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(54)名稱

電子裝置用材料

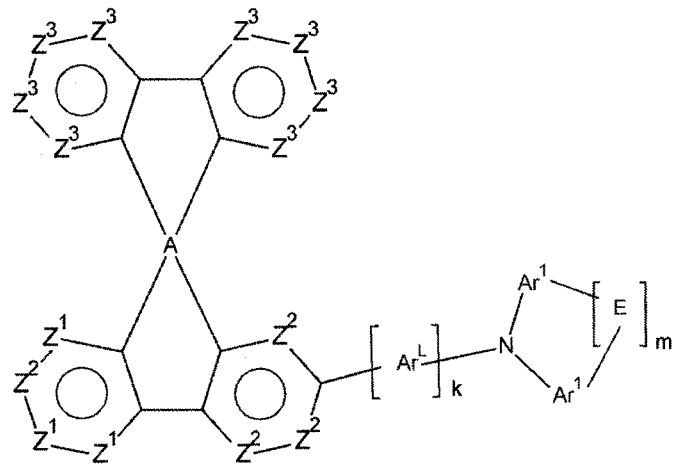
(57)摘要

本申請案關於適合使用於電子裝置的特定式之螺聯萘衍生物。

The present application relates to a spirobifluorene derivative of a specific formula which is suitable for use in electronic devices.

特徵化學式：

式 (I)





I779067

公告本

【發明摘要】

【中文發明名稱】

電子裝置用材料

【英文發明名稱】

MATERIALS FOR ELECTRONIC DEVICES

【中文】

本申請案關於適合使用於電子裝置的特定式之螺聯茚衍生物。

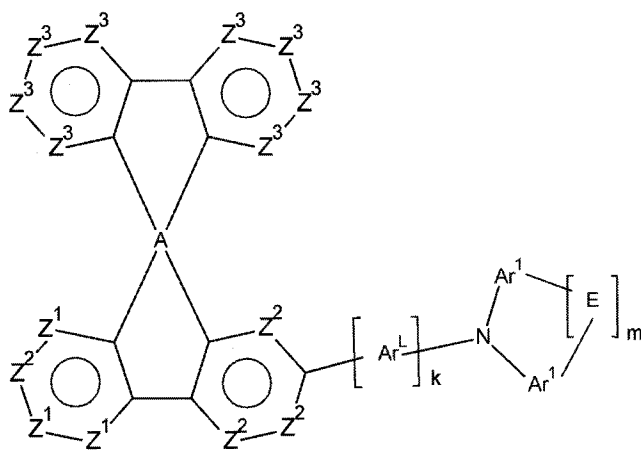
【英文】

The present application relates to a spirobifluorene derivative of a specific formula which is suitable for use in electronic devices.

【指定代表圖】 無

【代表圖之符號簡單說明】 無

【特徵化學式】 式 (I)



【發明說明書】

【中文發明名稱】

電子裝置用材料

【英文發明名稱】

MATERIALS FOR ELECTRONIC DEVICES

【技術領域】

本申請案關於一種下文所定義的式(I)之螺聯萘衍生物，其適合使用於電子裝置，尤其是有機電致發光裝置(OLED)。

電子裝置在本申請案的情況下係理解為意指所謂的有機電子裝置，其含有有機半導體材料作為功能材料。更具體地說，這些係理解為意指OLED。

【先前技術】

其中有機化合物係用作為功能材料的OLED之構造在先前技術中為常識。通常，術語OLED係理解為意指具有一或多個包含有機化合物之層並在施加電壓時發光的電子裝置。

在電子裝置(尤其是OLED)中，在改良性能數據(尤其是壽命、效率和工作電壓)方面有著極大的興趣。在這些方面，還沒有找到任何完全令人滿意的解決方案。

具有電洞傳輸功能的層(例如電洞注入層、電洞傳輸

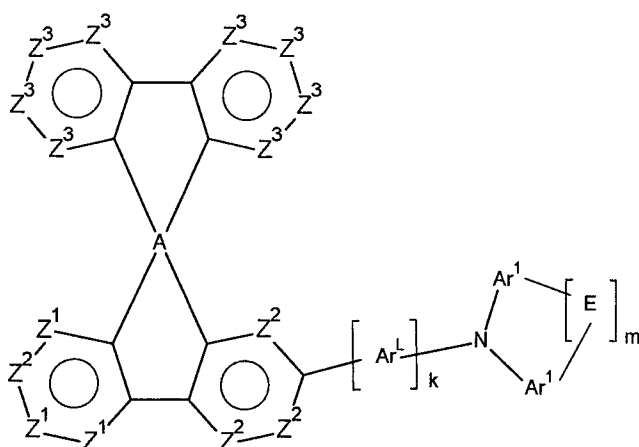
層、電子阻擋層以及發光層)對電子裝置之性能數據具有巨大影響。為了使用於這些層中，仍然在尋求具有電洞傳輸性質的新材料。

在本發明的過程中，已經發現在螺聯萸之2-位置中具有胺基或橋接胺基，及在5、6和8-位置中之一者具有選自特定化學基團的另一取代基之螺聯萸衍生物非常適合於用作為具有電洞傳導功能的材料，特別是用作為電洞傳輸層、電子阻擋層和發光層的材料，更特別地使用於電子阻擋層。電子阻擋層在此情況下係理解為與陽極側上的發光層直接相鄰的層，且其用於阻擋存在於發光層中的電子進入OLED的電洞傳輸層。

當使用於電子裝置(特別是使用於OLED)中時，彼等就裝置的壽命、工作電壓和量子效率而言產生優異的結果。該等化合物的特徵亦在於：非常好的電洞傳導性質、非常好的電子阻擋性質、高玻璃轉移溫度、高氧化穩定性、良好的溶解性、高熱穩定性和低昇華溫度。

【發明內容】

本申請案因此關於一種式(I)化合物



式 (I)

其中變數係定義如下：

A 為 C 或 Si ；

Z¹ 在每次出現時係相同或不同地選自 CR¹、CR²和 N ；

Z² 在每次出現時係相同或不同地選自 CR²和 N ；

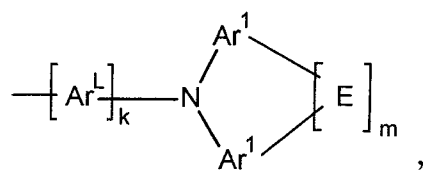
Z³ 在每次出現時係相同或不同地選自 CR³和 N ；

Ar^L 在每次出現時係相同或不同地選自可經一或多個基團 R⁴取代的具有 6 至 40 個芳族環原子之芳族環系統和可經一或多個基團 R⁴取代的具有 5 至 40 個芳族環原子之雜芳族環系統 ；

Ar¹ 係相同或不同地選自可經一或多個基團 R⁴取代的具有 6 至 40 個芳族環原子之芳族環系統和可經一或多個基團 R⁴取代的具有 5 至 40 個芳族環原子之雜芳族環系統 ；

E 為單鍵或為選自 C(R⁴)₂、N(R⁴)、O、和 S 的二價基 ；

R¹ 在每次出現時係相同或不同地選自



$\text{Si}(\text{R}^5)_3$ 、具有 1 至 20 個 C 原子之直鏈烷基、烷氧基或烷硫基 (thioalkyl)、具有 3 至 20 個 C 原子之支鏈或環狀烷基、烷氧基、或烷硫基、具有 6 至 40 個芳族環原子之芳族環系統、和具有 5 至 40 個芳族環原子之雜芳族環系統，其中該等烷基、烷氧基和烷硫基及該等芳族和雜芳族環系統在各情況下可經一或多個基團 R^5 取代；

R^2 、 R^3 在每次出現時係相同或不同地選自 H、D、F、Cl、Br、I、 $\text{C}(=\text{O})\text{R}^5$ 、CN、 $\text{Si}(\text{R}^5)_3$ 、 $\text{N}(\text{R}^5)_2$ 、 $\text{P}(=\text{O})(\text{R}^5)_2$ 、 OR^5 、 $\text{S}(=\text{O})\text{R}^5$ 、 $\text{S}(=\text{O})_2\text{R}^5$ 、SCN、 SF_5 、具有 1 至 20 個 C 原子之直鏈烷基或烷氧基、具有 3 至 20 個 C 原子之支鏈或環狀烷基或烷氧基、具有 2 至 20 個 C 原子之烯基或炔基、具有 6 至 40 個芳族環原子之芳族環系統、和具有 5 至 40 個芳族環原子之雜芳族環系統；其中二或多個選自基團 R^2 和 R^3 的基團可彼此連接以形成環；其中該等烷基、烷氧基、烯基和炔基及該等芳族和雜芳族環系統在各情況下可經一或多個基團 R^5 取代，及其中該等烷基、烷氧基、烯基和炔基中之一或多個 CH_2 基團在各情況下可經 $-\text{R}^5\text{C}=\text{CR}^5-$ 、 $-\text{C}\equiv\text{C}-$ 、 $\text{Si}(\text{R}^5)_2$ 、 $\text{C}=\text{O}$ 、 $\text{C}=\text{NR}^5$ 、

