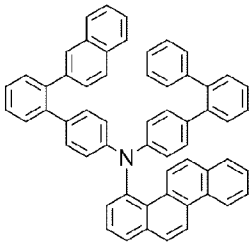
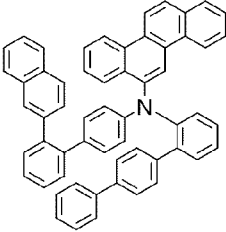
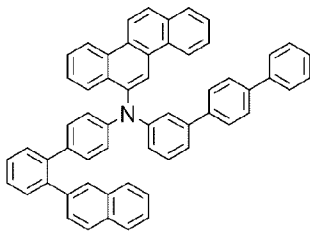
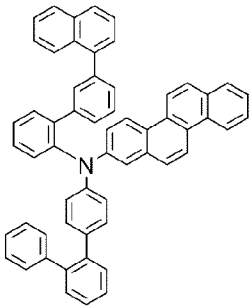
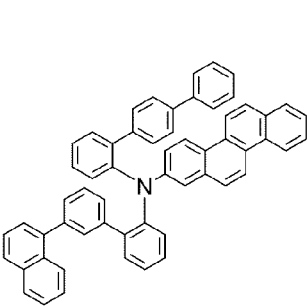
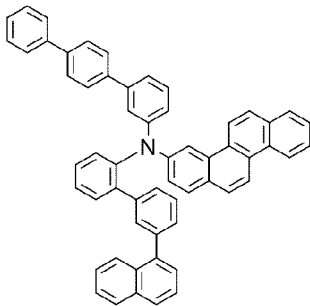


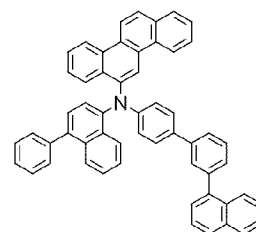
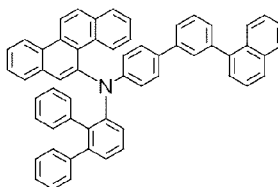
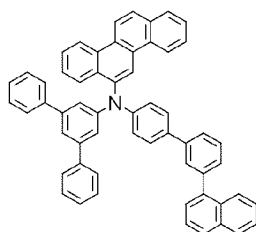
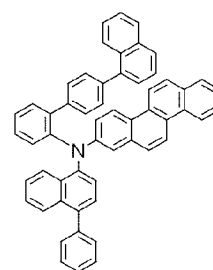
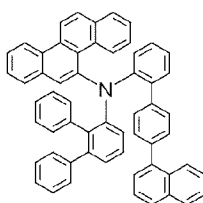
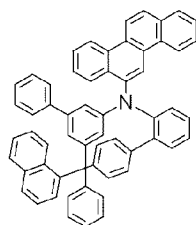
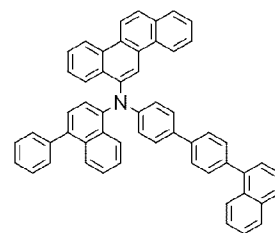
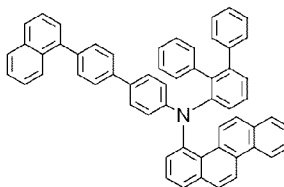
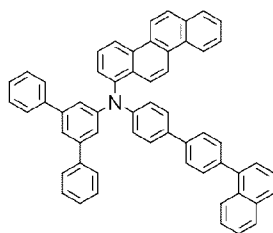
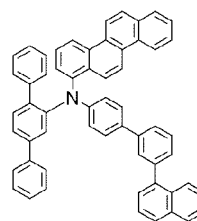
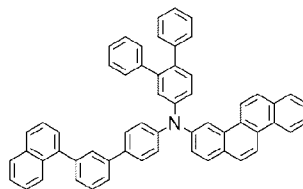
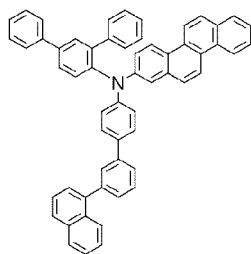
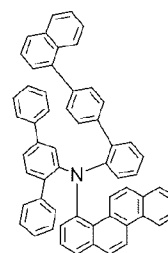
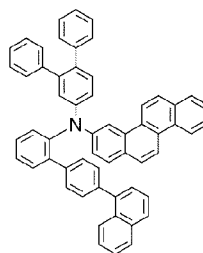
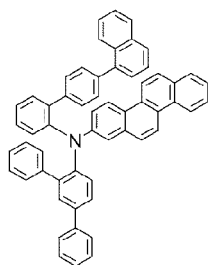
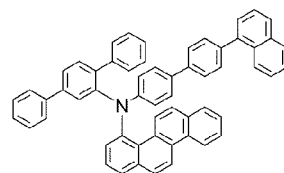
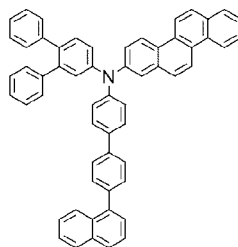
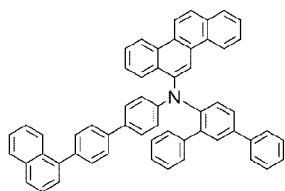


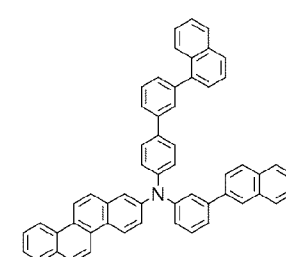
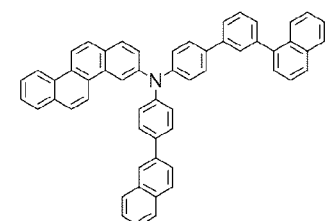
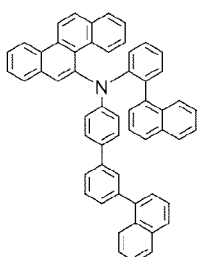
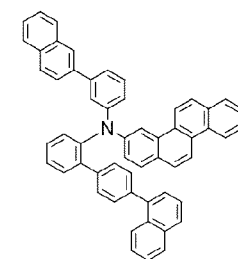
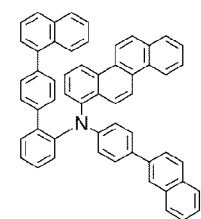
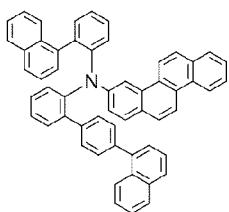
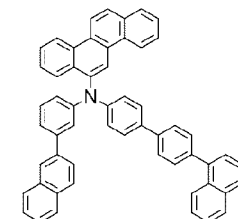
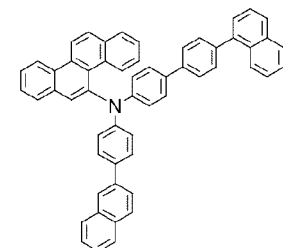
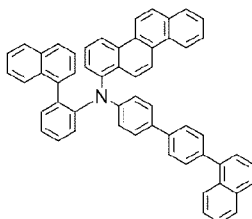
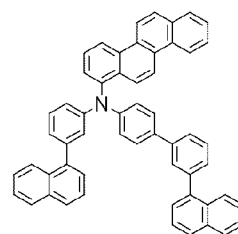
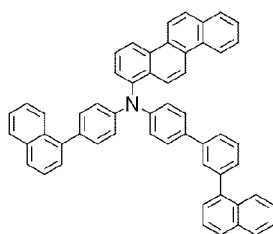
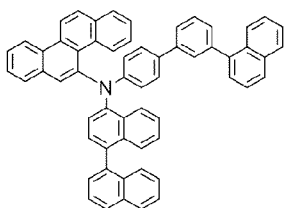
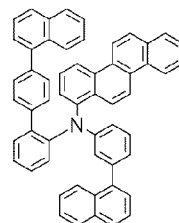
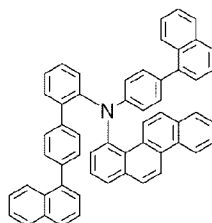
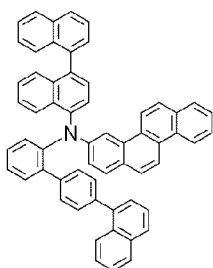
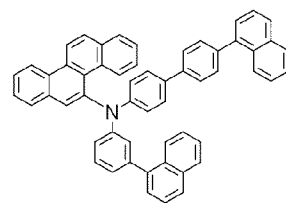
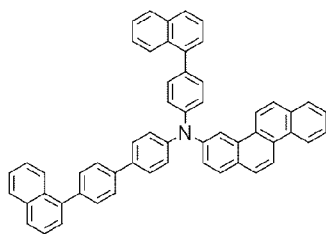
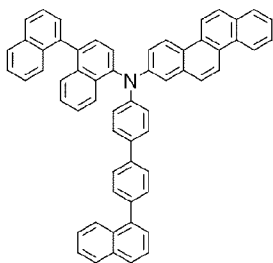


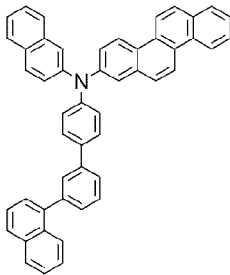
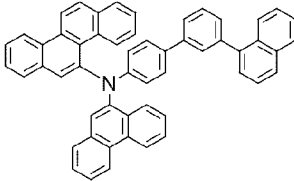
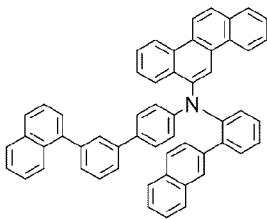
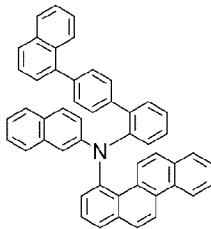
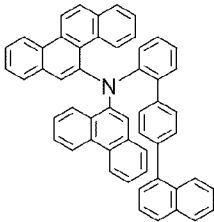
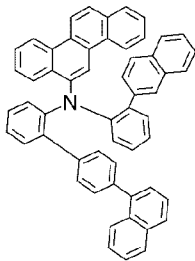
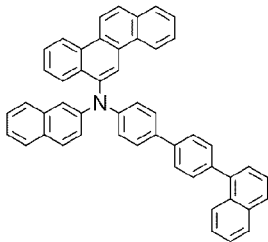
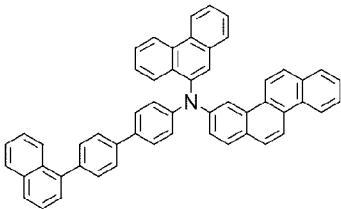
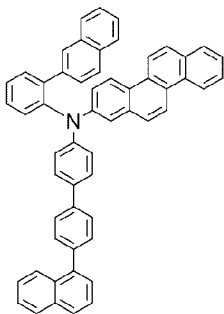


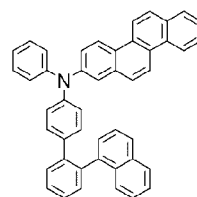
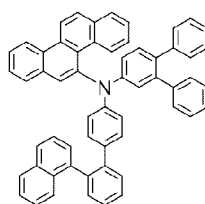
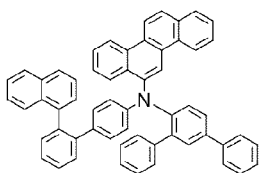
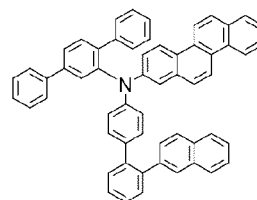
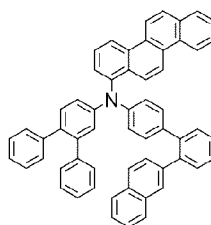
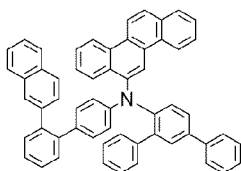
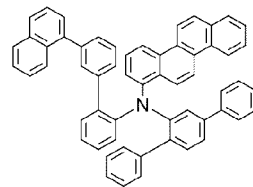
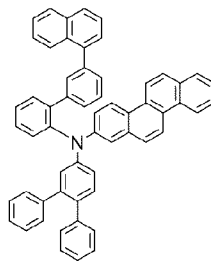
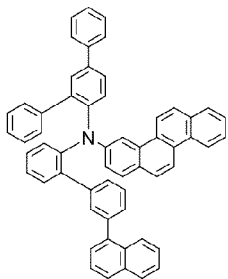


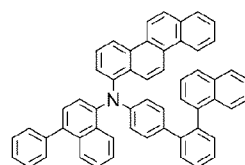
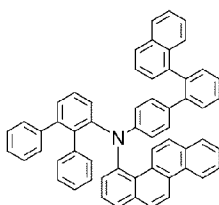
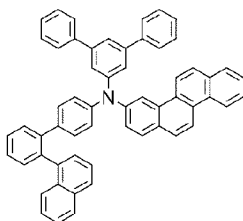
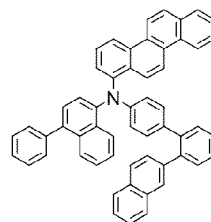
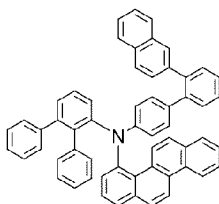
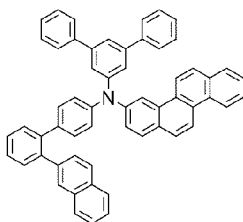
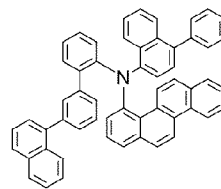
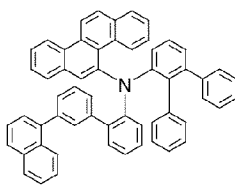
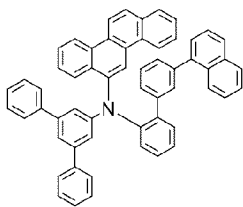


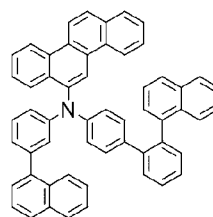
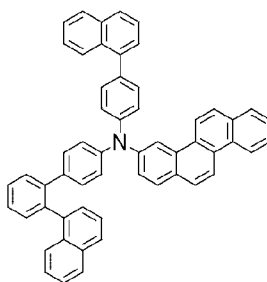
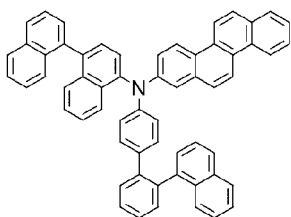
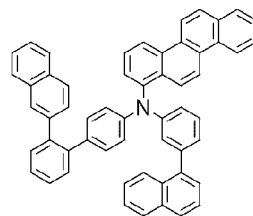
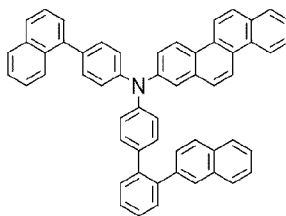
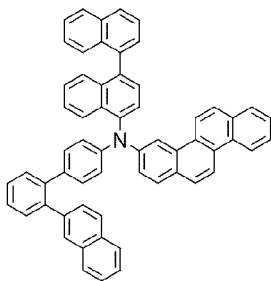
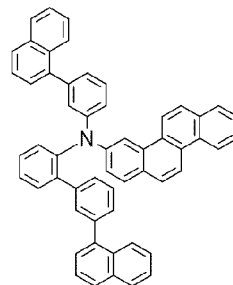
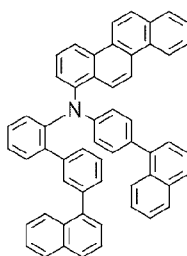
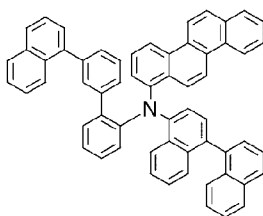


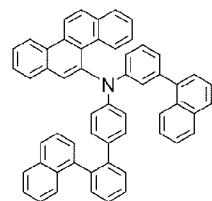
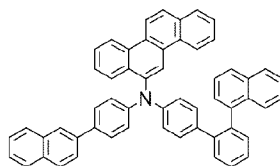
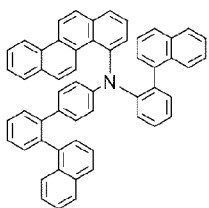
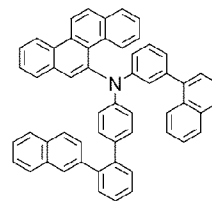
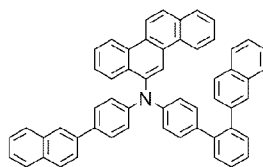
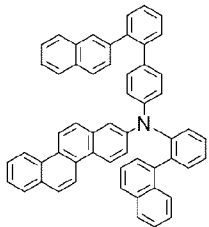
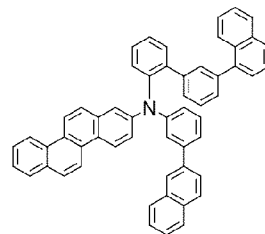
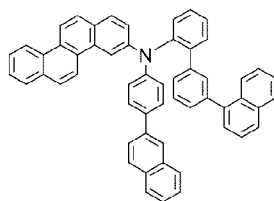
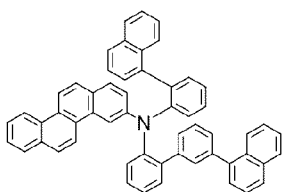


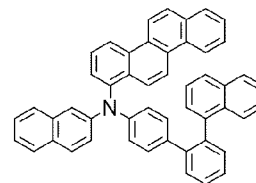
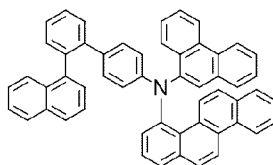
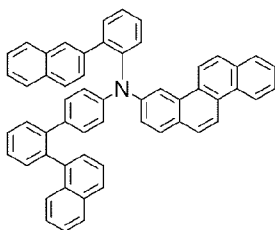
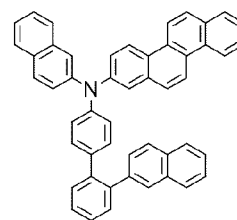
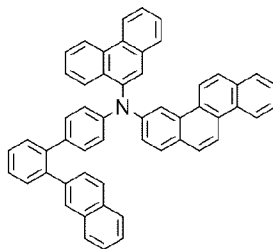
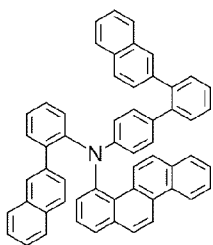
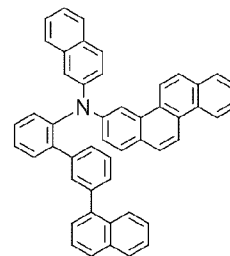
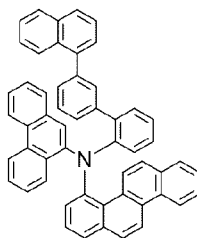
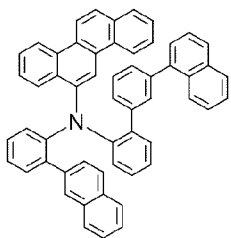