-C(=O)O-、-C(=O)NR⁵-、NR⁵、P(=O)(R⁵)、

-O-、-S-、SO或SO₂置換；

R⁴ 在每次出現時係相同或不同地選自H、D、F、C(=O)R⁵、CN、Si(R⁵)₃、N(R⁵)₂、P(=O)(R⁵)₂、OR⁵、S(=O)R⁵、S(=O)₂R⁵、具有1至20個C原子之直鏈烷基或烷氧基、具有3至20個C原子之支鏈或環狀烷基或烷氧基、具有2至20個C原子之烯基或炔基、具有6至40個芳族環原子之芳族環系統、和具有5至40個芳族環原子之雜芳族環系統；其中二或多個基團R⁴可彼此連接以形成環；其中該等烷基、烷氧基、烯基和炔基及該等芳族和雜芳族環系統在各情況下可經一或多個基團R⁵取代，及其中該等烷基、烷氧基、烯基和炔基中之一或多個CH₂基團在各情況下可經-R⁵C=CR⁵-、

-C≡C-、Si(R⁵)₂、C=O、C=NR⁵、-C(=O)O-、

-C(=O)NR⁵-、NR⁵、P(=O)(R⁵)、-O-、-S-、SO或SO₂置換；

R⁵ 在每次出現時係相同或不同地選自H、D、F、C(=O)R⁶、CN、Si(R⁶)₃、N(R⁶)₂、P(=O)(R⁶)₂、OR⁶、S(=O)R⁶、S(=O)₂R⁶、具有1至20個C原子之直鏈烷基或烷氧基、具有3至20個C原子之支鏈或環狀烷基或烷氧基、具有2至20個C原子之烯基或炔基、具有6至40個芳族環原子之芳族環系統、和具有5至40個芳族環原子之雜芳族環系統；其

中二或多個基團 R^5 可彼此連接以形成環；其中該等烷基、烷氧基、烯基和炔基及該等芳族和雜芳族環系統在各情況下可經一或多個基團 R^6 取代，及其中該等烷基、烷氧基、烯基和炔基中之一或多個 CH_2 基團在各情況下可經 $-R^6C=CR^6-$ 、 $-C\equiv C-$ 、 $Si(R^6)_2$ 、 $C=O$ 、 $C=NR^6$ 、 $-C(=O)O-$ 、 $-C(=O)NR^6-$ 、 NR^6 、 $P(=O)(R^6)$ 、 $-O-$ 、 $-S-$ 、 SO 或 SO_2 置換；

R^6 在每次出現時係相同或不同地選自 H 、 D 、 F 、 CN 、具有 1 至 20 個 C 原子之烷基、具有 6 至 40 個 C 原子之芳族環系統、和具有 5 至 40 個芳族環原子之雜芳族環系統；其中二或多個基團 R^6 可彼此連接以形成環；及其中該等烷基、芳族環系統和雜芳族環系統可經 F 和 CN 取代；

k 在每次出現時係相同或不同地為 0 或 1；其中在 $k=0$ 的情況下，基團 Ar^L 不存在且該氮原子和該螺聯萘基團係直接連接；

m 在每次出現時係相同或不同地為 0 或 1，其中在 $m=0$ 的情況下，基團 E 不存在且基團 Ar^1 不連接；

其特徵在於基團 Z^1 中至少一者為 CR^1 。

在式 (I) 之六環中所繪製的圓圈意指各個環由於形成環的原子之間的雙鍵和單鍵的交替而具有芳族性。

下列定義適用於作為一般定義使用的化學基團。彼等僅適用於沒有給出更具體定義的範圍。

芳基就本發明之意義而言含有6至40個芳族環原子，其中沒有任何一個是雜原子。芳基在此意指簡單芳族環(例如苯)或縮合芳族多環(例如萘、菲或蒽)。縮合芳族多環就本申請案之意義而言由二或多個彼此縮合之簡單芳族環組成。

雜芳基就本發明之意義而言含有5至40個芳族環原子，其中至少一者為雜原子。雜原子較佳係選自N、O及S。雜芳基在此意指簡單雜芳族環，諸如吡啶、嘧啶或噻吩，或縮合雜芳族多環，諸如喹啉或吡嗪。縮合雜芳族多環就本申請案的意義而言由二或多個彼此縮合之簡單雜芳族環組成。

在各情況下可經上述基團取代且可經由任何所欲位置連接至芳族或雜芳族環系統之芳基或雜芳基特別意指衍生自下列之基團：苯、萘、蒽、菲、芘、二氫芘、蒽(chrysene)、芘、丙二烯合芘(fluoranthene)、苯並蒽、苯並菲、稠四苯、稠五苯、苯並芘、呋喃、苯並呋喃、異苯並呋喃、二苯並呋喃、噻吩、苯並噻吩、異苯並噻吩、二苯並噻吩、吡咯、吡啶、異吡啶、吡嗪、吡啶、喹啉、異喹啉、吡嗪、啡啶、苯並-5,6-喹啉、苯並-6,7-喹啉、苯並-7,8-喹啉、啡噻唑、啡噻唑、吡嗪、吡啶、咪唑、苯並咪唑、萘並咪唑(naphthimidazole)、菲並咪唑(phenanthrimidazole)、吡啶並咪唑(pyridimidazole)、吡嗪並咪唑(pyrazinimidazole)、喹噻唑並咪唑(quinoxalinimidazole)、噻唑、苯並噻唑、萘並噻唑

(naphthoxazole)、蒽並噁唑 (anthroxazole)、菲並噁唑 (phenanthroxazole)、異噁唑、1,2-噻唑、1,3-噻唑、苯並噻唑、嗒吡、苯並嗒吡、嘧啶、苯並嘧啶、喹啉、吡啶、啡啶、噻啶、氮雜呋唑、苯並呋啶、啡啶、1,2,3-三唑、1,2,4-三唑、苯並三唑、1,2,3-噁二唑、1,2,4-噁二唑、1,2,5-噁二唑、1,3,4-噁二唑、1,2,3-噻二唑、1,2,4-噻二唑、1,2,5-噻二唑、1,3,4-噻二唑、1,3,5-三吡、1,2,4-三吡、1,2,3-三吡、四唑、1,2,4,5-四吡、1,2,3,4-四吡、1,2,3,5-四吡、嘌呤、蝶啶、吡啶及苯並噻二唑。

芳族環系統就本發明之意義而言在環系統中含有6至40個C原子且不包括任何雜原子作為芳族環原子。芳族環系統就本發明之意義而言因此不含任何雜芳基。芳族環系統就本發明之意義而言意欲係指不一定只含有芳基而是其中此外多個芳基可能以非芳族單元(諸如一或多個隨意經取代之C、Si、N、O或S原子)連接的系統。非芳族單元在此情況下較佳包含少於10%非H之原子，相對於整個芳族環系統中非H之原子的總數。因此，例如，系統諸如9,9'-螺聯萸、9,9'-二芳基萸、三芳基胺、二芳基醚和二苯乙烯也意欲認為是就本發明之意義而言的芳族環系統，如為其中二或多個芳基例如以直鏈或環狀烷基、烯基或炔基或以矽基連接之系統。此外，其中二或多個芳基係經由單鍵彼此連接之系統也被認為是就本發明之意義而言的芳族環系統，諸如，例如系統諸如聯苯和聯三苯。

較佳地，芳族環系統係理解為化學基團，其中構成化

學基團的芳基彼此共軛。此意指芳基經由單鍵或經由具有可參與共軛的自由 π 電子對之連接單元彼此連接。連接單元較佳係選自氮原子，單 $C=C$ 單元、單 $C\equiv C$ 單元、彼等彼此共軛之多個 $C=C$ 單元及/或 $C\equiv C$ 單元、 $-O-$ 、和 $-S-$ 。