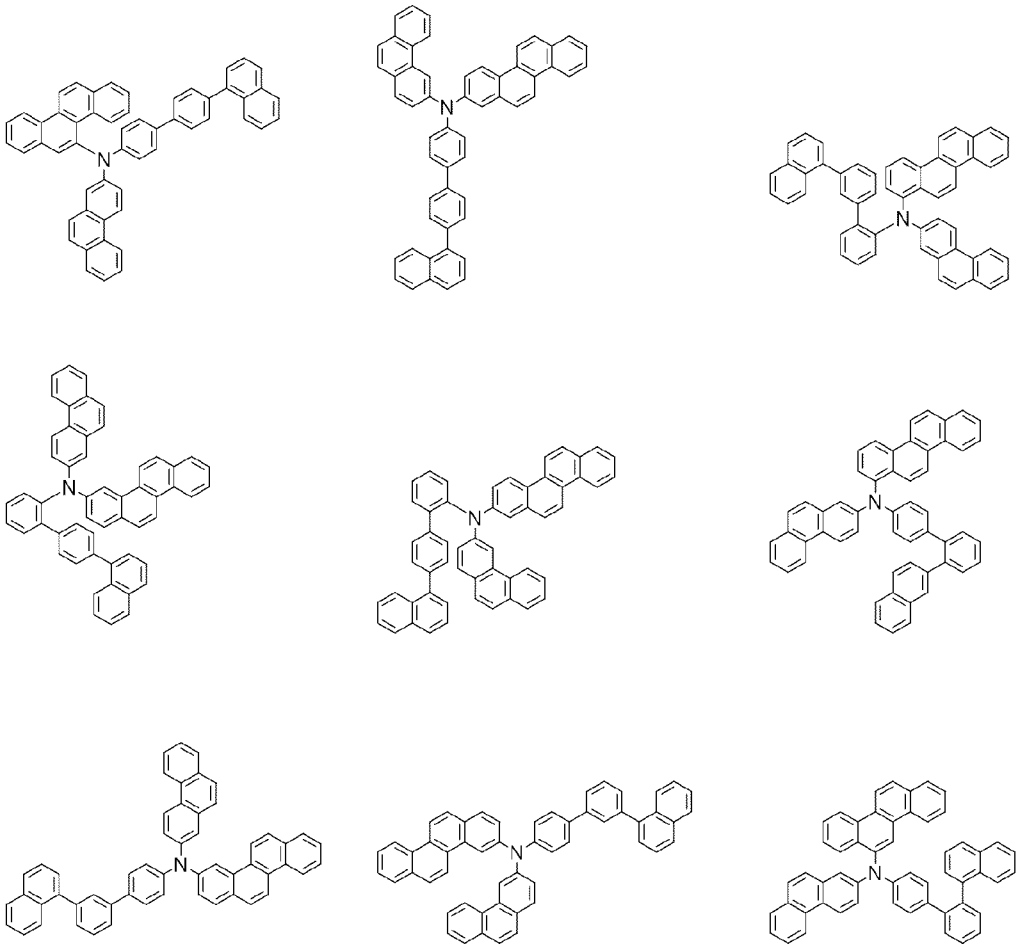


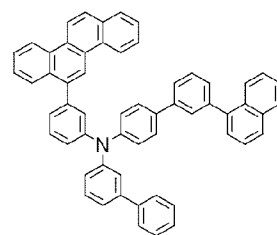
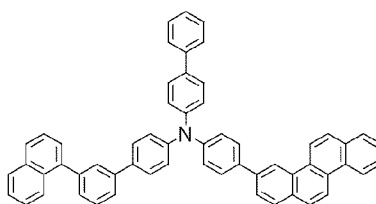
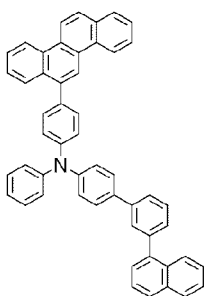
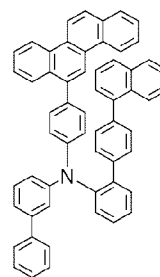
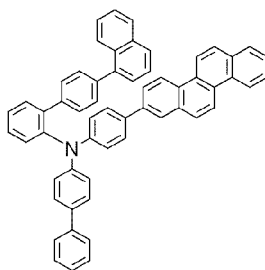
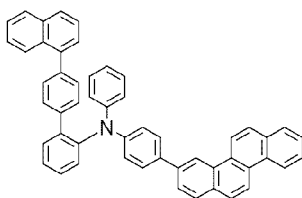
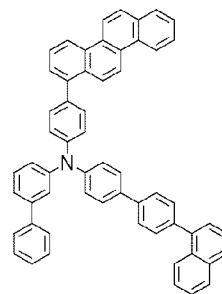
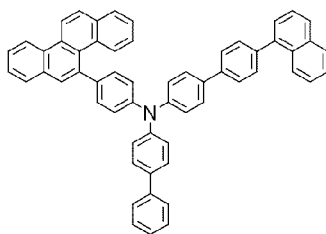
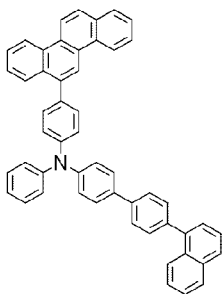


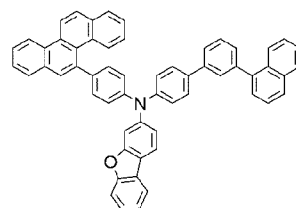
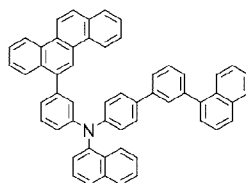
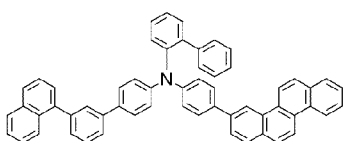
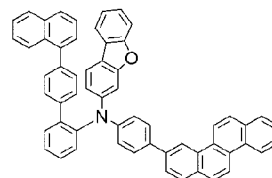
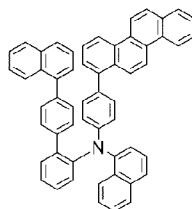
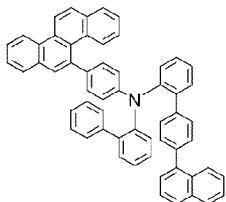
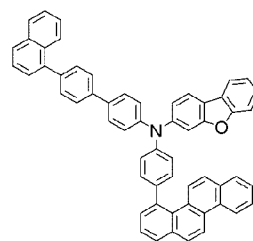
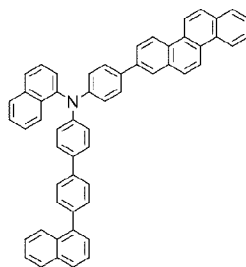
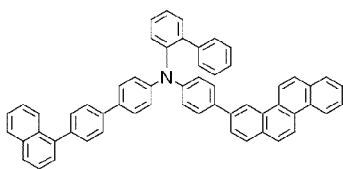


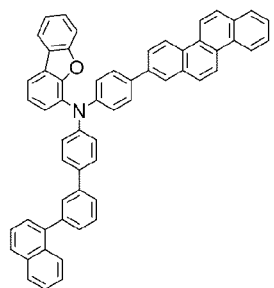
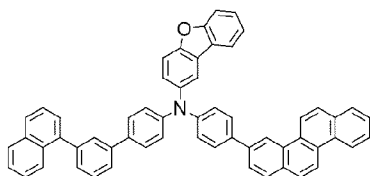
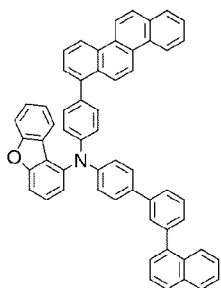
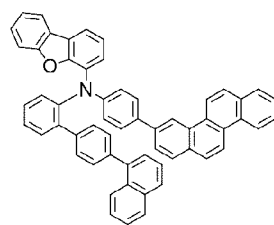
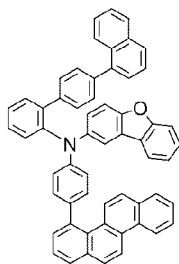
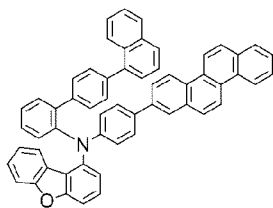
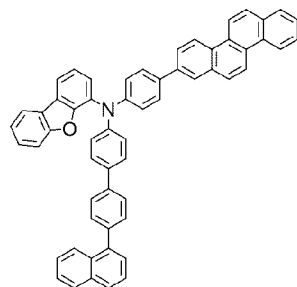
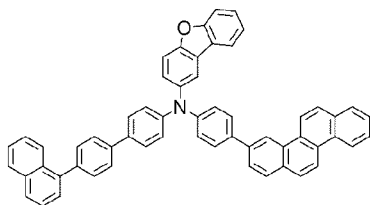
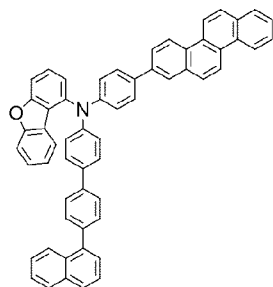


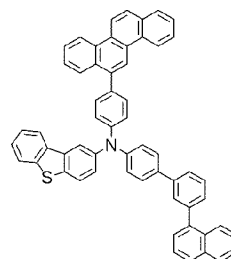
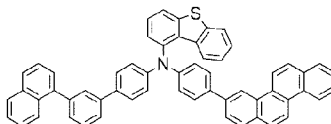
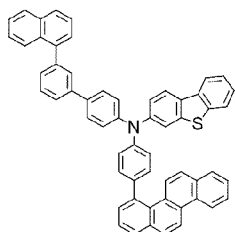
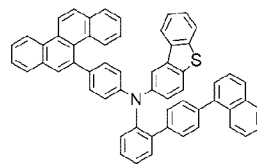
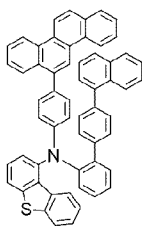
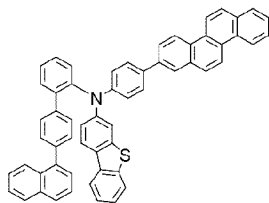
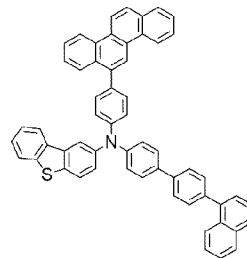
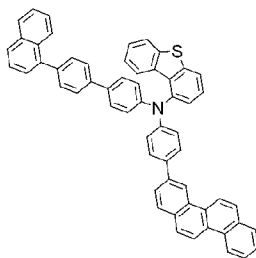
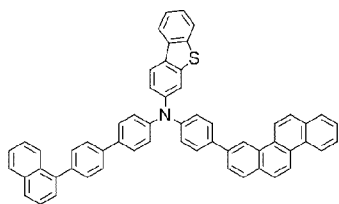


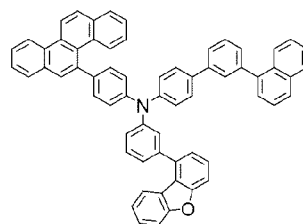
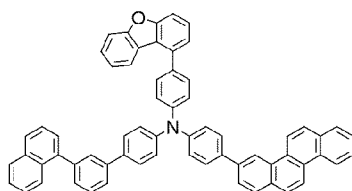
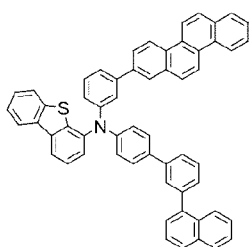
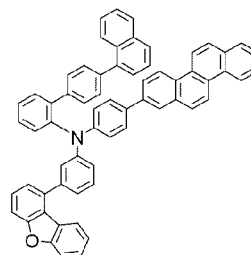
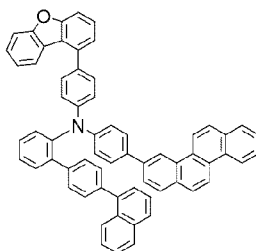
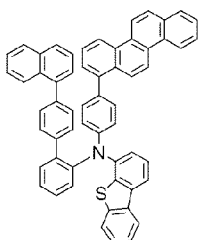
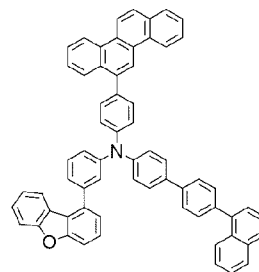
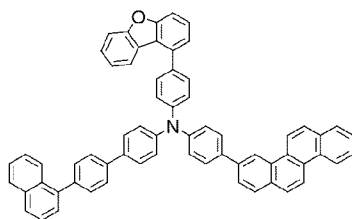
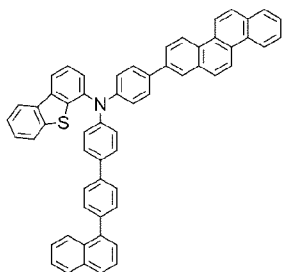


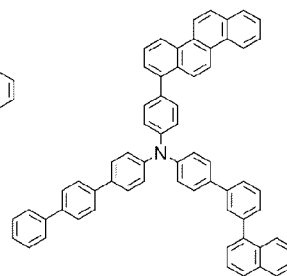
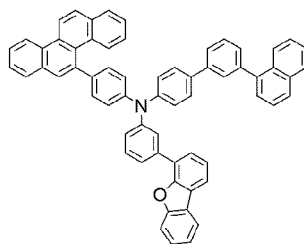
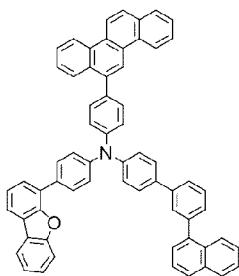
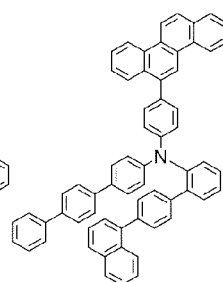
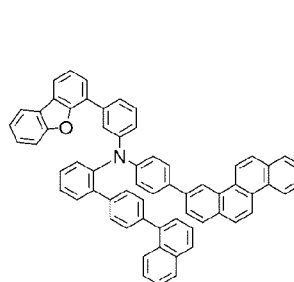
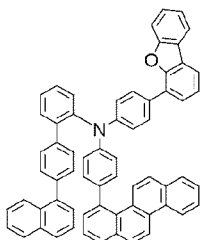
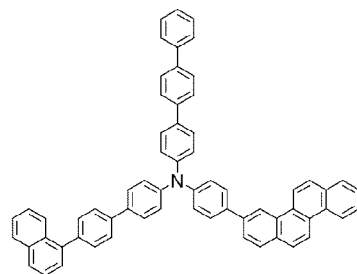
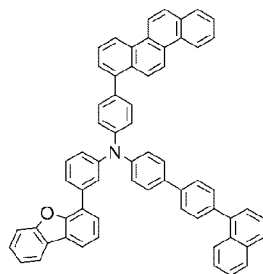
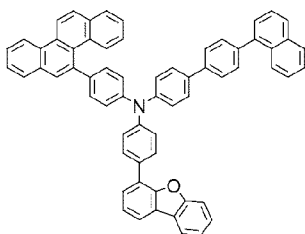


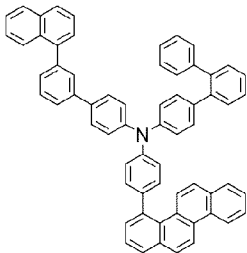
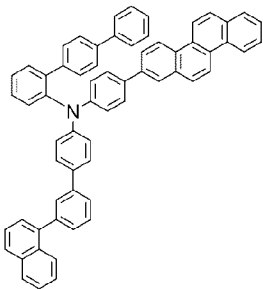
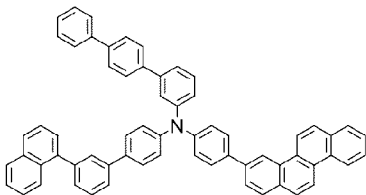
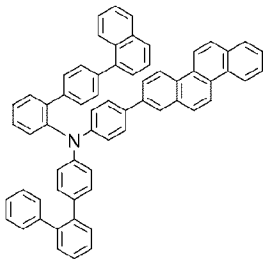
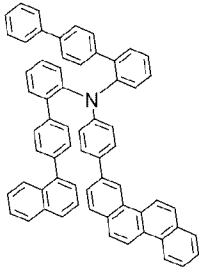
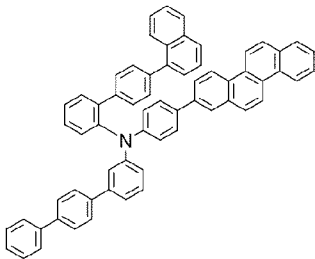
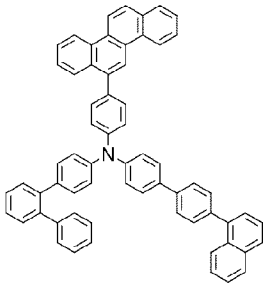
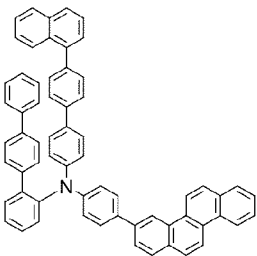
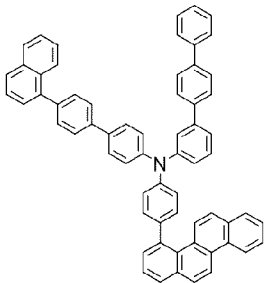


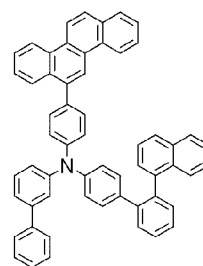
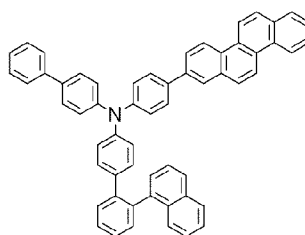
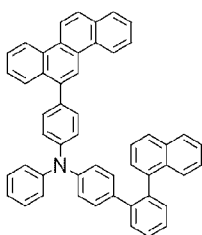
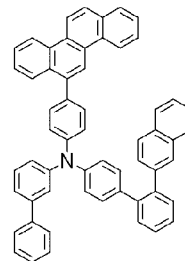
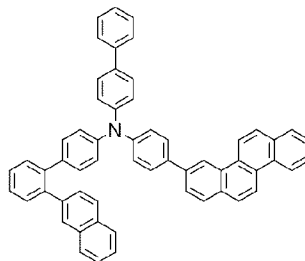
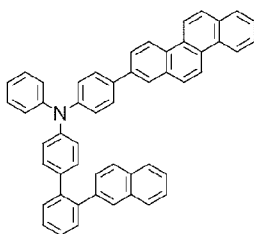
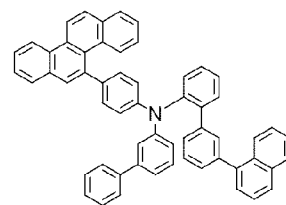
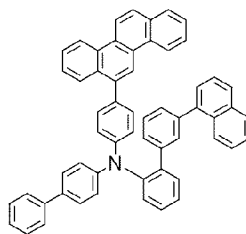
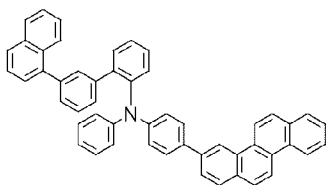


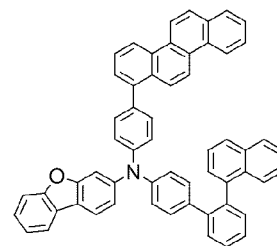
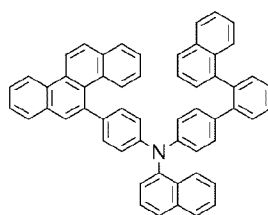
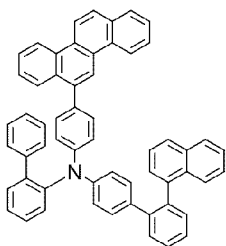
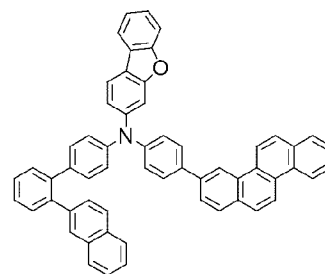
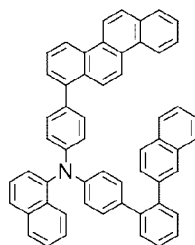
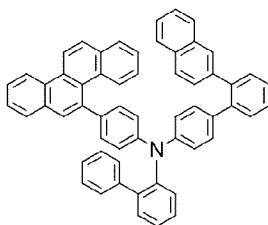
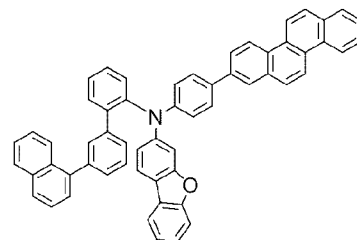
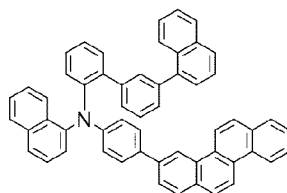
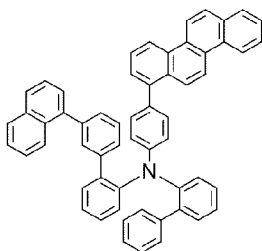


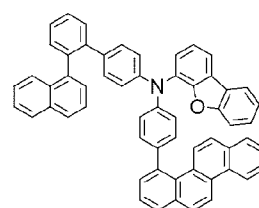
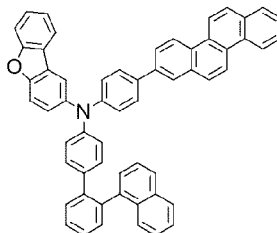
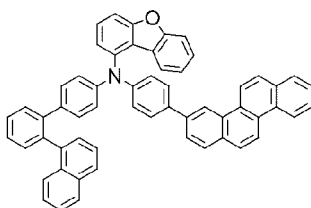
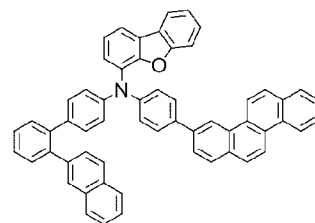
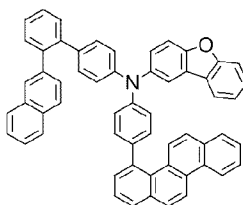
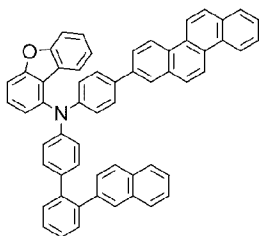
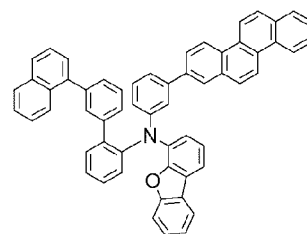
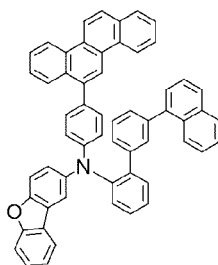
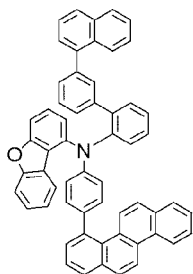


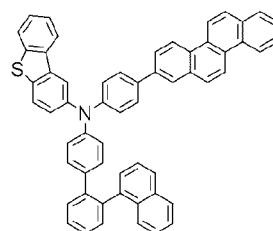
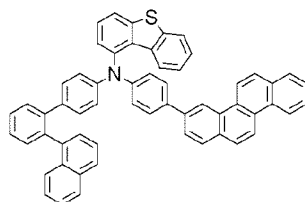
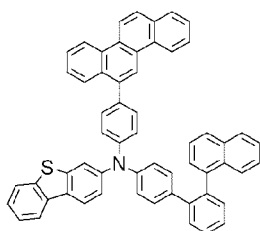
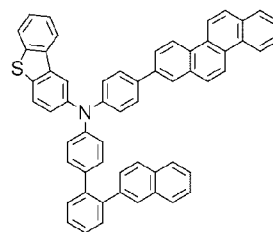
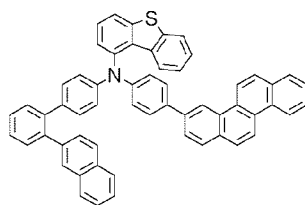
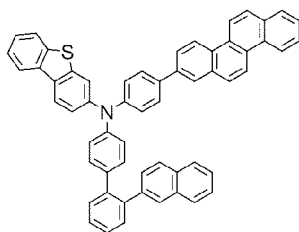
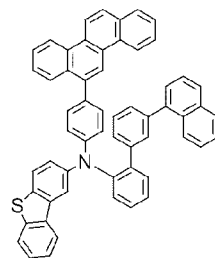
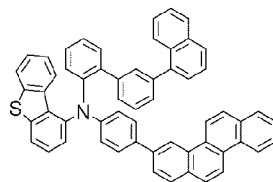
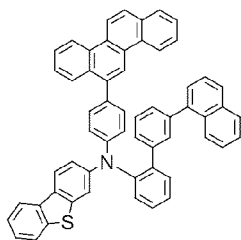


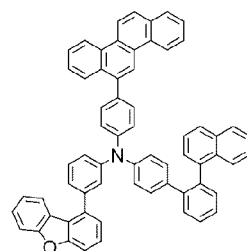
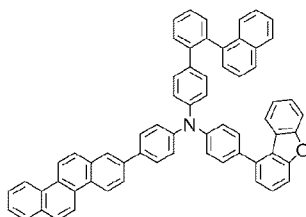
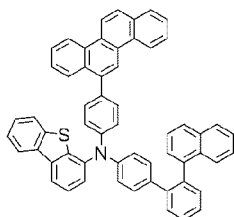
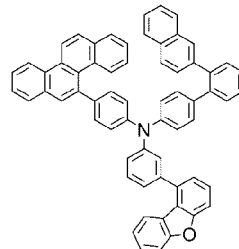
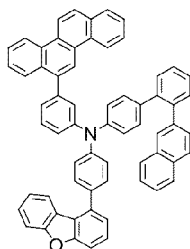
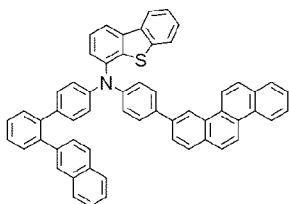
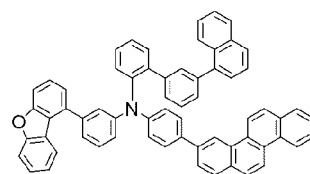
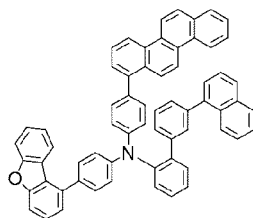
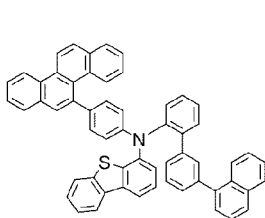


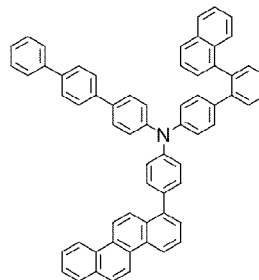
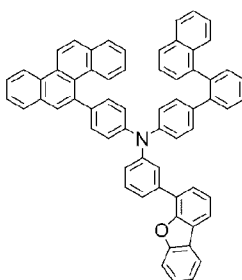
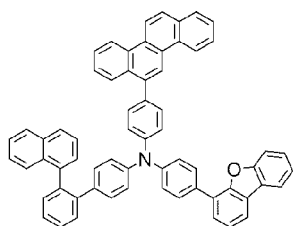
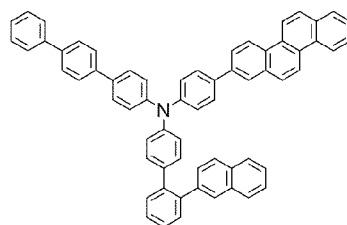
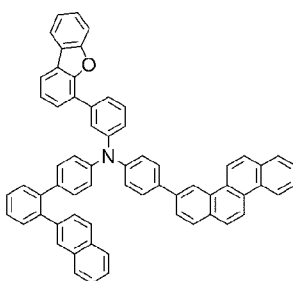
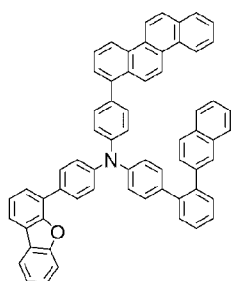
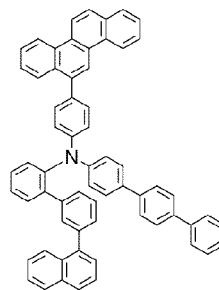
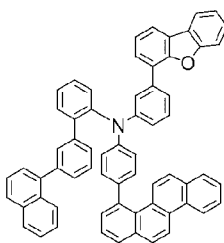
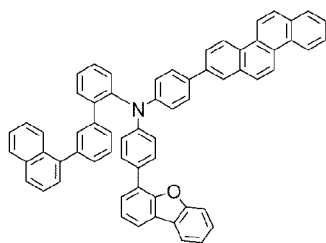


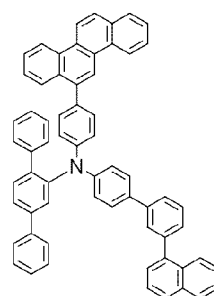
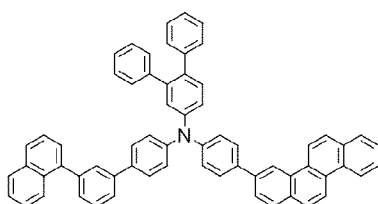
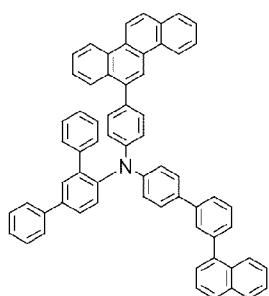
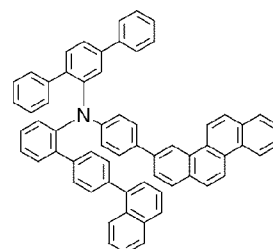
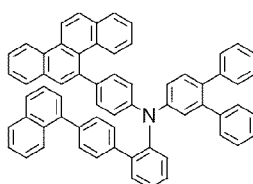
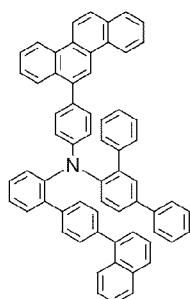
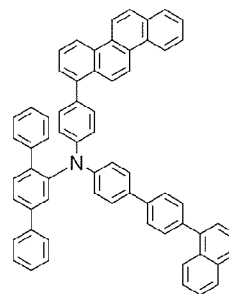
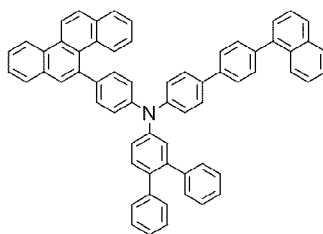
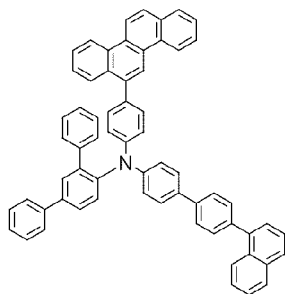


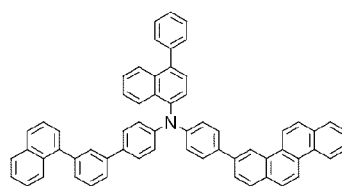
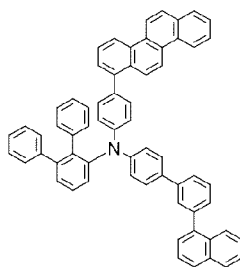
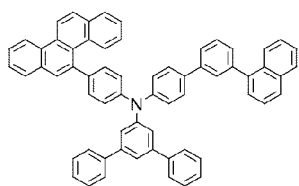
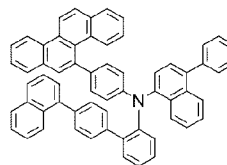
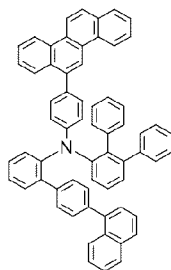
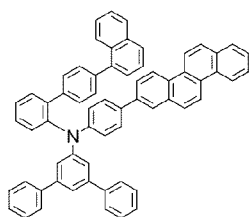
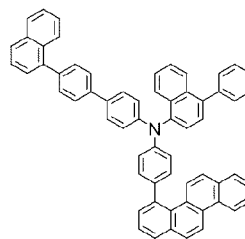
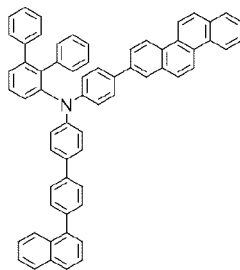
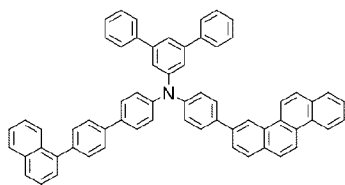


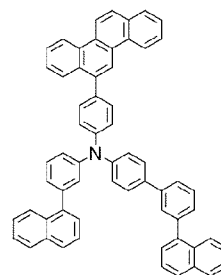
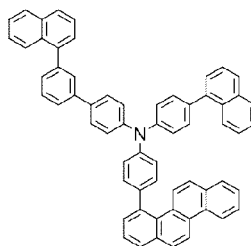
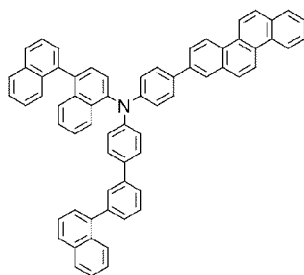
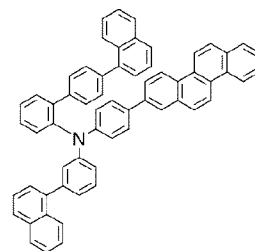
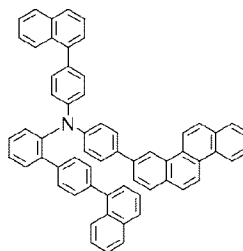
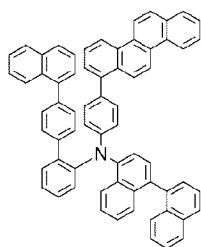
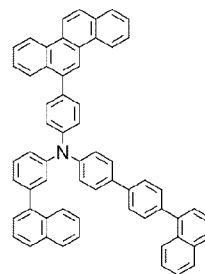
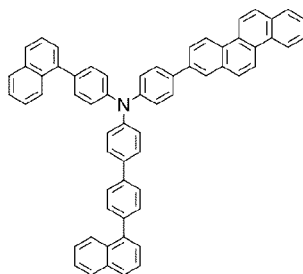
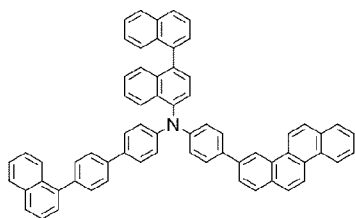