雜芳族環系統就本發明之意義而言含有5至40個芳族環原子，其中至少一者為雜原子。雜原子較佳係選自N、O或S。雜芳族環系統如上述芳族環系統所定義，且其差異為必須獲得具有至少一個雜原子作為芳族環原子中之一者。因此其不同於根據本申請案之定義的芳族環系統，其不含任何雜原子作為芳族環原子。

具有6至40個芳族環原子之芳族環系統或具有5至40個芳族環原子之雜芳族環系統特別是衍生自上述芳基和雜芳基之基團，或衍生自聯苯、聯三苯、聯四苯、萸、螺聯萸、二氫萸、二氫芘、四氫芘、茛並萸、三聚茛(truxene)、異三聚茛(isotruene)、螺三聚茛、螺異三聚茛、和茛並吡啶之基團。

就本發明之目的而言，具有1至20個C原子之直鏈烷基或具有3至20個C原子之支鏈或環狀烷基或具有2至20個C原子之烯基或炔基，其中，此外，個別H原子或 CH_2 基團可經在上述該等基團定義下之基團取代，較佳意指基團甲基、乙基、正丙基、異丙基、正丁基、異丁基、二級丁基、三級丁基、2-甲基丁基、正戊基、二級戊基、環戊基、新戊基、正己基、環己基、新己基、正庚基、環庚基、正辛基、環辛基、2-乙基己基、三氟甲基、五氟乙

基、2,2,2-三氟乙基、乙烯基、丙烯基、丁烯基、戊烯基、環戊烯基、己烯基、環己烯基、庚烯基、環庚烯基、辛烯基、環辛烯基、乙炔基、丙炔基、丁炔基、戊炔基、己炔基或辛炔基。

具有1至20個C原子之烷氧基或烷硫基(thioalkyl)較佳意指甲氧基、三氟甲氧基、乙氧基、正丙氧基、異丙氧基、正丁氧基、異丁氧基、二級丁氧基、三級丁氧基、正戊氧基、二級戊氧基、2-甲基丁氧基、正己氧基、環己氧基、正庚氧基、環庚氧基、正辛氧基、環辛氧基、2-乙基己氧基、五氟乙氧基、2,2,2-三氟乙氧基、甲硫基、乙硫基、正丙硫基、異丙硫基、正丁硫基、異丁硫基、二級丁硫基、三級丁硫基、正戊硫基、二級戊硫基、正己硫基、環己硫基、正庚硫基、環庚硫基、正辛硫基、環辛硫基、2-乙基己硫基、三氟甲硫基、五氟乙硫基、2,2,2-三氟乙硫基、乙烯硫基、丙烯硫基、丁烯硫基、戊烯硫基、環戊烯硫基、己烯硫基、環己烯硫基、庚烯硫基、環庚烯硫基、辛烯硫基、環辛烯硫基、乙炔硫基、丙炔硫基、丁炔硫基、戊炔硫基、己炔硫基、庚炔硫基或辛炔硫基。

較佳地，在式(I)化合物中，基團A為C。

此外，較佳地， Z^1 係選自 CR^1 和 CR^2 。

此外，較佳地， Z^2 為 CR^2 。

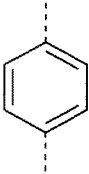
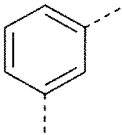
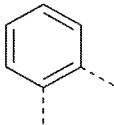
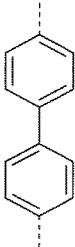
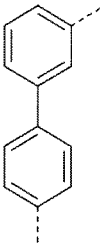
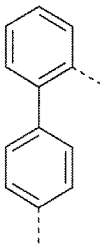
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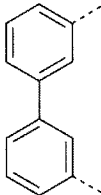
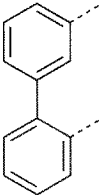
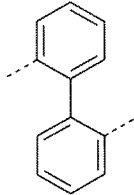
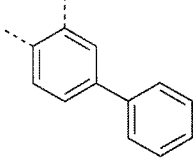
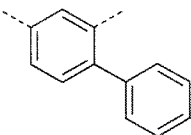
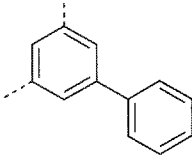
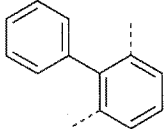
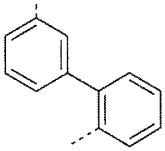
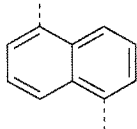
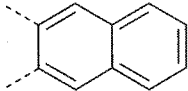
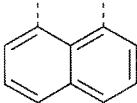
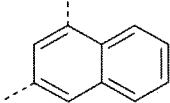
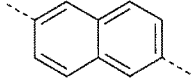
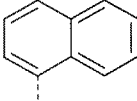
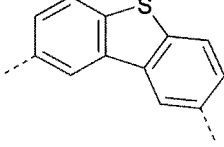
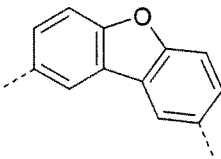
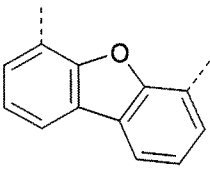
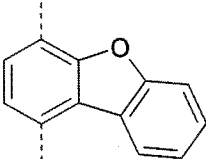
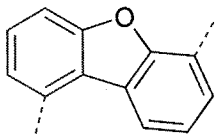
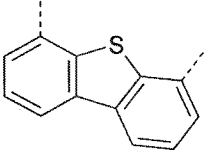
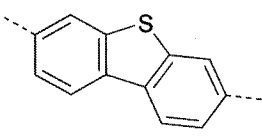
此外，較佳的是式(I)化合物之每個芳族環最多三個選自基團 Z^1 、 Z^2 和 Z^3 之基團為N。更佳地，在式(I)化合物

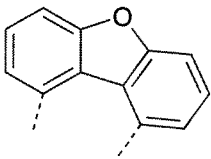
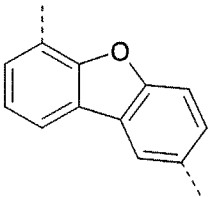
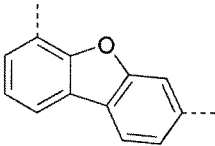
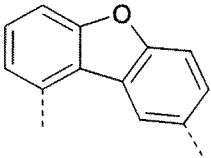
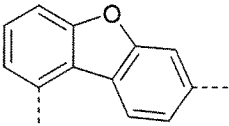
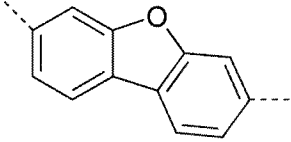
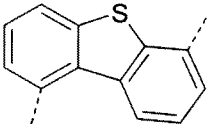
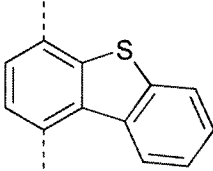
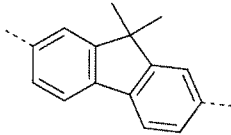
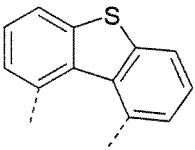
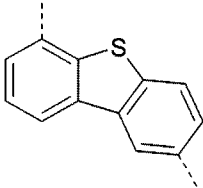
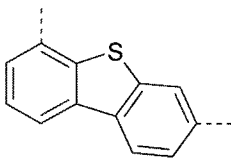
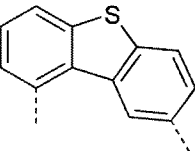
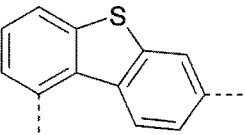
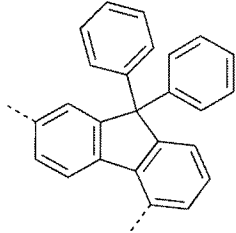
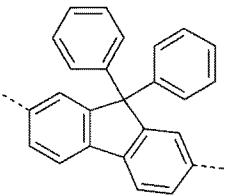
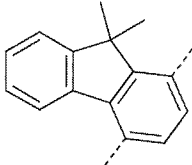
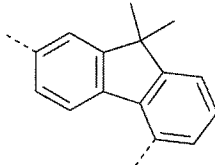
中，最多三個選自基團 Z^1 、 Z^2 和 Z^3 之基團為N。