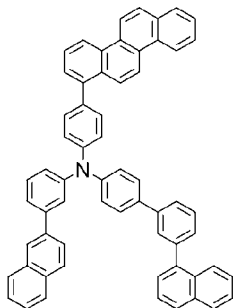
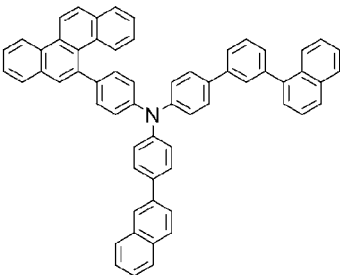
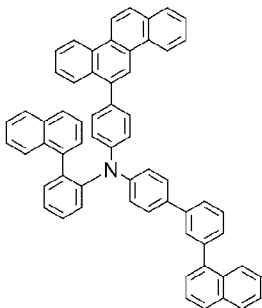
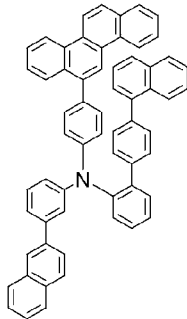
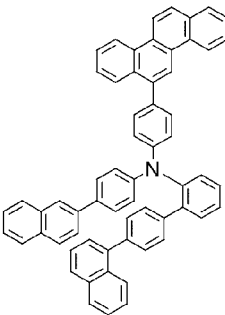
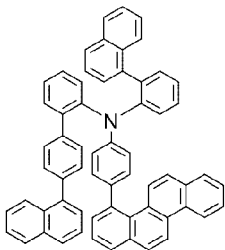
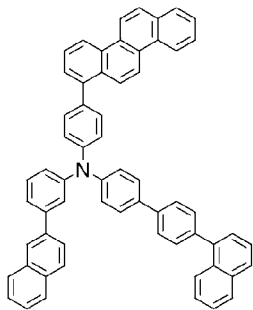
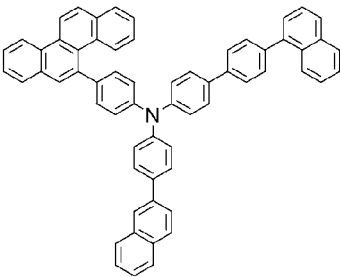
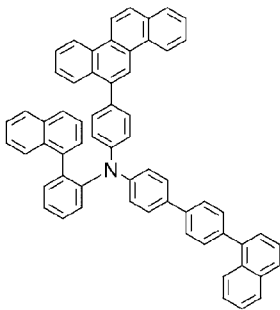


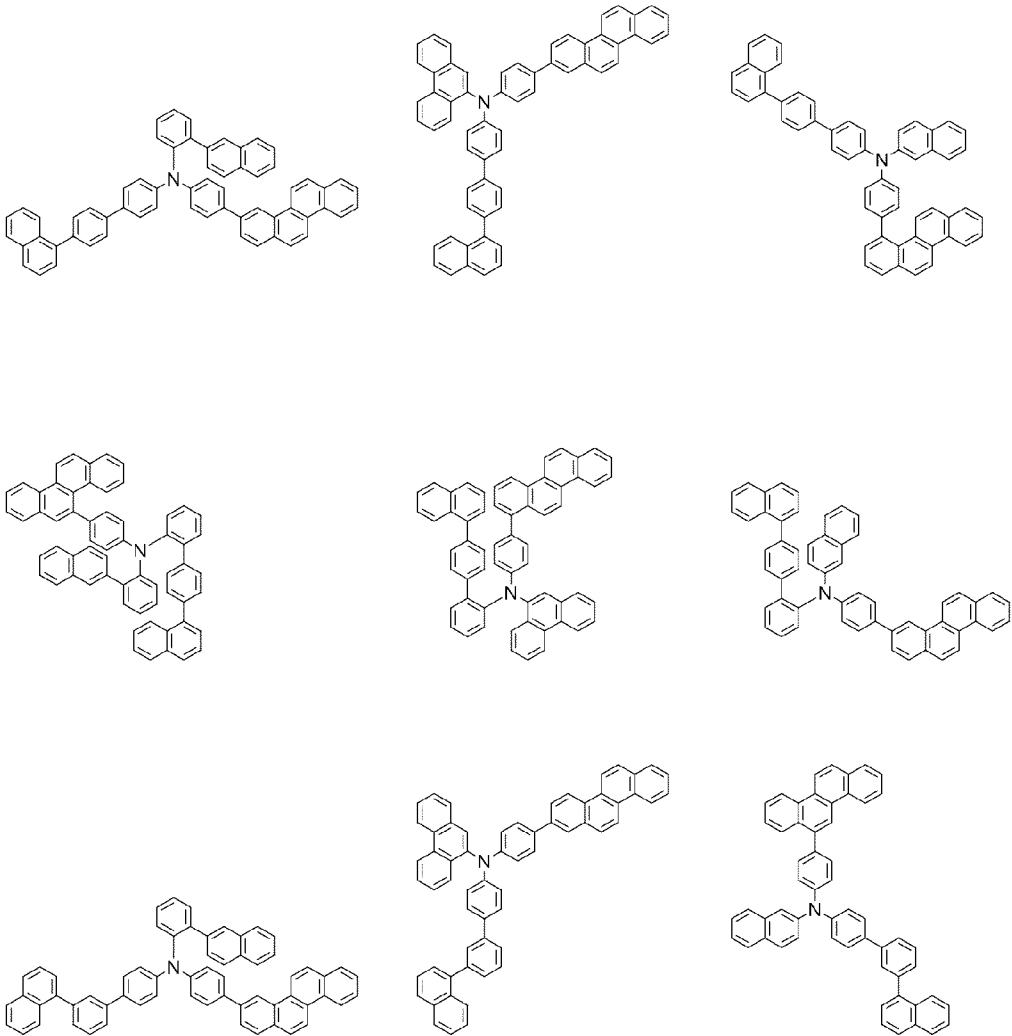


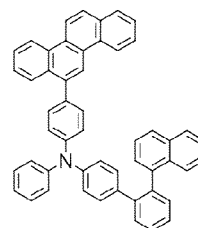
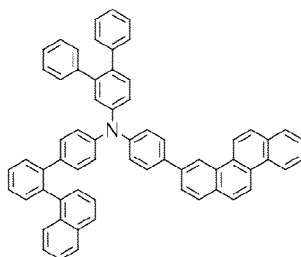
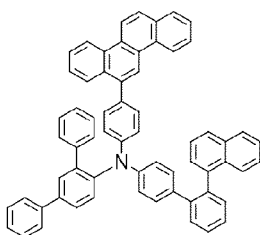
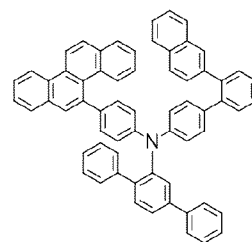
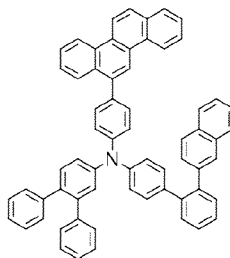
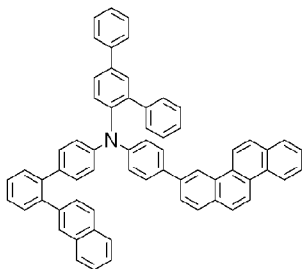
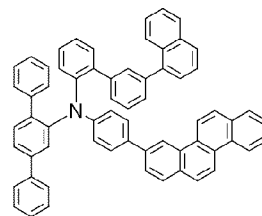
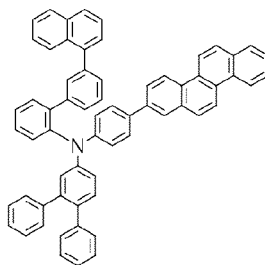
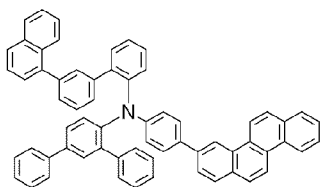


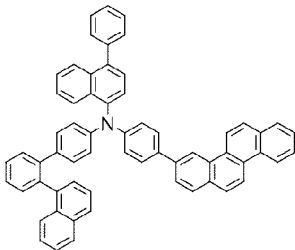
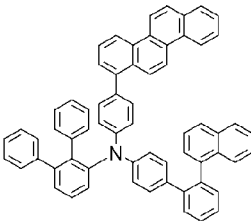
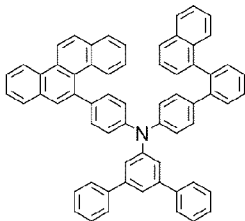
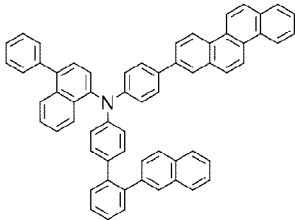
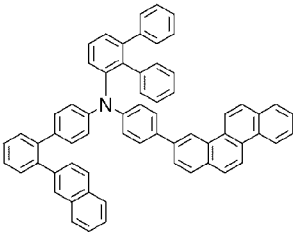
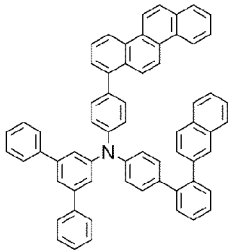
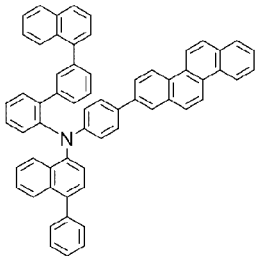
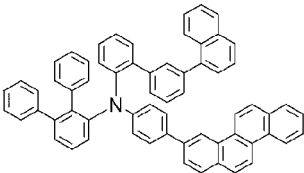
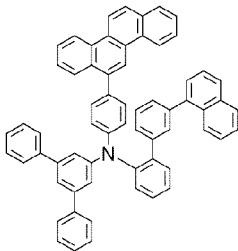


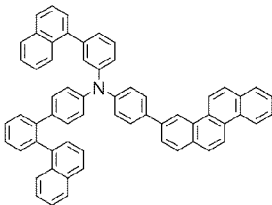
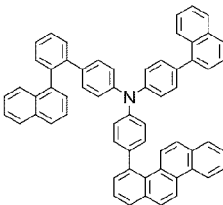
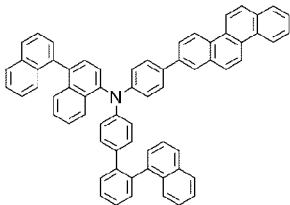
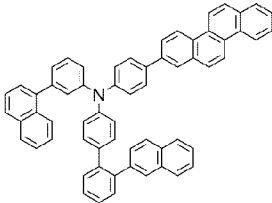
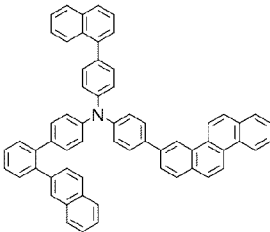
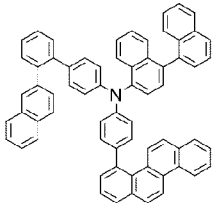
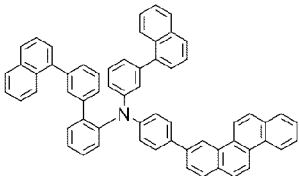
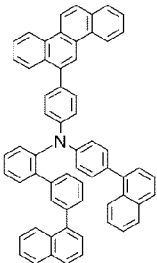
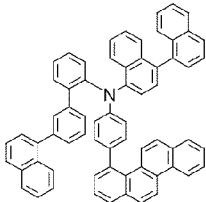


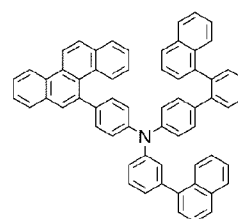
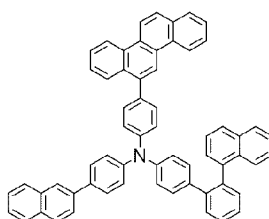
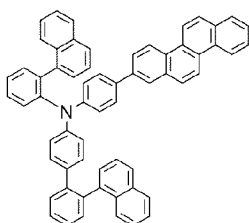
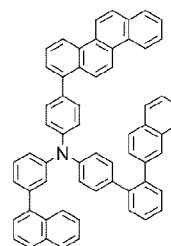
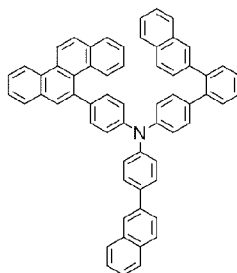
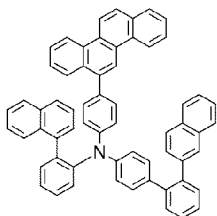
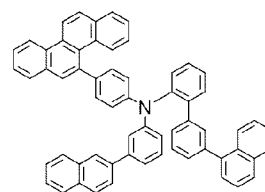
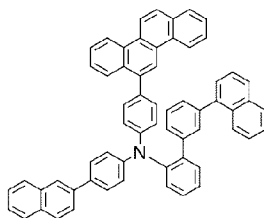
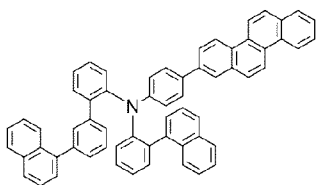


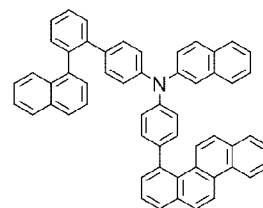
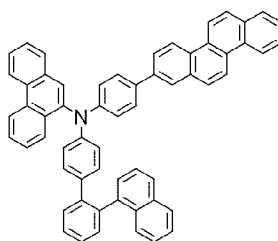
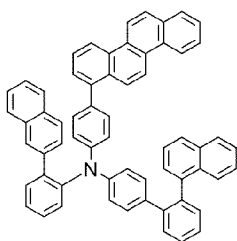
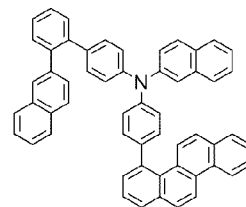
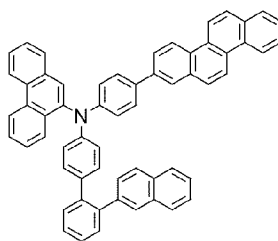
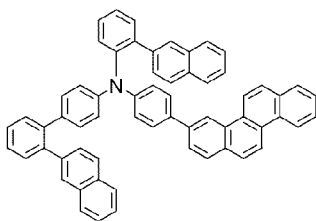
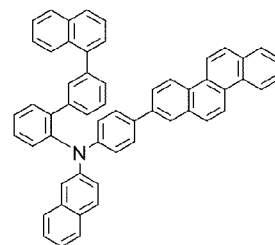
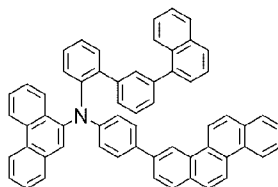
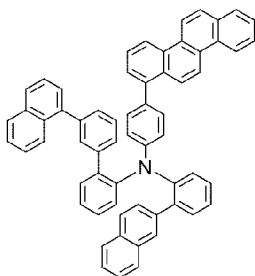


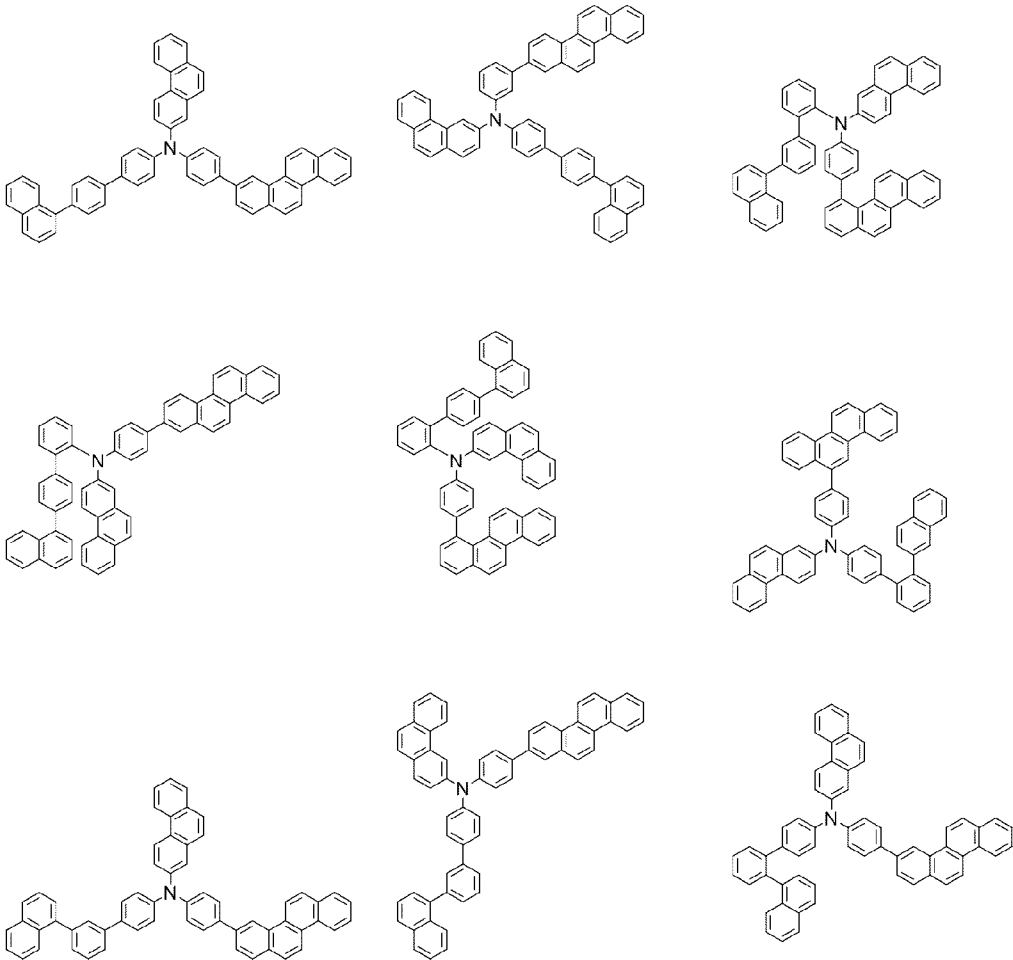


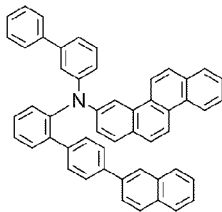
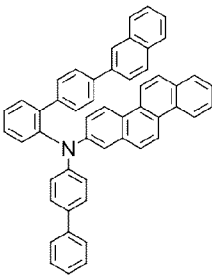
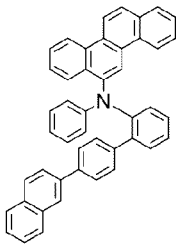
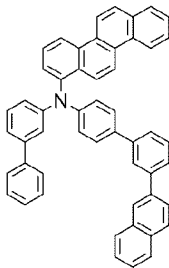
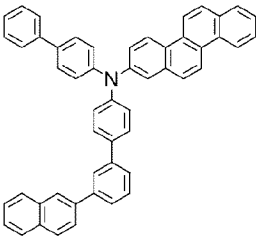
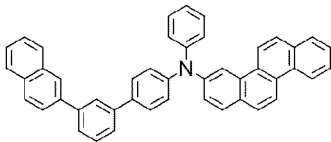
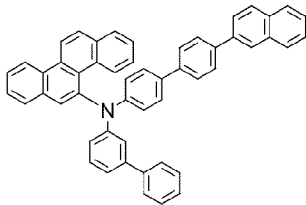
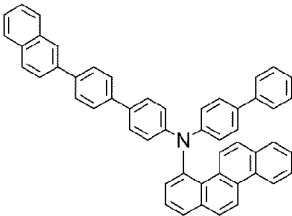
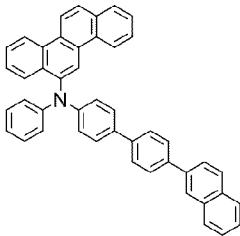


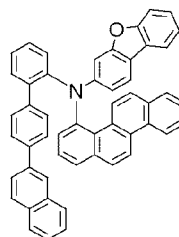
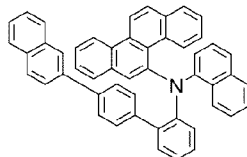
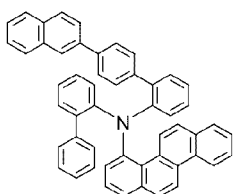
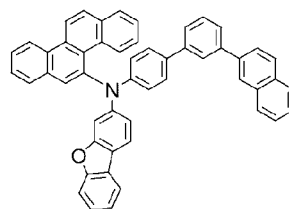
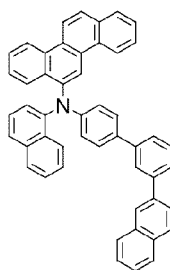
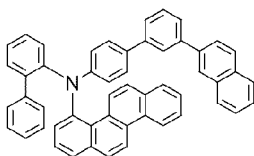
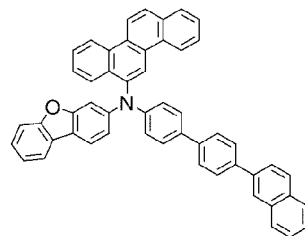
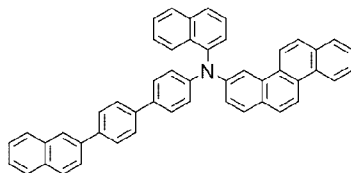
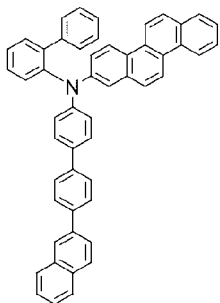


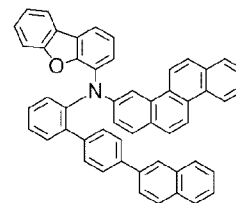
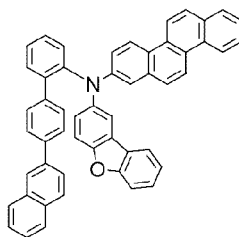
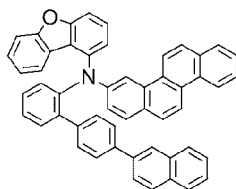
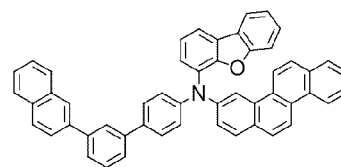
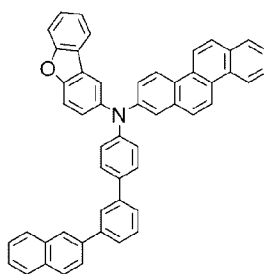
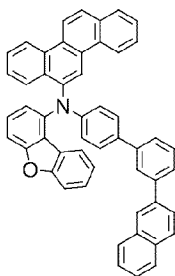
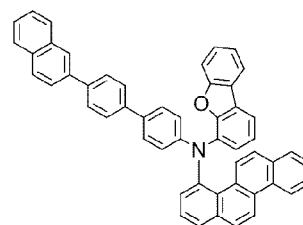
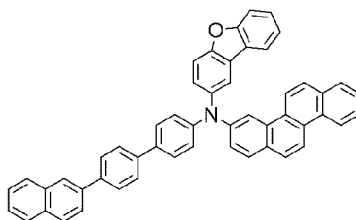
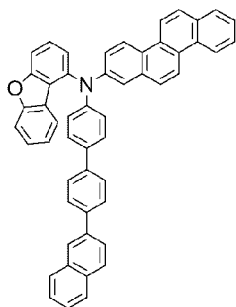


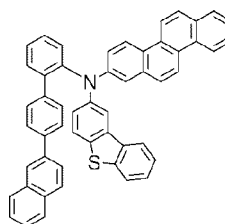
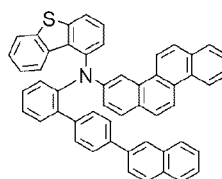
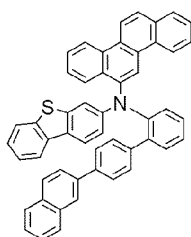
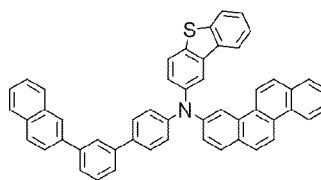
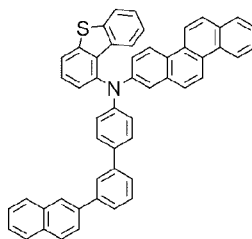
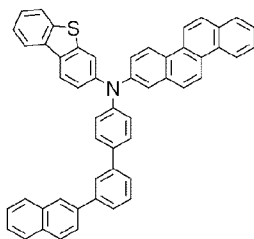
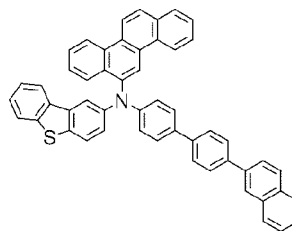
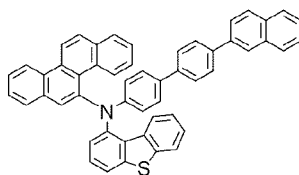
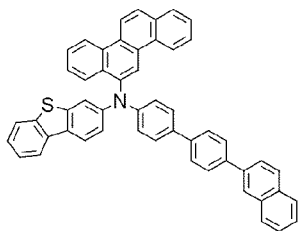


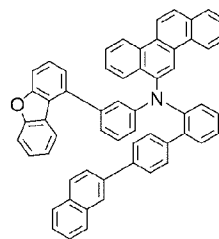
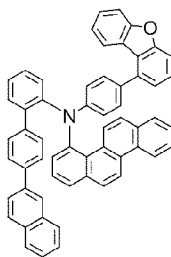
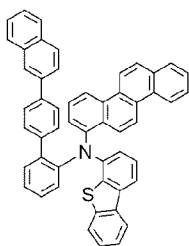
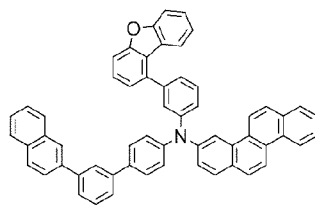
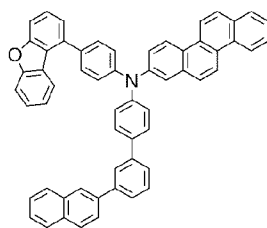
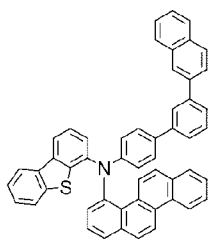
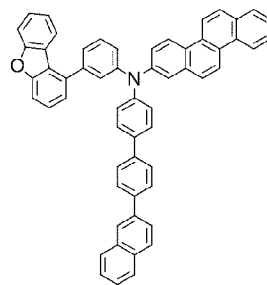
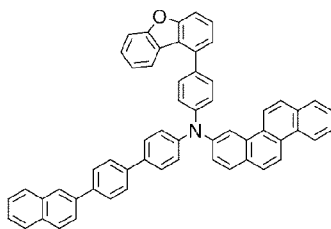
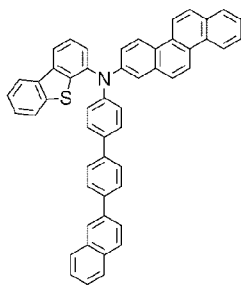


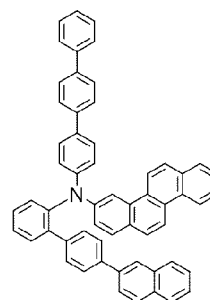
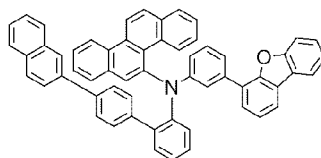
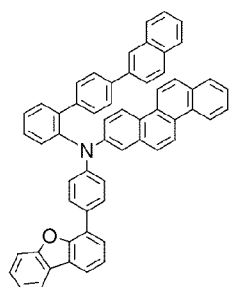
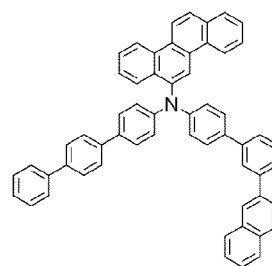
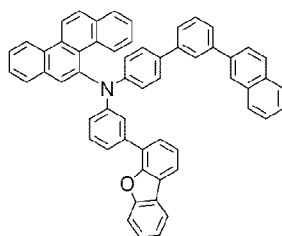
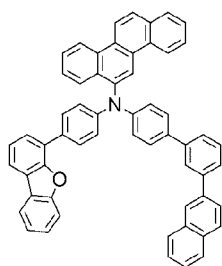
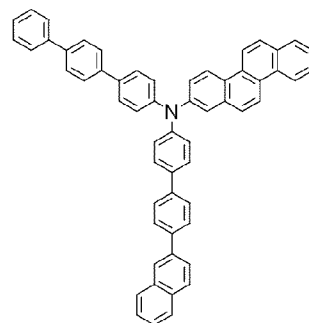
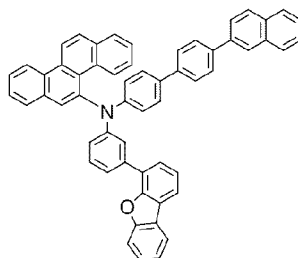
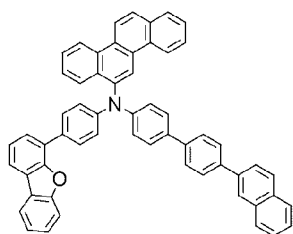


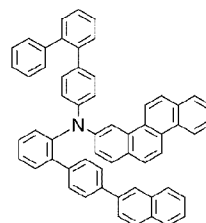
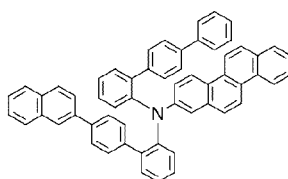
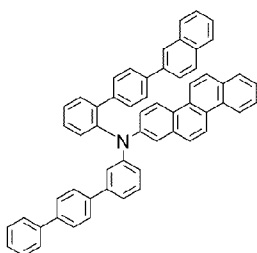
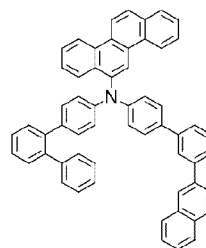
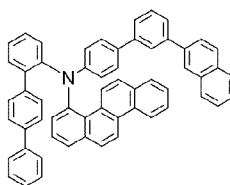
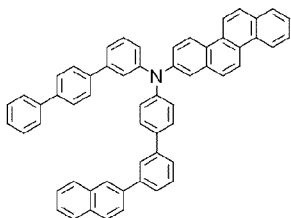
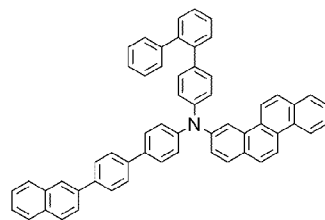
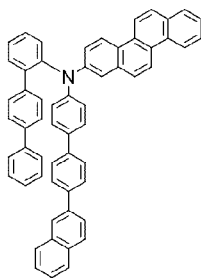
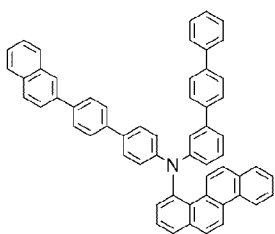


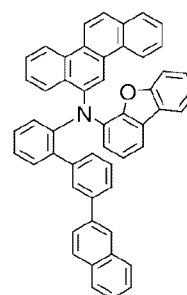
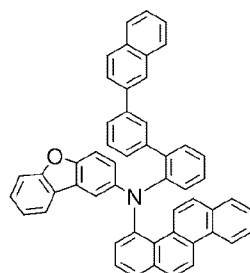
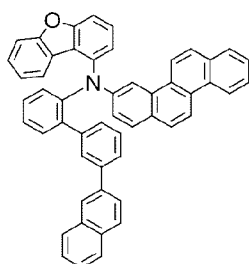
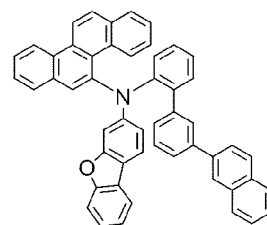
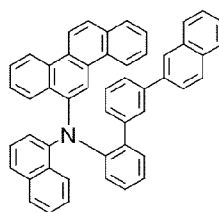
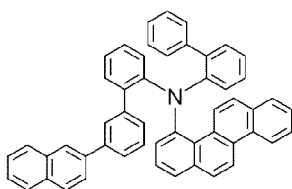
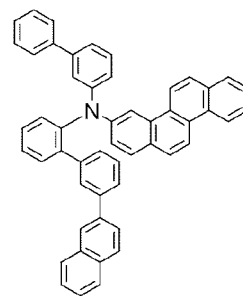
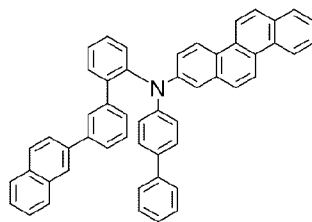
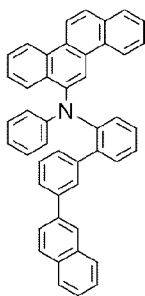


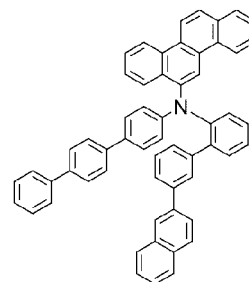
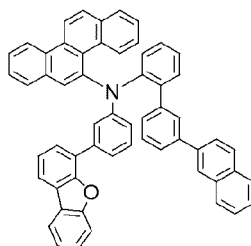
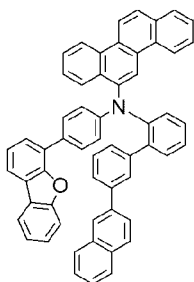
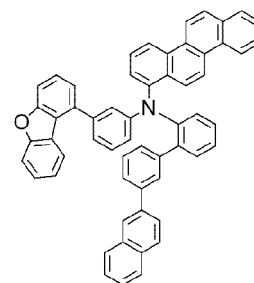
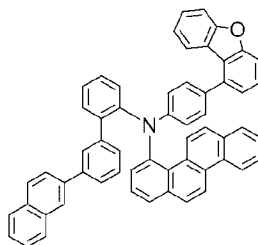
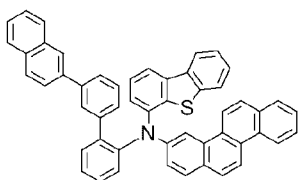
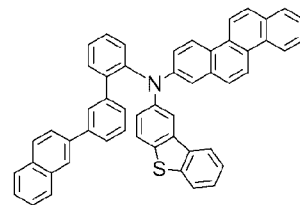
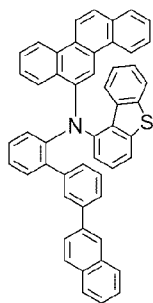
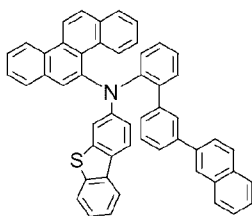


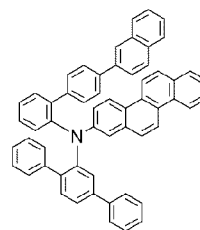
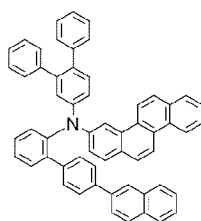
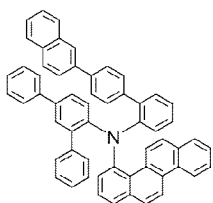
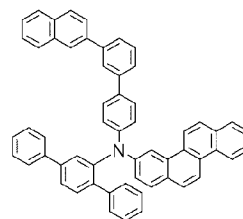
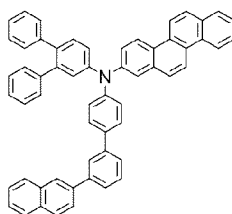
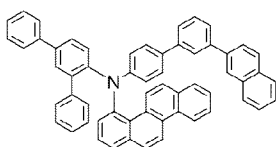
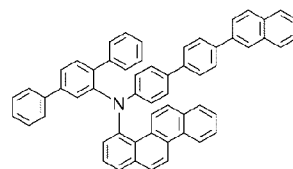
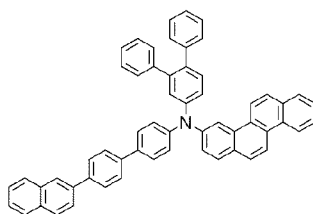
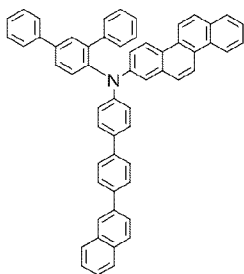