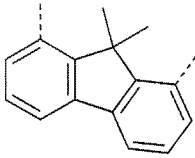
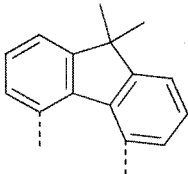
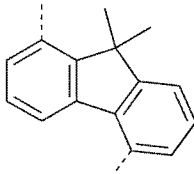
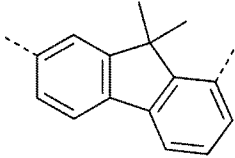
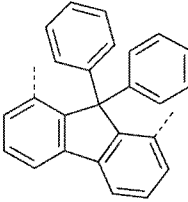
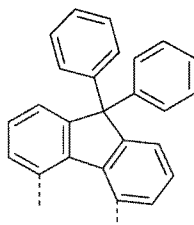
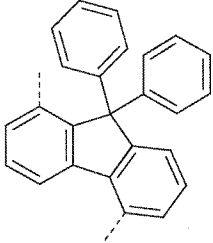
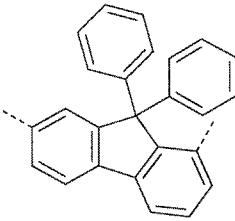
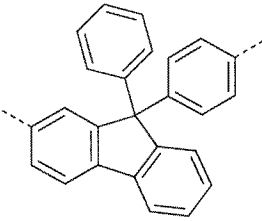
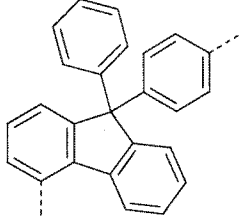
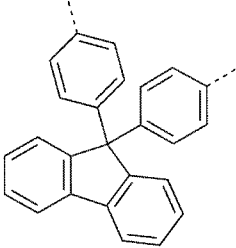
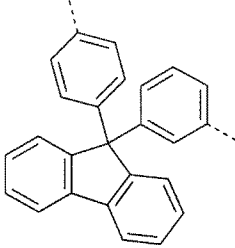
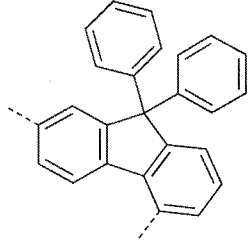
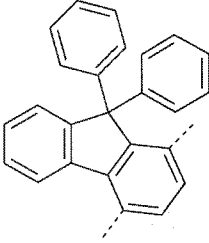
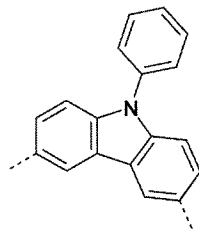
較佳地，基團 Ar^L 係選自具有6至30個芳族環原子之芳族環系統，其可經一或多個基團 R^4 取代。特佳的是若 Ar^L 係選自衍生自苯、聯苯、聯三苯、萘基、蒾基、茛並蒾基、螺聯蒾基、二苯並呋喃基、二苯並噻吩基、和卟啉基之二價基團，則彼等可各自經一或多個基團 R^4 取代。最佳地， Ar^L 係衍生自苯之二價基團，其可經一或多個基團 R^4 取代。

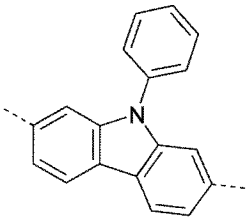
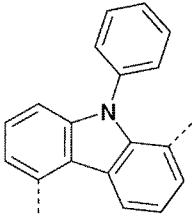
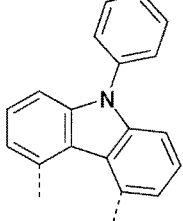
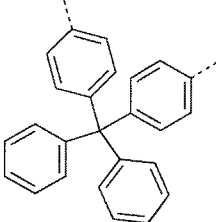
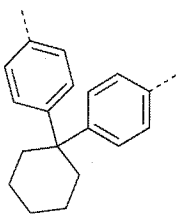
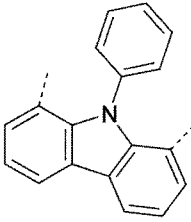
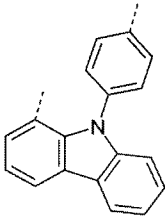
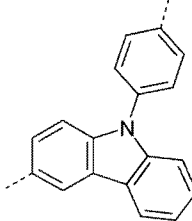
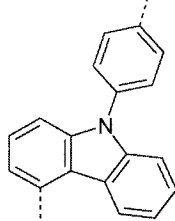
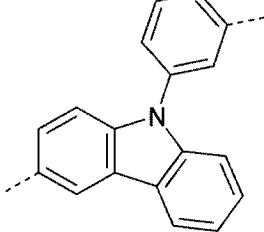
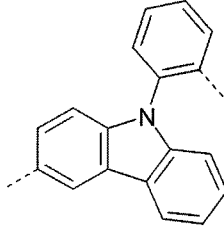
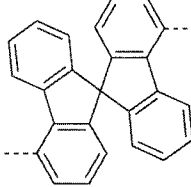
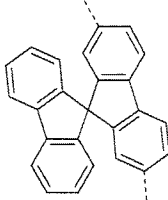
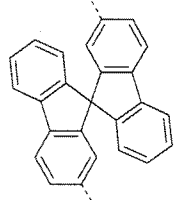
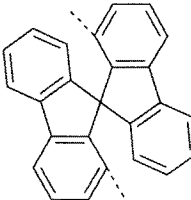
較佳基團 Ar^L 符合下列式

		
Ar^L-1	Ar^L-2	Ar^L-3
		

Ar ^L -4	Ar ^L -5	Ar ^L -6
		
Ar ^L -7	Ar ^L -8	Ar ^L -9
		
Ar ^L -10	Ar ^L -11	Ar ^L -12
		
Ar ^L -13	Ar ^L -14	Ar ^L -15
		
Ar ^L -16	Ar ^L -17	Ar ^L -18
		
Ar ^L -19	Ar ^L -20	Ar ^L -21
		
Ar ^L -22	Ar ^L -23	Ar ^L -24
		
Ar ^L -25	Ar ^L -26	Ar ^L -27

		
Ar ^L -28	Ar ^L -29	Ar ^L -30
		
Ar ^L -31	Ar ^L -32	Ar ^L -33
		
Ar ^L -34	Ar ^L -35	Ar ^L -36
		
Ar ^L -37	Ar ^L -38	Ar ^L -39
		
Ar ^L -40	Ar ^L -41	Ar ^L -42
		
Ar ^L -43	Ar ^L -44	Ar ^L -45

		
Ar ^L -46	Ar ^L -47	Ar ^L -48
		
Ar ^L -49	Ar ^L -50	Ar ^L -51
		
Ar ^L -52	Ar ^L -53	Ar ^L -54
		
Ar ^L -55	Ar ^L -56	Ar ^L -57
		
Ar ^L -58	Ar ^L -59	Ar ^L -60

		
Ar ^L -61	Ar ^L -62	Ar ^L -63
		
Ar ^L -64	Ar ^L -65	Ar ^L -66
		
Ar ^L -67	Ar ^L -68	Ar ^L -69
		
Ar ^L -70	Ar ^L -71	Ar ^L -72
		
Ar ^L -73	Ar ^L -74	Ar ^L -75

其中虛線表示二價基團至式(I)之其餘部分的鍵。

上述基團之中特佳為根據式 Ar^L-1、Ar^L-2、Ar^L-3、Ar^L-4、Ar^L-15、Ar^L-20、Ar^L-25、和 Ar^L-36中之一者的基團。