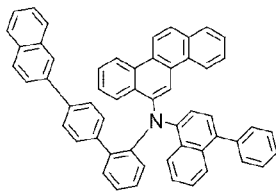
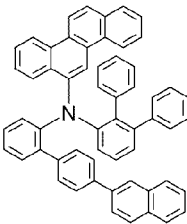
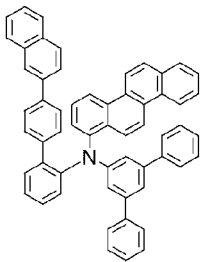
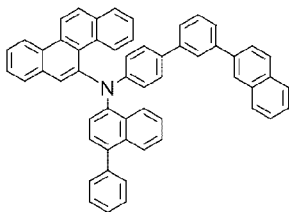
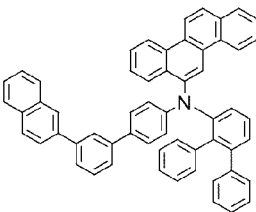
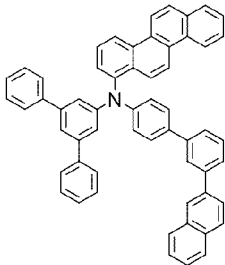
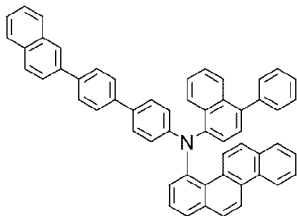
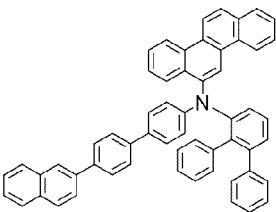
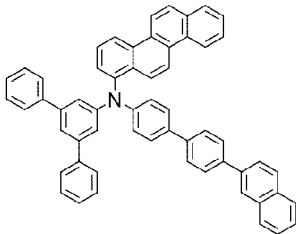


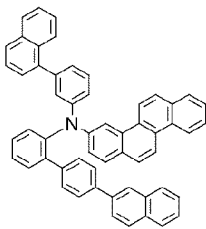
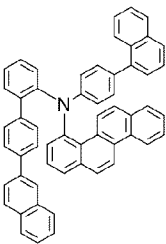
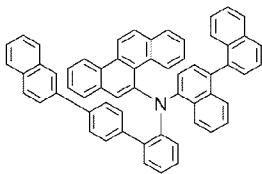
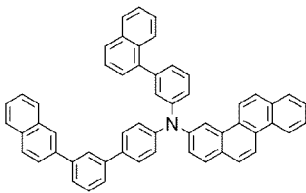
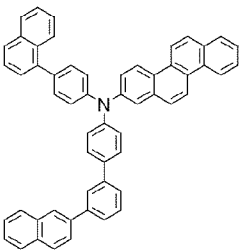
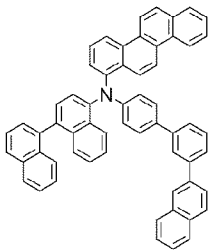
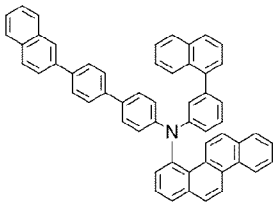
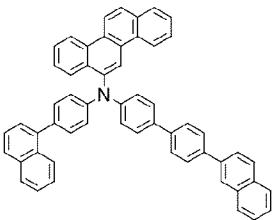
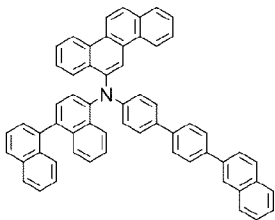


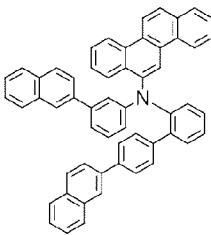
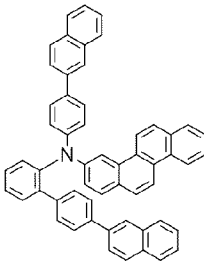
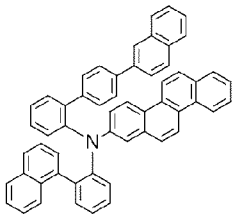
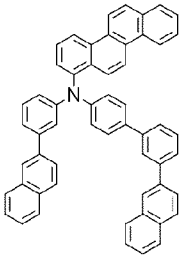
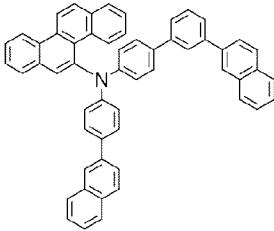
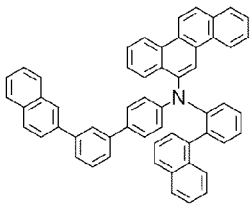
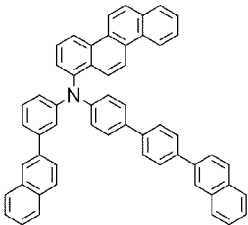
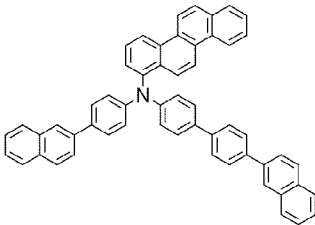
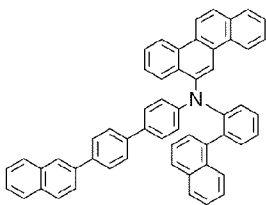


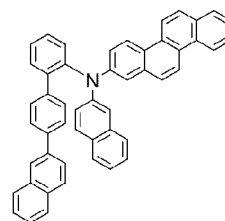
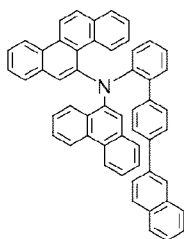
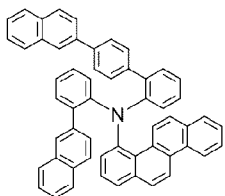
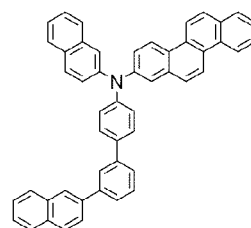
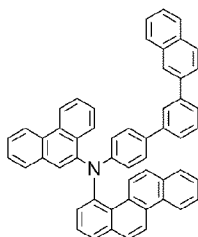
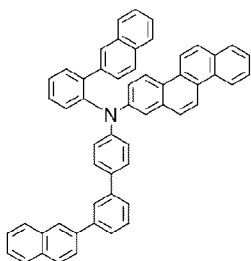
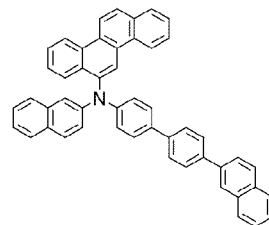
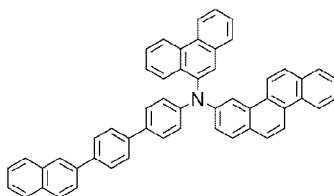
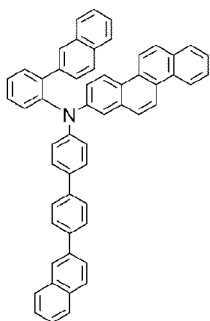


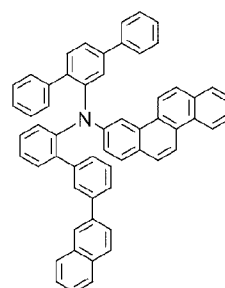
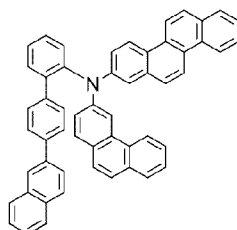
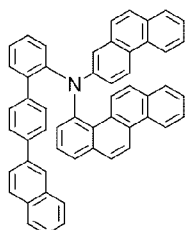
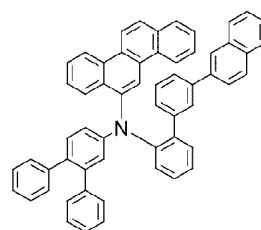
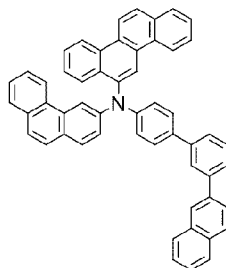
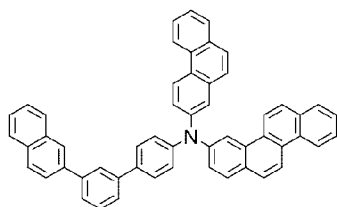
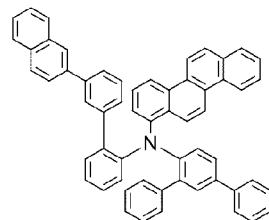
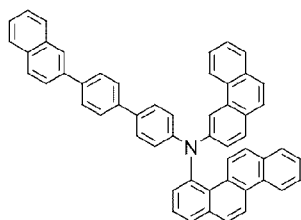
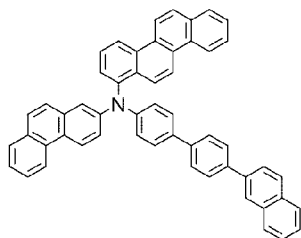


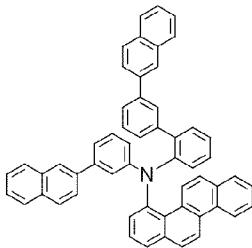
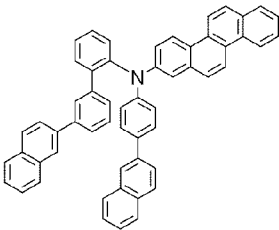
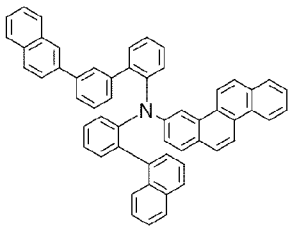
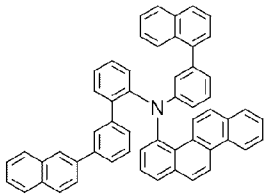
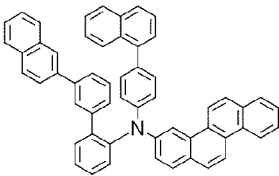
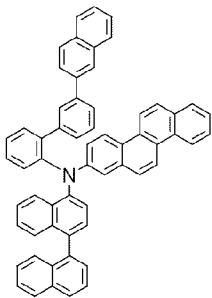
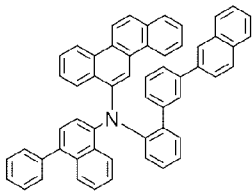
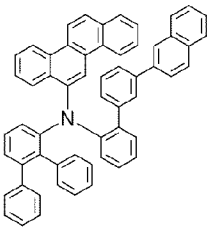
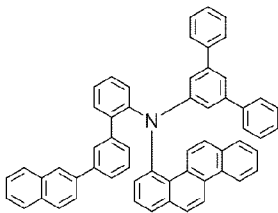


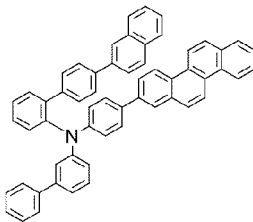
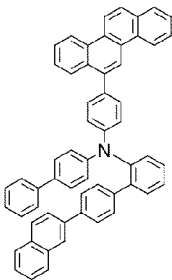
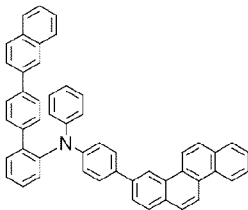
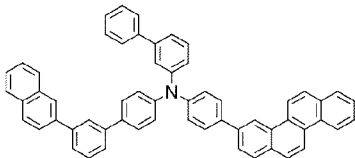
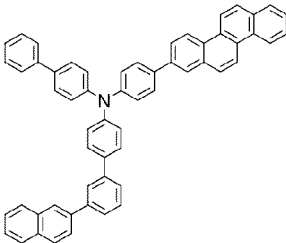
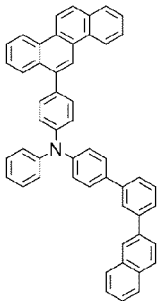
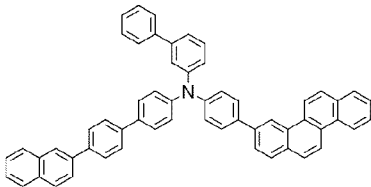
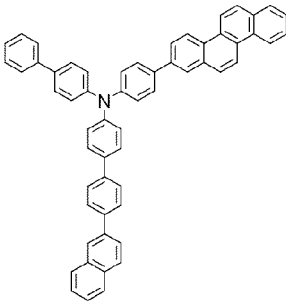
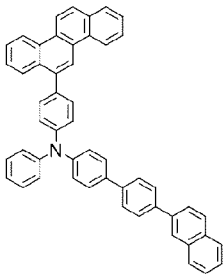


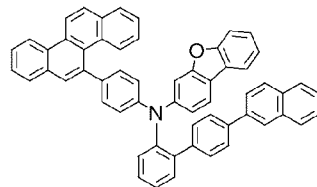
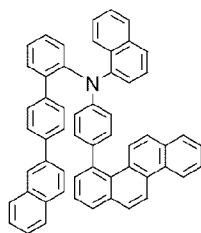
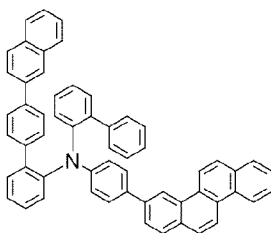
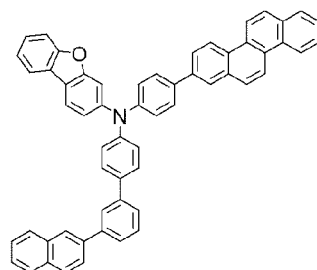
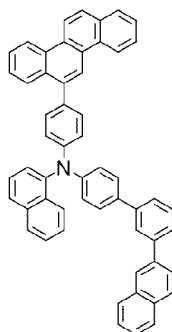
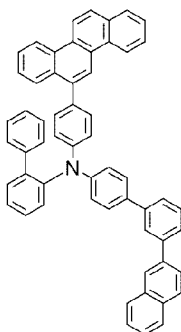
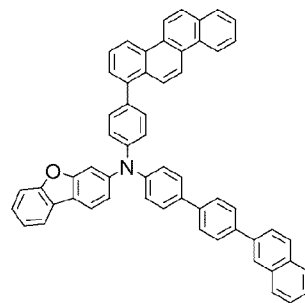
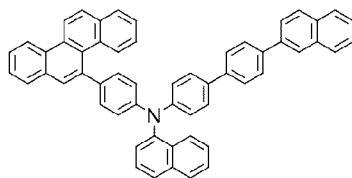
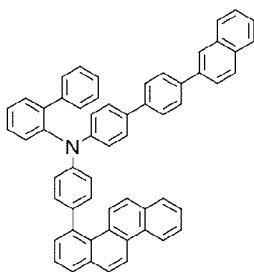


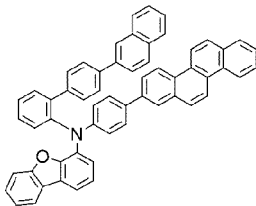
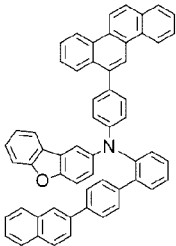
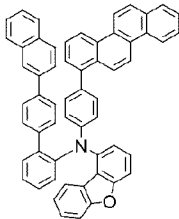
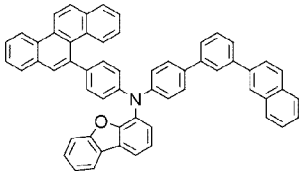
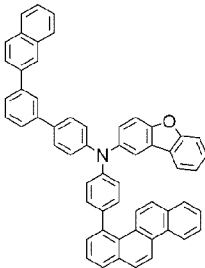
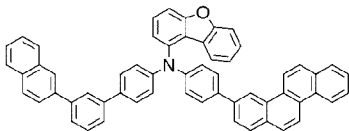
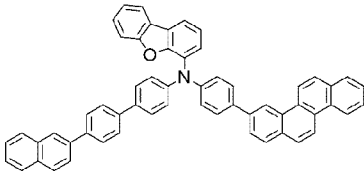
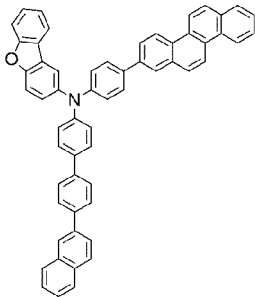
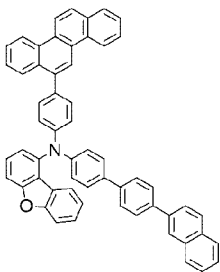


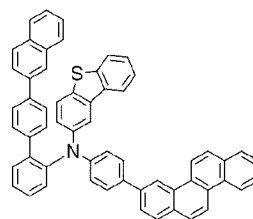
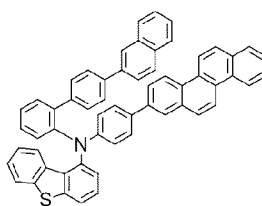
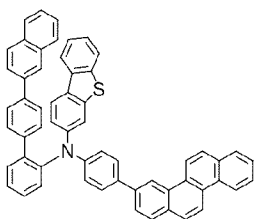
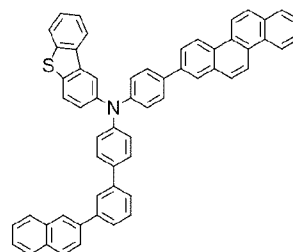
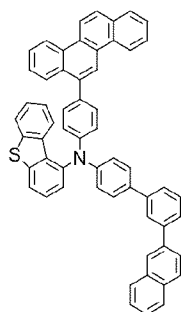
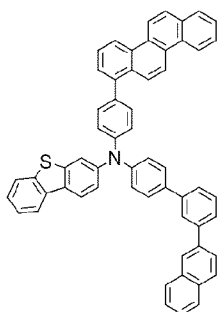
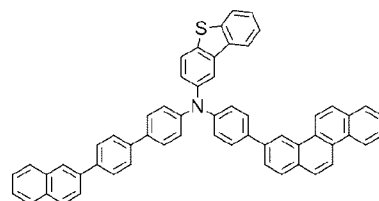
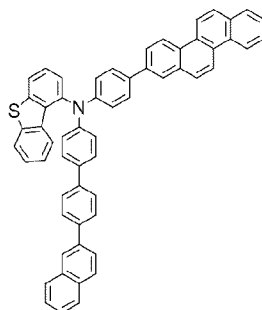
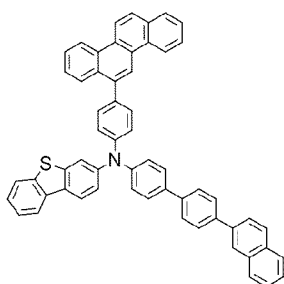