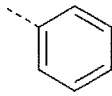
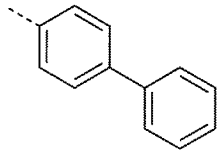
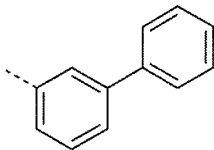
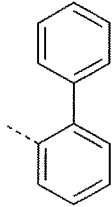
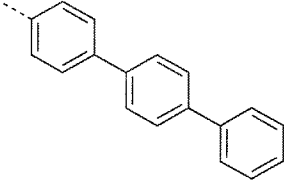
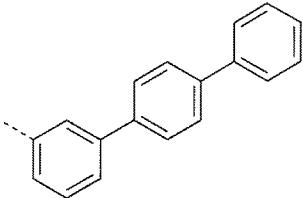
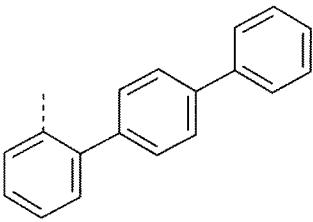
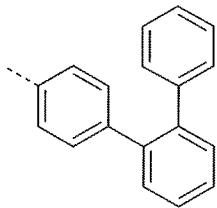
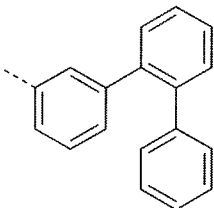
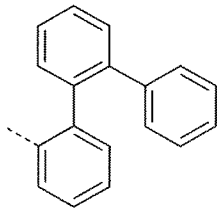
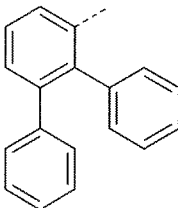
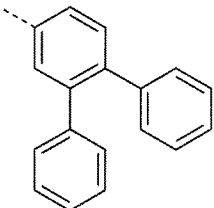
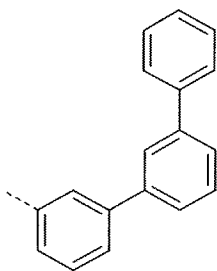
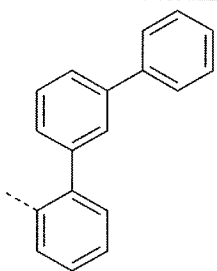
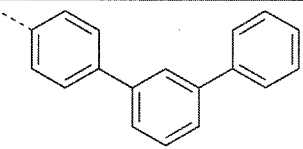
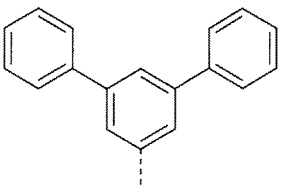
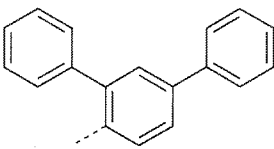
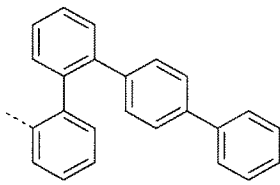
較佳的是標號 k 為 0，意指基團 Ar^L 不存在，所以該螺聯萸和該胺的氮原子彼此直接連接。

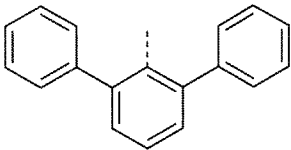
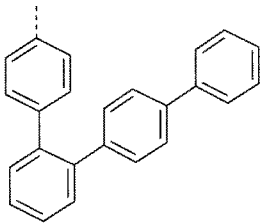
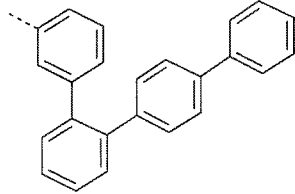
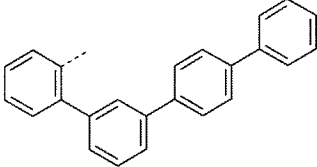
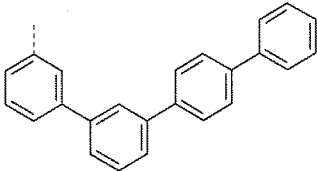
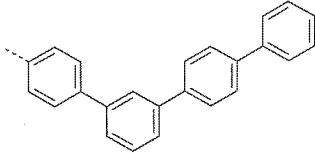
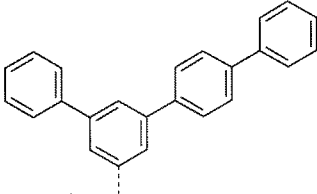
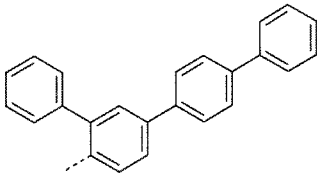
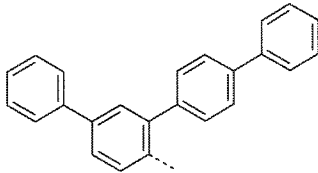
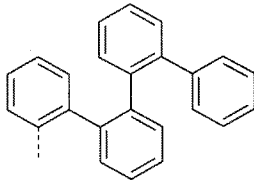
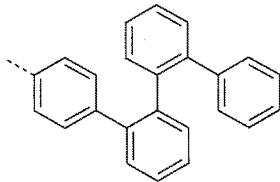
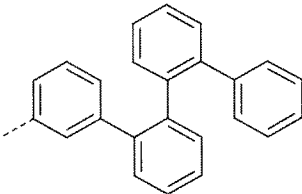
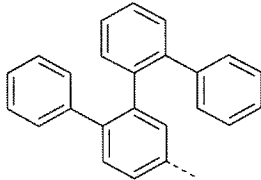
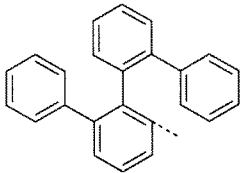
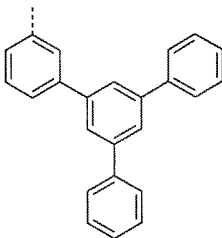
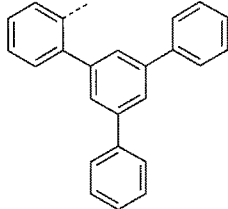
較佳地，基團 Ar^1 係相同或不同地選自衍生自下列基團之基團，彼等各自隨意地經一或多個基團 R^4 取代，或選自 2 或 3 個衍生自下列基團之基團的組合，彼等各自隨意地經一或多個基團 R^4 取代：苯基、聯苯基、聯三苯基、聯四苯基、萘基、萸基(尤其是 9,9'-二甲基萸基和 9,9'-二苯基萸基)、苯並萸基、螺聯萸基、茛並萸基、二苯並呋喃基、二苯並噻吩基、呋唑基、苯並呋喃基、苯並噻吩基、吡啶基、喹啉基、吡啶基、嘧啶基、吡嗪基、噻嗪基和三吡嗪基。

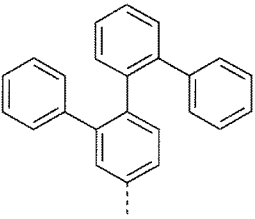
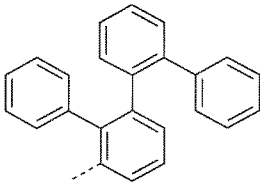
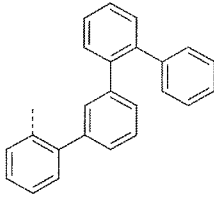
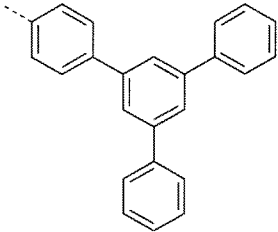
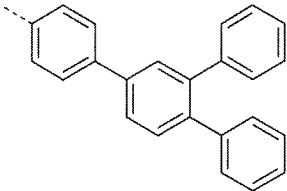
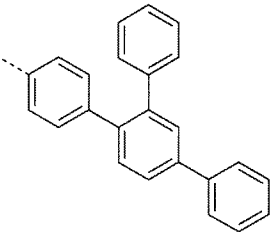
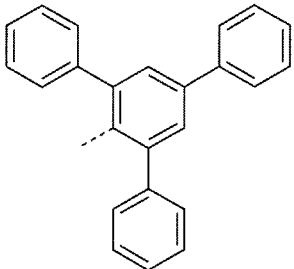
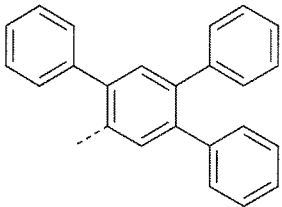
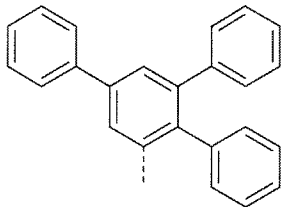
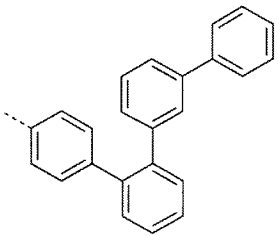
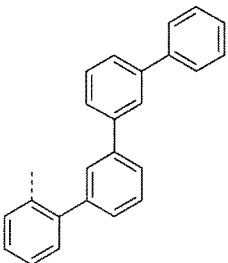
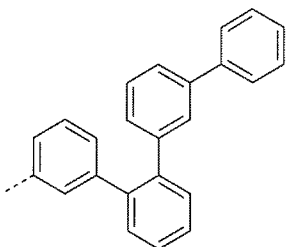
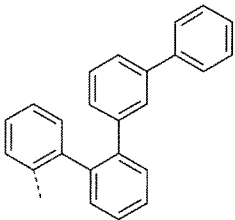
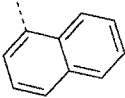
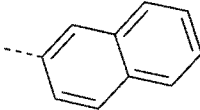
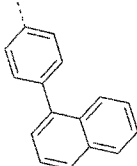
特佳基團 Ar^1 係相同或不同地選自苯基、聯苯基、聯三苯基、聯四苯基、萘基、萸基(尤其是 9,9'-二甲基萸基和 9,9'-二苯基萸基)、苯並萸基、螺聯萸基、茛並萸基、二苯並呋喃基、二苯並噻吩基、呋唑基、苯並呋喃基、苯並噻吩基、苯並稠合的二苯並呋喃基、苯並稠合的二苯並噻吩基、萘基取代之苯基、萸基取代之苯基、螺聯萸基取代之苯基、二苯並呋喃基取代之苯基、二苯並噻吩基取代之苯基、呋唑基取代之苯基、吡啶基取代之苯基、嘧啶基取代之苯基、和三吡嗪基取代之苯基，彼等各自可隨意地經一或多個基團 R^4 取代。

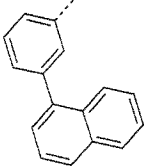
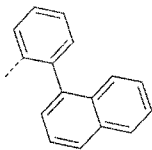
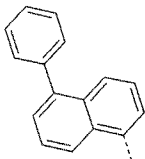
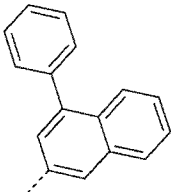
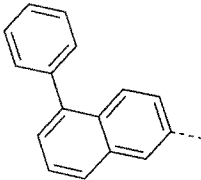
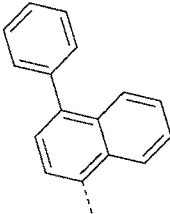
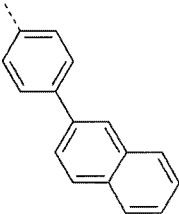
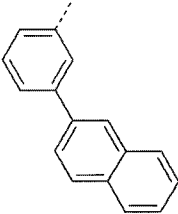
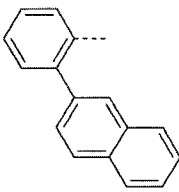
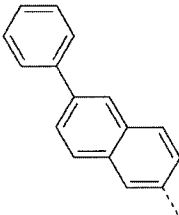
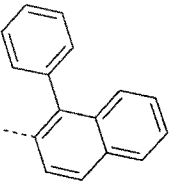
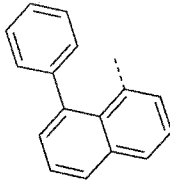
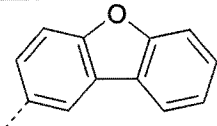
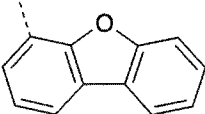
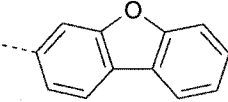
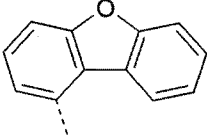
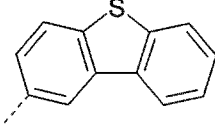
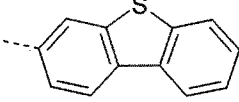
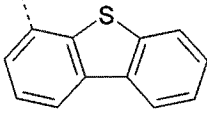
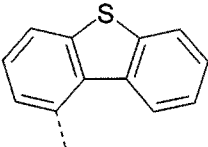
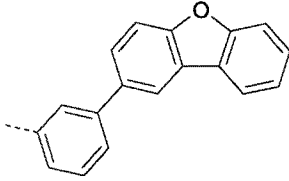
較佳地，基團 Ar^1 在每次出現時係不同地選擇。

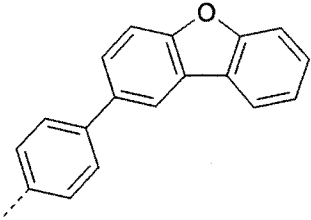
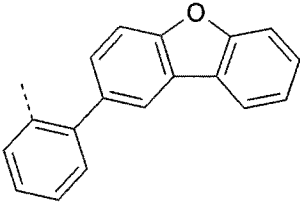
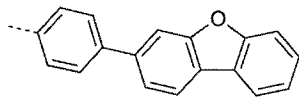
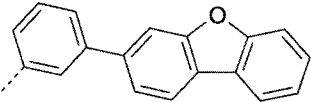
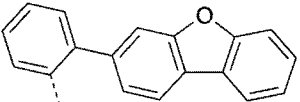
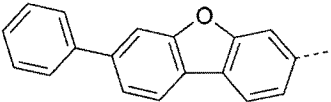
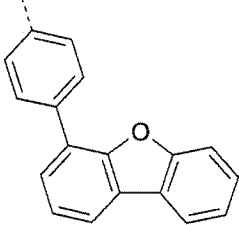
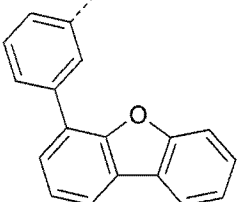
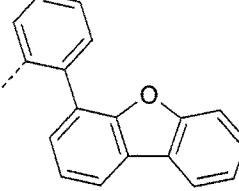
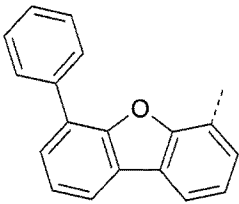
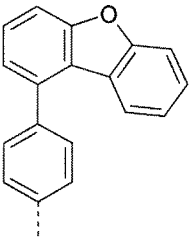
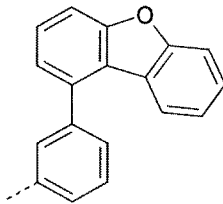
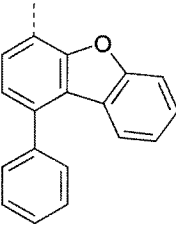
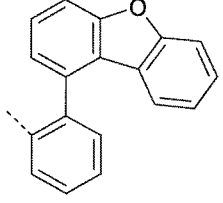
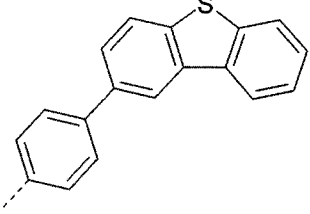
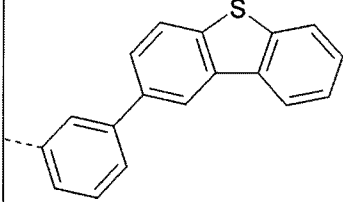
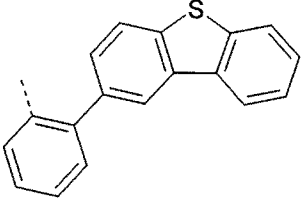
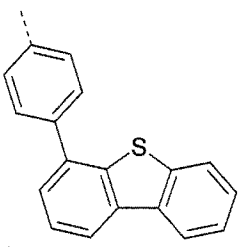
較佳基團 Ar^1 係相同或不同地選自下列式之基團

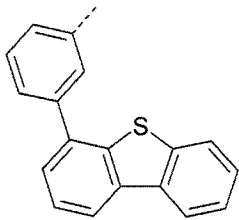
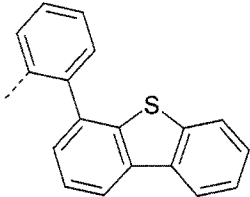
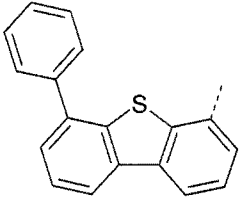
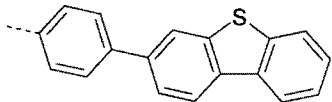
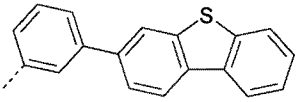
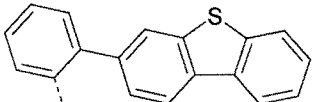
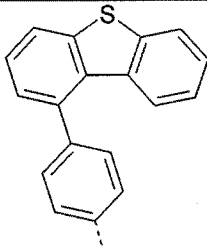
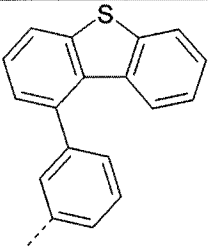
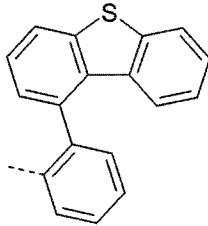
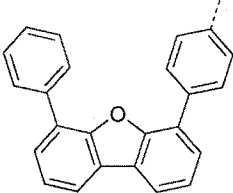
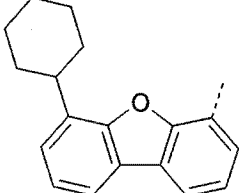
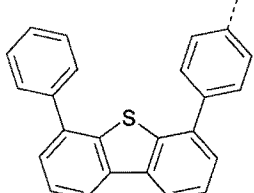
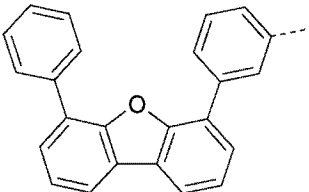
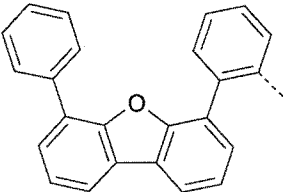
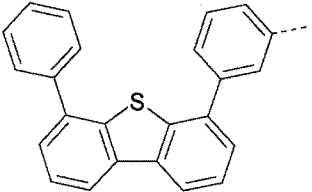
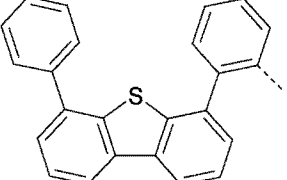
		