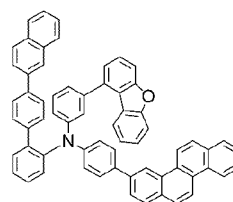
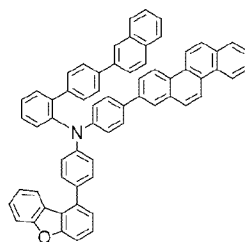
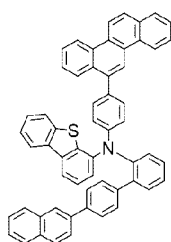
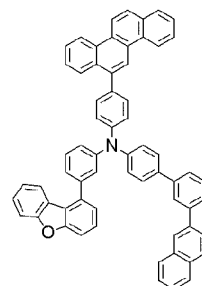
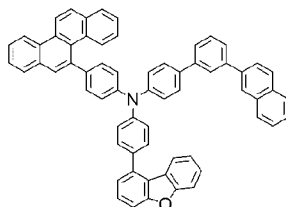
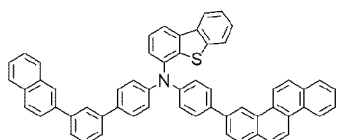
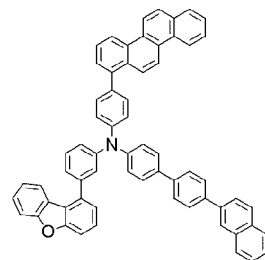
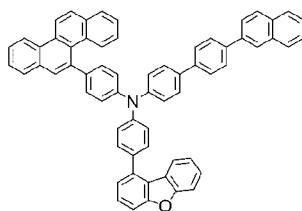
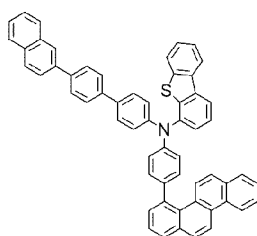


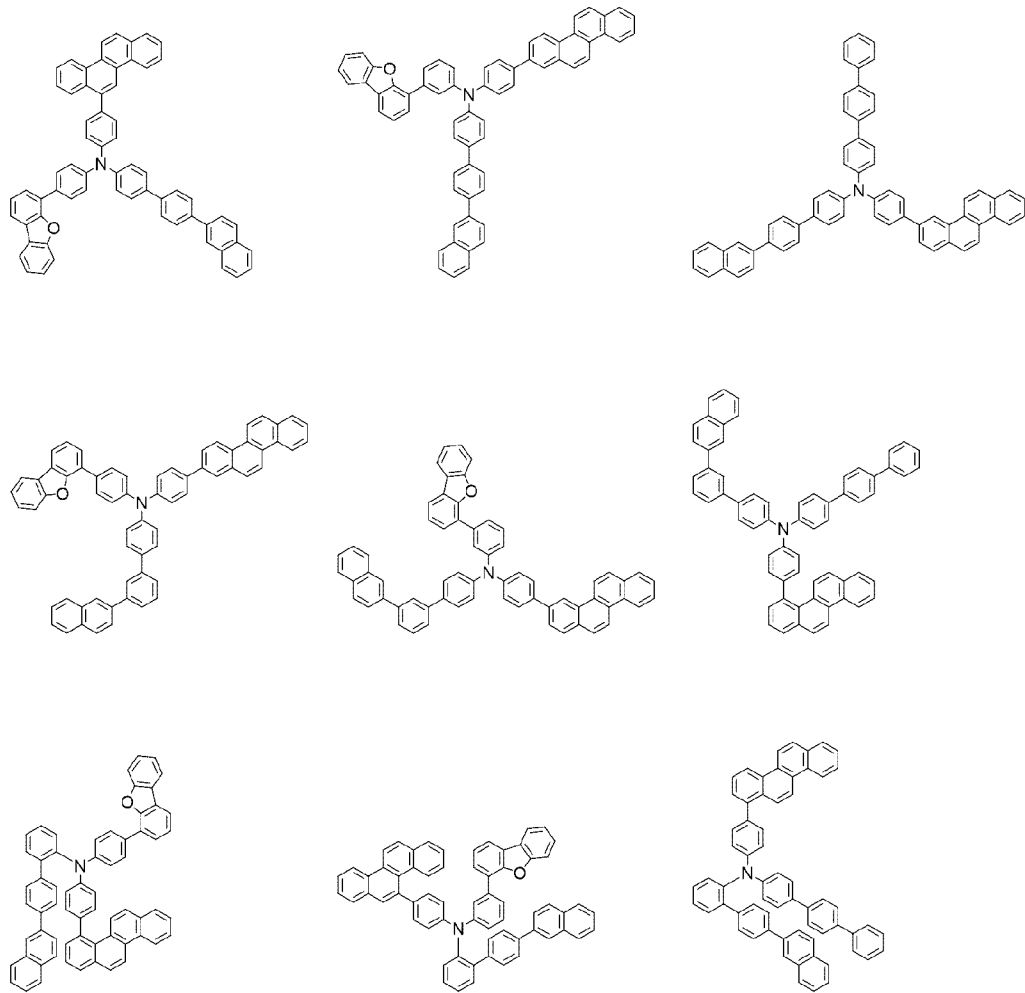


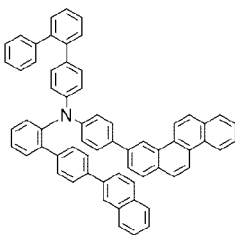
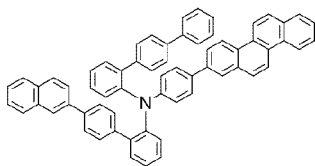
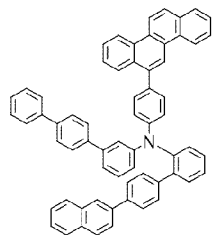
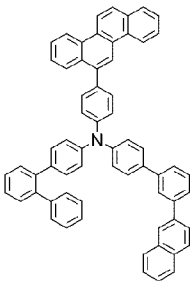
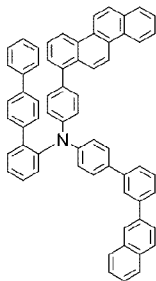
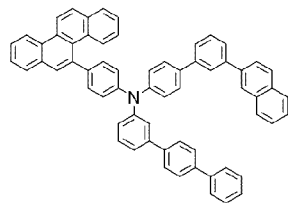
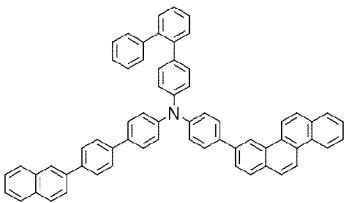
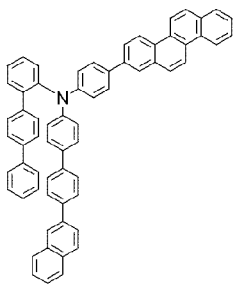
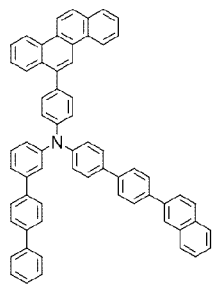


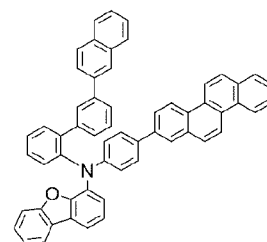
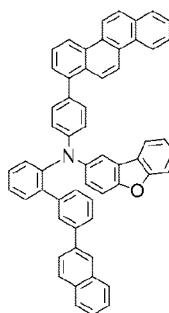
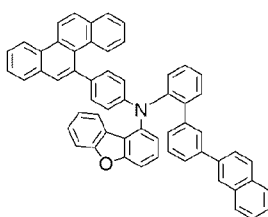
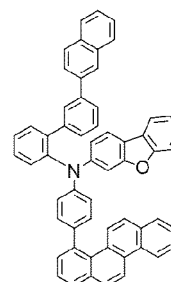
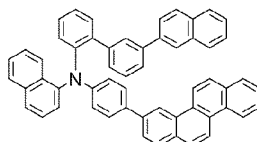
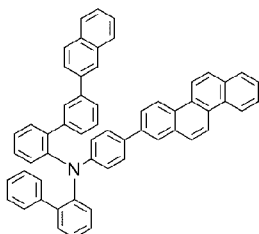
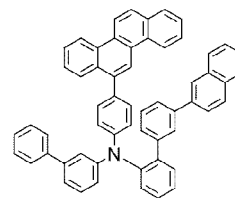
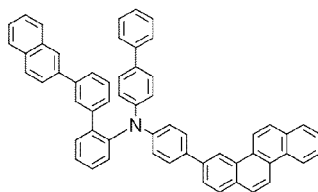
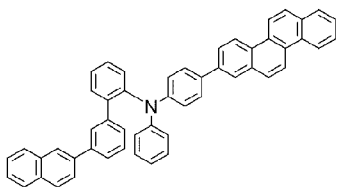


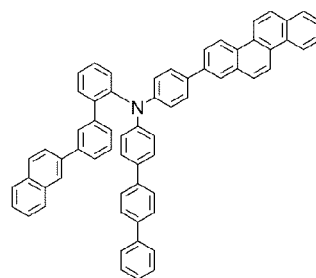
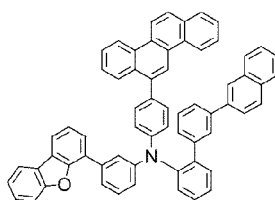
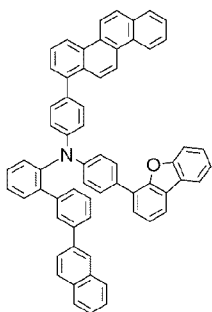
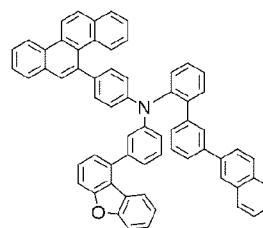
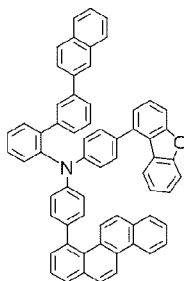
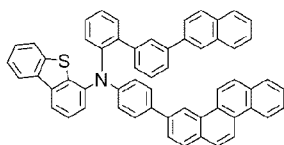
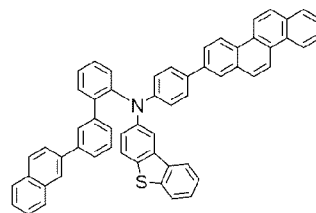
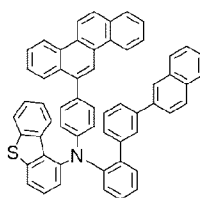
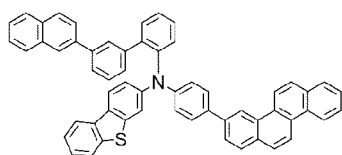


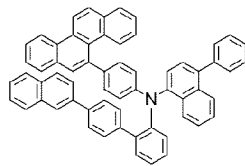
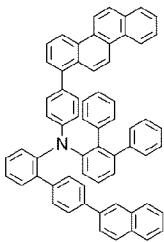
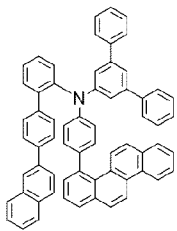
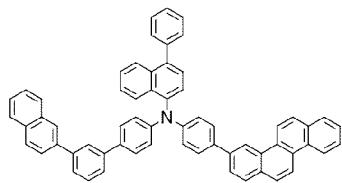
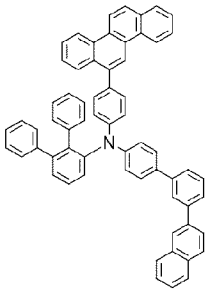
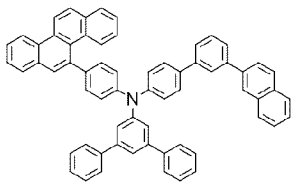
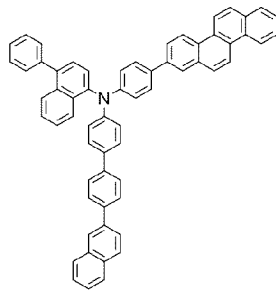
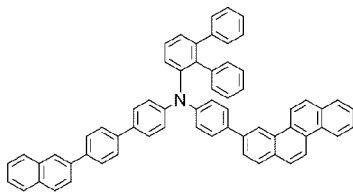
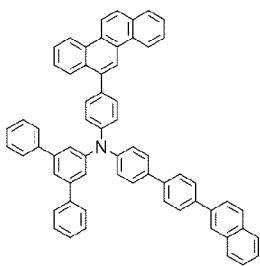


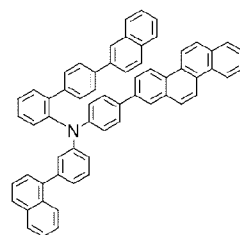
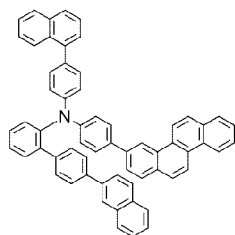
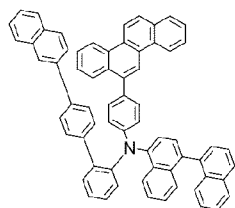
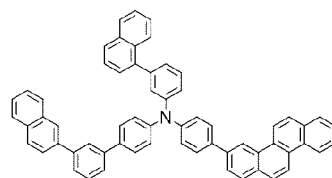
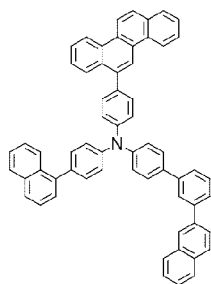
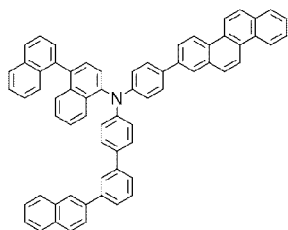
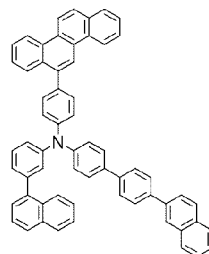
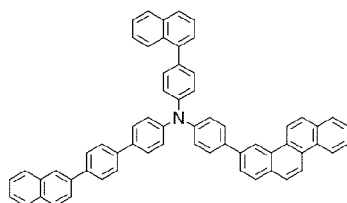
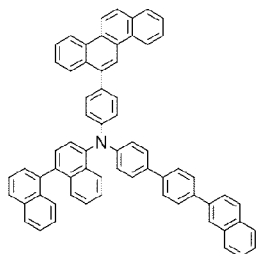


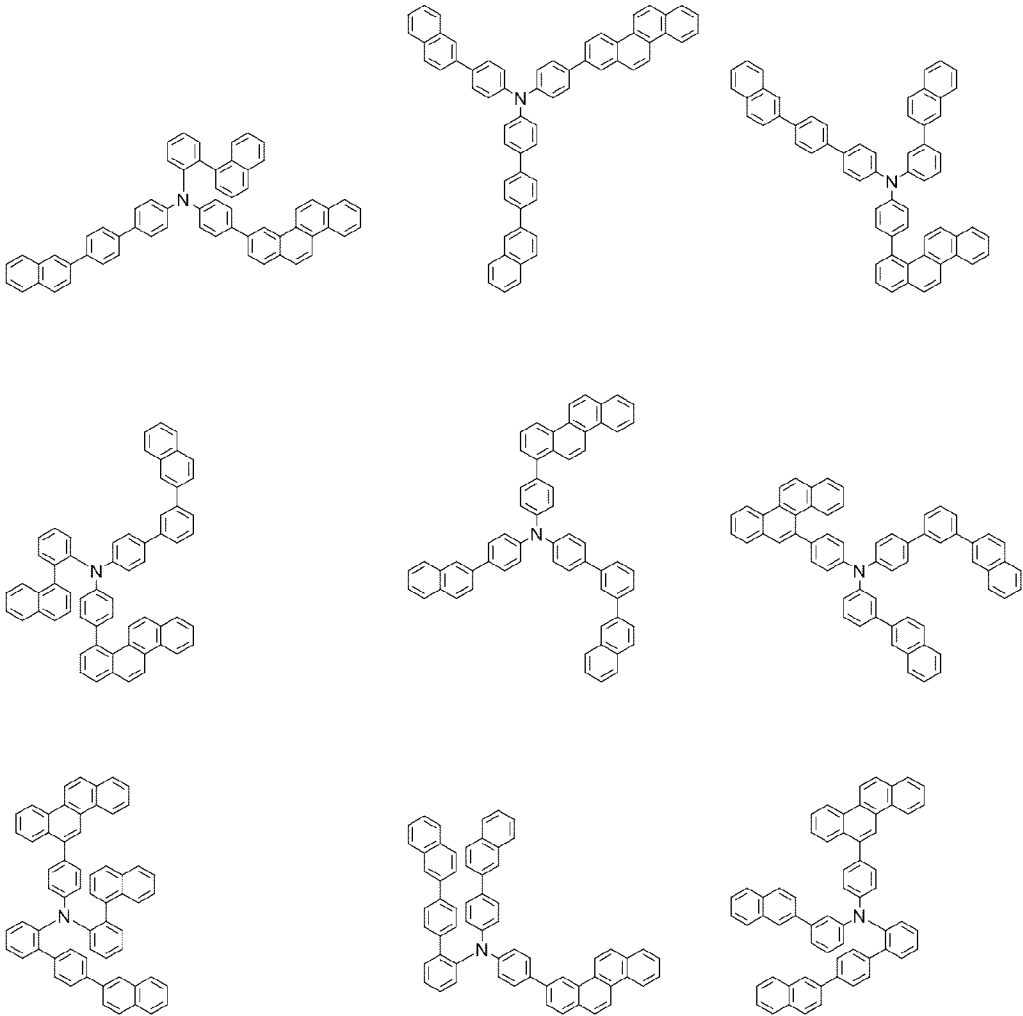


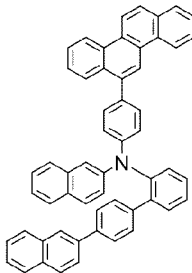
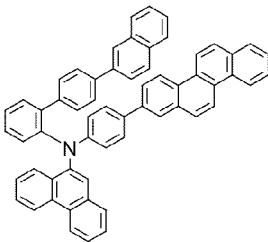
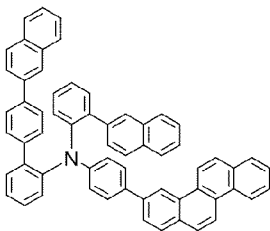
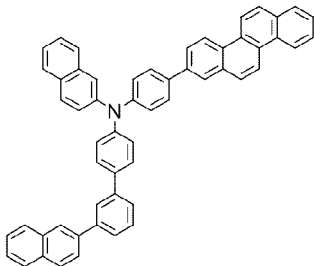
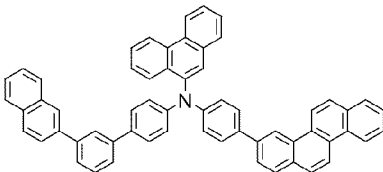
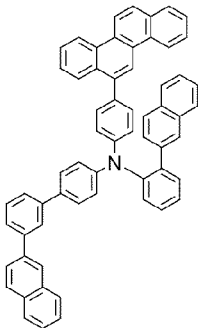
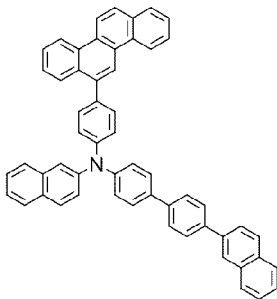
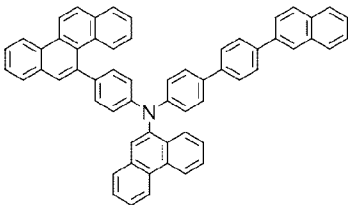
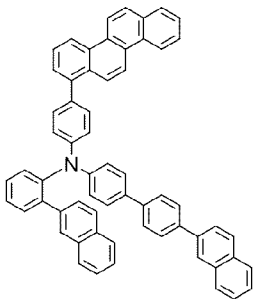