Ar-1	Ar-2	Ar-3
		
Ar-4	Ar-5	Ar-6
		
Ar-7	Ar-8	Ar-9
		
Ar-10	Ar-11	Ar-12
		
Ar-13	Ar-14	Ar-15
		
Ar-16	Ar-17	Ar-18

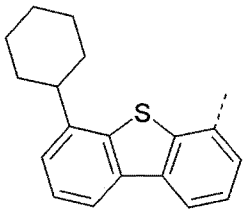
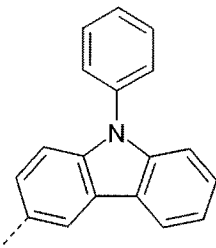
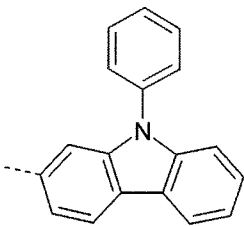
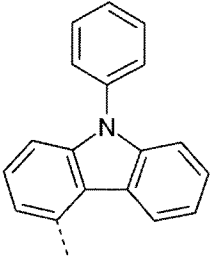
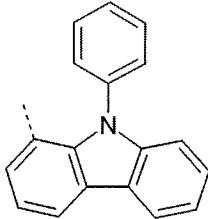
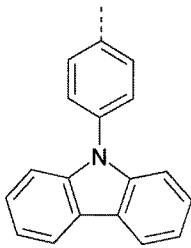
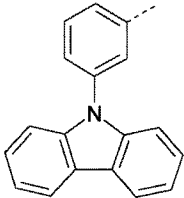
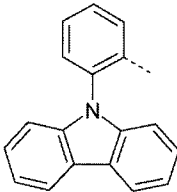
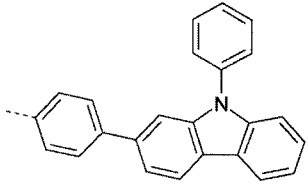
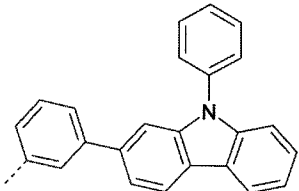
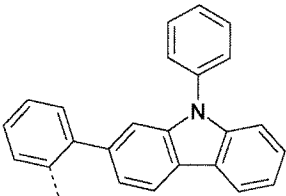
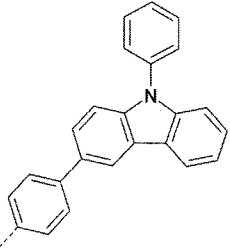
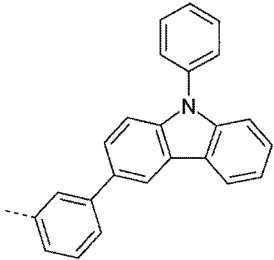
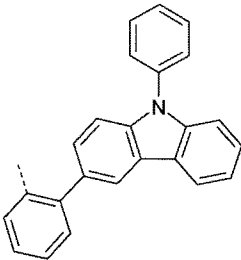
		
Ar-19		
		
Ar-20	Ar-21	Ar-22
		
Ar-23	Ar-24	Ar-25
		
Ar-26	Ar-27	Ar-28
		
Ar-29	Ar-30	Ar-31
		
Ar-32	Ar-33	Ar-34

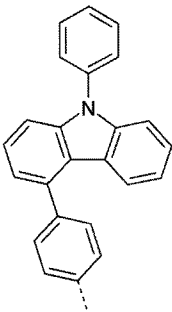
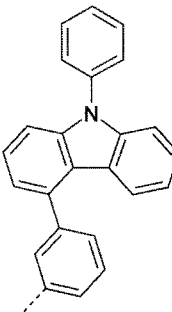
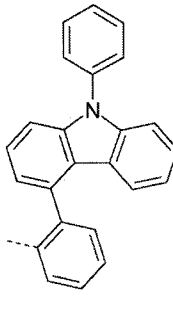
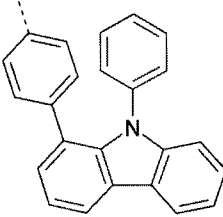
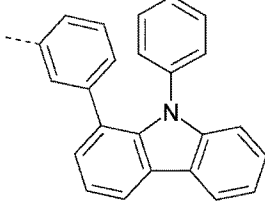
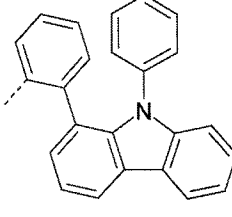
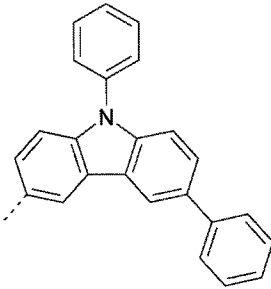
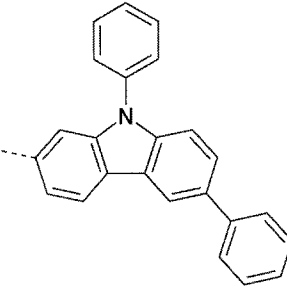
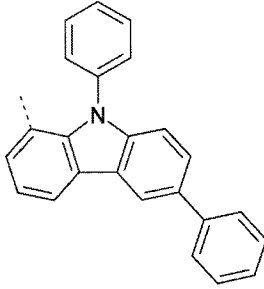
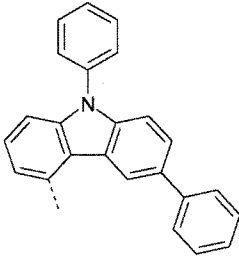
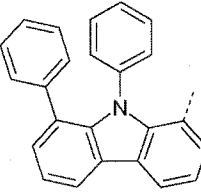
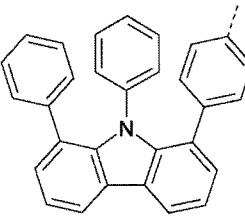
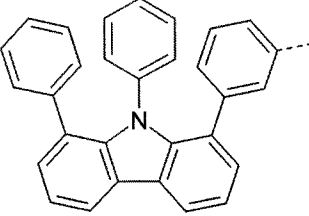
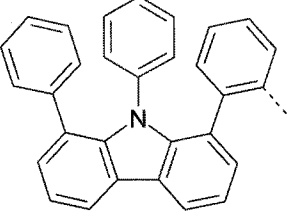
		