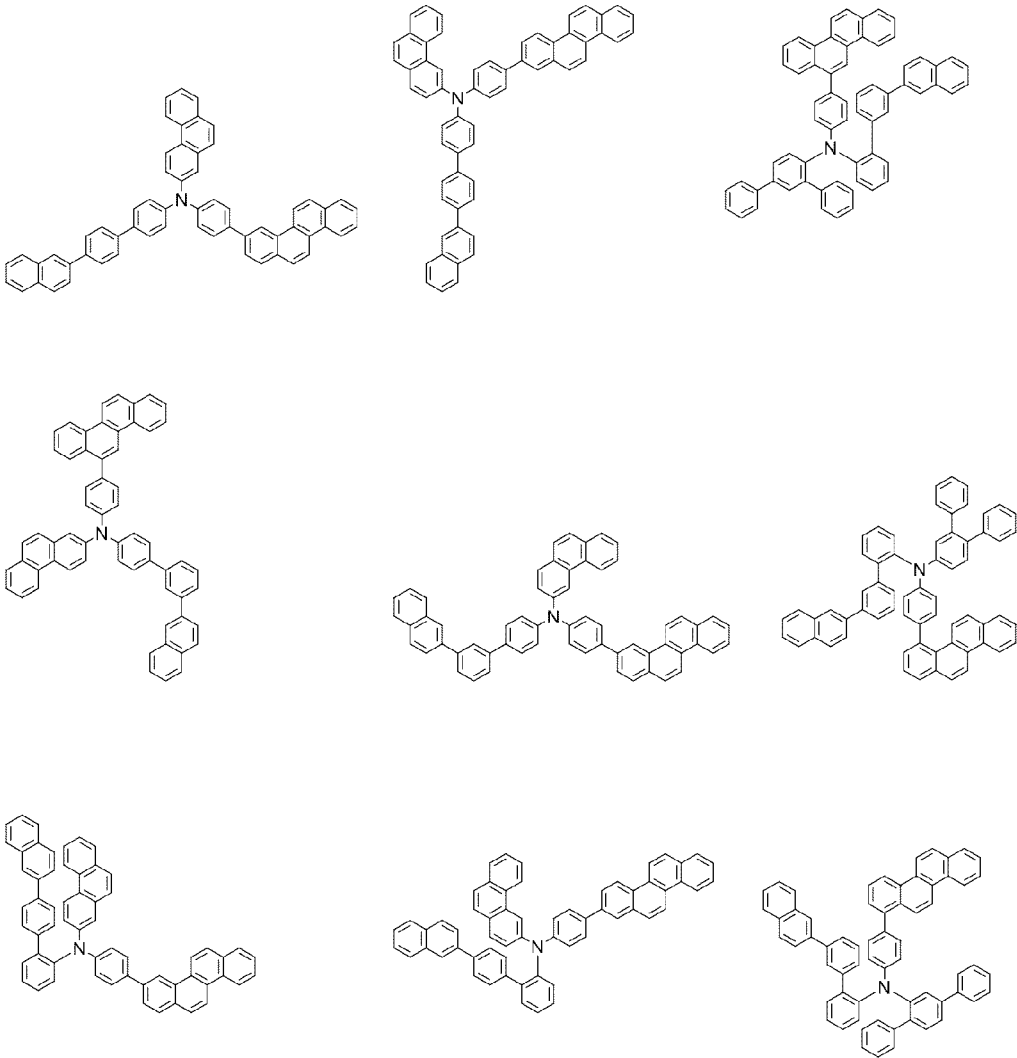


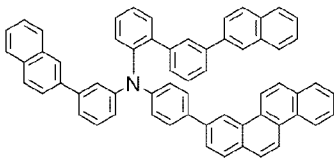
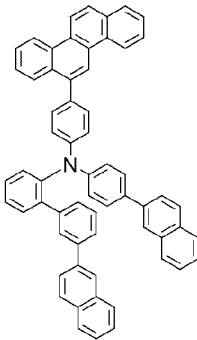
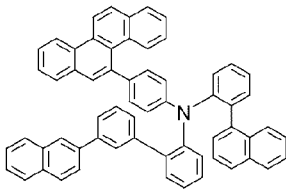
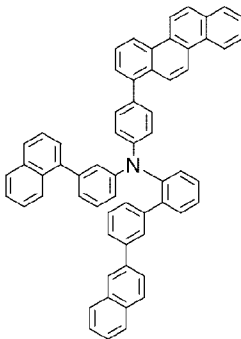
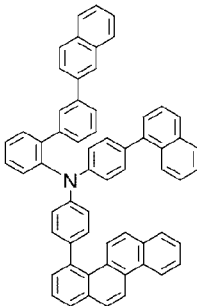
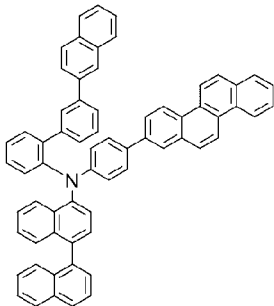
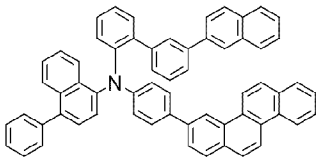
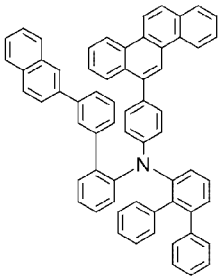
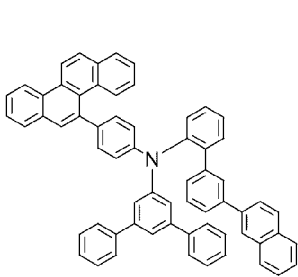


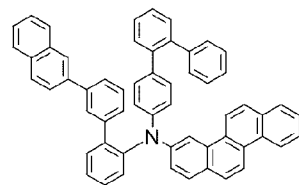
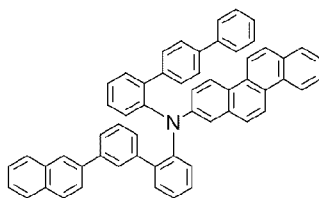
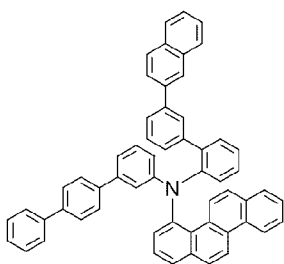
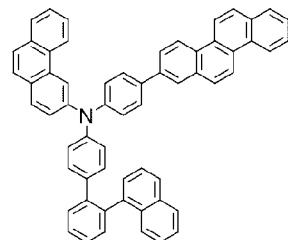
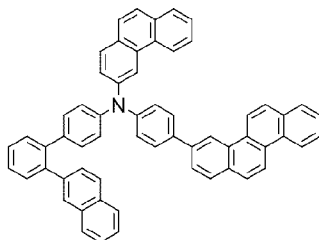
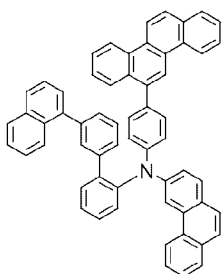
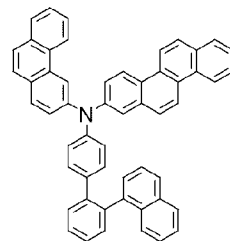
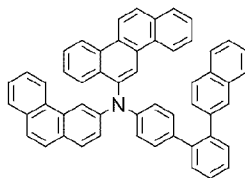
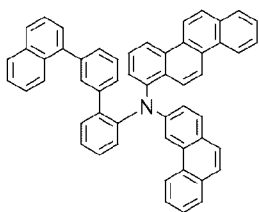


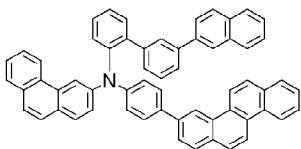
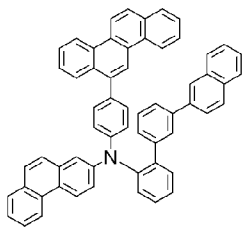
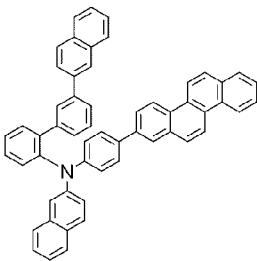
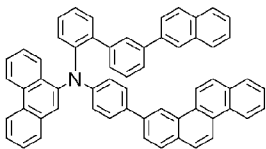
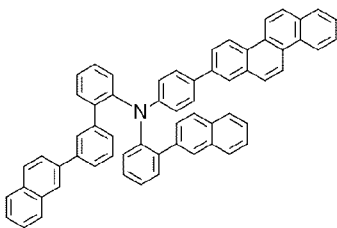
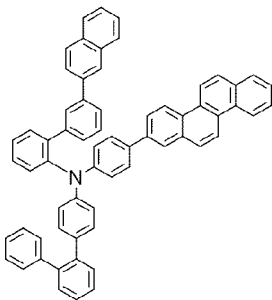
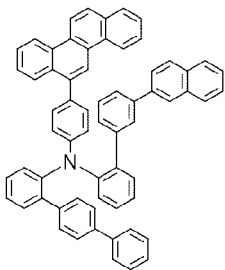
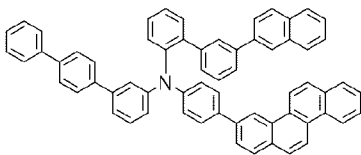
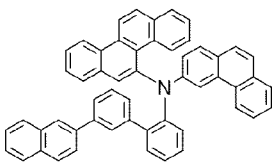
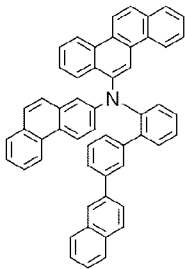
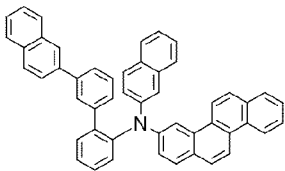
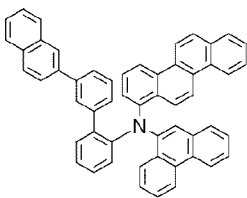
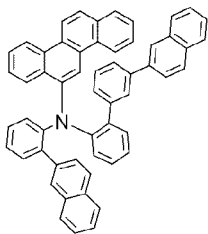












- [청구항 10] 제1 전극; 상기 제1 전극과 대향하여 구비된 제2 전극; 및 상기 제1 전극과 상기 제2 전극 사이에 구비된 1층 이상의 유기물층을 포함하는 유기 발광 소자로서, 상기 유기물층 중 1층 이상은 제1항 내지 제9항 중 어느 하나의 항에 따른 화합물을 포함하는, 유기 발광 소자.
- [청구항 11] 제10항에 있어서
상기 화합물을 포함하는 유기물층은 발광층인,
유기 발광 소자.

[도1]

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[도2]

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2024/009358

A. CLASSIFICATION OF SUBJECT MATTER**C07C 211/61**(2006.01)i; **C07C 211/54**(2006.01)i; **C07C 211/58**(2006.01)i; **C07D 307/91**(2006.01)i; **C07D 333/76**(2006.01)i; **H10K 85/60**(2023.01)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)

C07C 211/61(2006.01); C07C 211/54(2006.01); C07C 211/57(2006.01); C07D 307/91(2006.01); C09K 11/06(2006.01); H01L 51/00(2006.01); H01L 51/50(2006.01); H10K 50/00(2023.01); H10K 99/00(2023.01)

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: 크라이센(chrysene), 나프틸(naphthyl), 페닐렌(phenylene), 아민(amine), 유기 발광 소자(organic light emitting device)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 10-2022-0117848 A (LG CHEM, LTD.) 24 August 2022 (2022-08-24) See claims 1, 3-6 and 8-10.	1-11
A	KR 10-2023-0066250 A (ROHM AND HAAS ELECTRONIC MATERIALS KOREA LTD.) 15 May 2023 (2023-05-15) See claims 1-25.	1-11
A	US 2023-0141672 A1 (ROHM AND HAAS ELECTRONIC MATERIALS KOREA LTD.) 11 May 2023 (2023-05-11) See abstract; and claim 1.	1-11
A	KR 10-2012-0062763 A (E.I. DU PONT DE NEMOURS AND COMPANY) 14 June 2012 (2012-06-14) See abstract; and claim 1.	1-11



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

“D” document cited by the applicant in the international application

“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

15 October 2024

Date of mailing of the international search report

16 October 2024

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon Building 4, 189 Cheongsaro, Seo-gu, Daejeon 35208

Facsimile No. +82-42-481-8578

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2024/009358

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 10-2022-0055411 A (ROHM AND HAAS ELECTRONIC MATERIALS KOREA LTD.) 03 May 2022 (2022-05-03) See claims 1-10.	1-11

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2024/009358

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
KR	10-2022-0117848	A	24 August 2022	CN	116438154	A	14 July 2023
KR	10-2023-0066250	A	15 May 2023	None			
US	2023-0141672	A1	11 May 2023	CN	116023366	A	28 April 2023
				KR	10-2023-0057737	A	02 May 2023
KR	10-2012-0062763	A	14 June 2012	CN	102834483	A	19 December 2012
				CN	102834483	B	15 July 2015
				CN	104783724	A	22 July 2015
				EP	2464709	A1	20 June 2012
				EP	2464709	A4	20 February 2013
				EP	2464709	B1	16 July 2014
				JP	2013-501783	A	17 January 2013
				JP	5567675	B2	06 August 2014
				KR	10-1545774	B1	19 August 2015
				KR	10-1811507	B1	21 December 2017
				KR	10-2015-0085138	A	22 July 2015
				US	2011-0037381	A1	17 February 2011
				US	2013-0187140	A1	25 July 2013
				US	8968883	B2	03 March 2015
				WO	2011-019360	A1	17 February 2011
KR	10-2022-0055411	A	03 May 2022	None			

A. 발명이 속하는 기술분류(국제특허분류(IPC))

C07C 211/61(2006.01)i; C07C 211/54(2006.01)i; C07C 211/58(2006.01)i; C07D 307/91(2006.01)i; C07D 333/76(2006.01)i; H10K 85/60(2023.01)i

B. 조사된 분야

조사된 최소문헌(국제특허분류를 기재)

C07C 211/61(2006.01); C07C 211/54(2006.01); C07C 211/57(2006.01); C07D 307/91(2006.01); C09K 11/06(2006.01); H01L 51/00(2006.01); H01L 51/50(2006.01); H10K 50/00(2023.01); H10K 99/00(2023.01)

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: 크라이센(chrysene), 나프틸(naphthyl), 페닐렌(phenylene), 아민(amine), 유기 발광 소자(organic light emitting device)

C. 관련 문헌

카테고리*	인용문헌명 및 관련 구절(해당하는 경우)의 기재	관련 청구항
X	KR 10-2022-0117848 A (주식회사 엘지화학) 2022.08.24 청구항 1, 3-6, 8-10	1-11
A	KR 10-2023-0066250 A (로옴트라스전자재료코리아유한회사) 2023.05.15 청구항 1-25	1-11
A	US 2023-0141672 A1 (ROHM AND HAAS ELECTRONIC MATERIALS KOREA LTD.) 2023.05.11 요약; 청구항 1	1-11
A	KR 10-2012-0062763 A (이 아이 듀폰 디 네모아 앤드 캄파니) 2012.06.14 요약; 청구항 1	1-11
A	KR 10-2022-0055411 A (로옴트라스전자재료코리아유한회사) 2022.05.03 청구항 1-10	1-11

☐ 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

“D” 본 국제출원에서 출원인이 인용한 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

2024년10월15일(15.10.2024)

국제조사보고서 발송일

2024년10월16일(16.10.2024)

ISA/KR의 명칭 및 우편주소

대한민국 특허청
(35208) 대전광역시 서구 청사로 189, 4동 (둔산동,
정부대전청사)

팩스 번호 +82-42-481-8578

심사관

권용경

전화번호 +82-42-481-3371

국제조사보고서에서 인용된 특허문헌	공개일	대응특허문헌	공개일
KR 10-2022-0117848 A	2022/08/24	CN 116438154 A	2023/07/14
KR 10-2023-0066250 A	2023/05/15	없음	
US 2023-0141672 A1	2023/05/11	CN 116023366 A	2023/04/28
		KR 10-2023-0057737 A	2023/05/02
KR 10-2012-0062763 A	2012/06/14	CN 102834483 A	2012/12/19
		CN 102834483 B	2015/07/15
		CN 104783724 A	2015/07/22
		EP 2464709 A1	2012/06/20
		EP 2464709 A4	2013/02/20
		EP 2464709 B1	2014/07/16
		JP 2013-501783 A	2013/01/17
		JP 5567675 B2	2014/08/06
		KR 10-1545774 B1	2015/08/19
		KR 10-1811507 B1	2017/12/21
		KR 10-2015-0085138 A	2015/07/22
		US 2011-0037381 A1	2011/02/17
		US 2013-0187140 A1	2013/07/25
		US 8968883 B2	2015/03/03
		WO 2011-019360 A1	2011/02/17
KR 10-2022-0055411 A	2022/05/03	없음	