Ar-35	Ar-36	Ar-37
		
Ar-38	Ar-39	Ar-40
		
Ar-41	Ar-42	Ar-43
		
Ar-44	Ar-45	Ar-46
		
Ar-47		
		

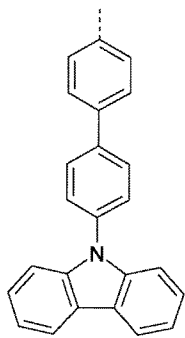
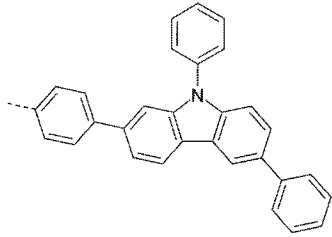
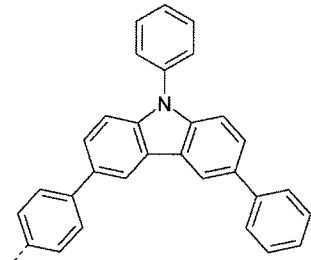
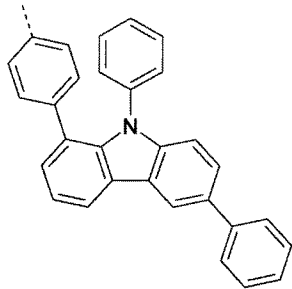
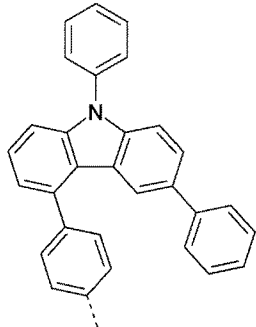
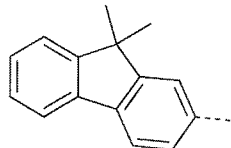
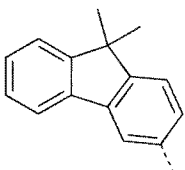
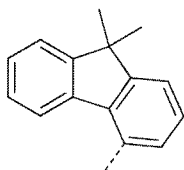
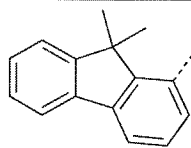
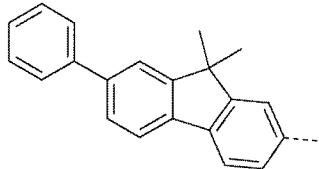
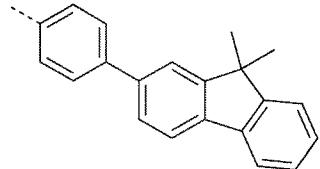
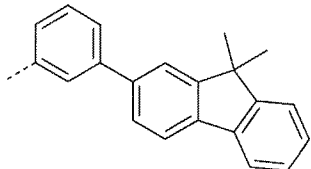
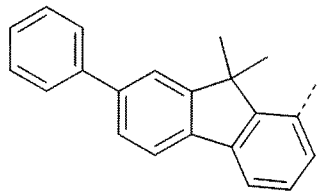
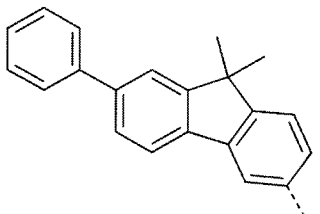
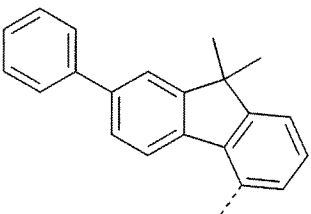
Ar-48	Ar-49	Ar-50
		
Ar-51	Ar-52	Ar-53
		
Ar-54	Ar-55	Ar-56
		
Ar-57	Ar-58	Ar-59
		
Ar-60	Ar-61	Ar-62
		
Ar-63	Ar-64	Ar-65
		
Ar-66	Ar-67	Ar-68
		

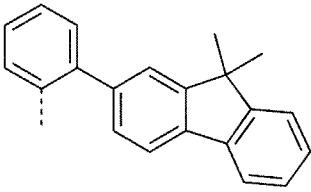
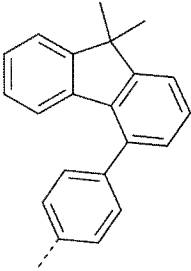
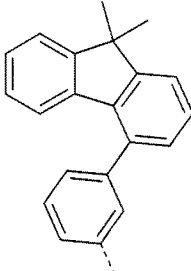
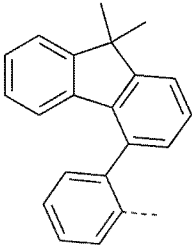
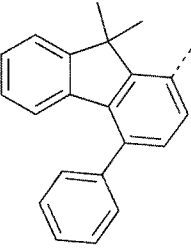
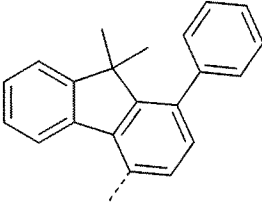
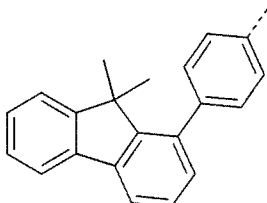
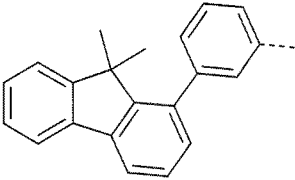
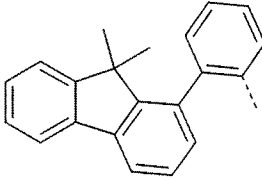
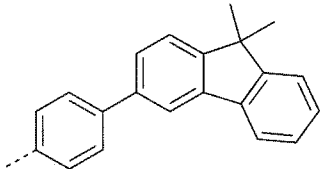
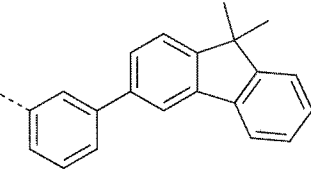
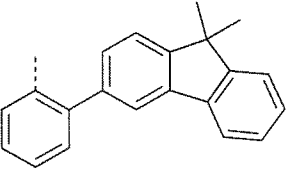
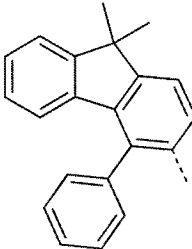
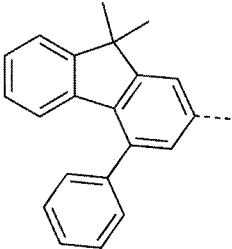
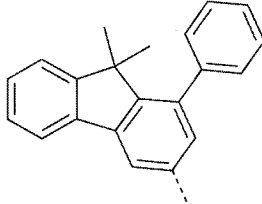
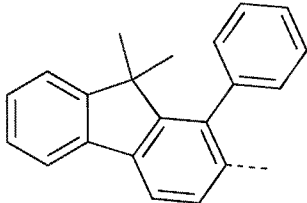
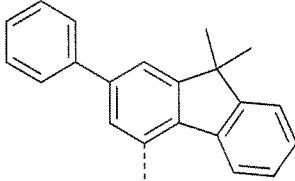
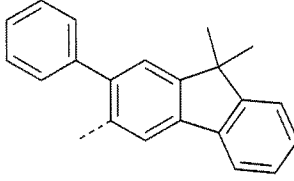
Ar-69	Ar-70	Ar-71
		
Ar-72	Ar-73	Ar-74
		
Ar-75	Ar-76	Ar-77
		
Ar-78	Ar-79	Ar-80
		
Ar-81	Ar-82	Ar-83
		
Ar-84	Ar-85	Ar-86
		
Ar-87	Ar-88	Ar-89

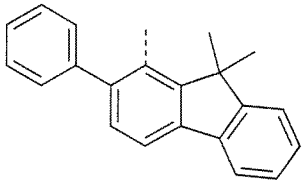
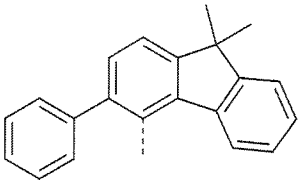
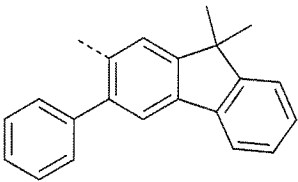
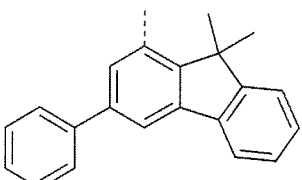
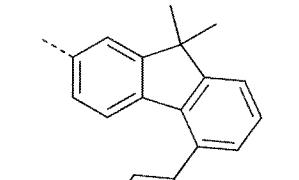
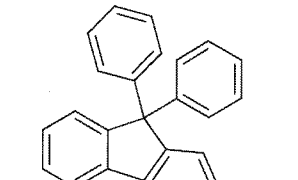
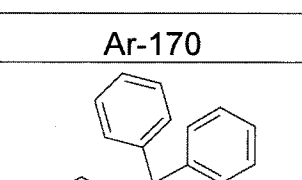
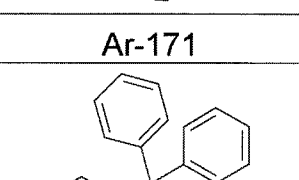
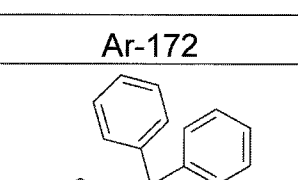
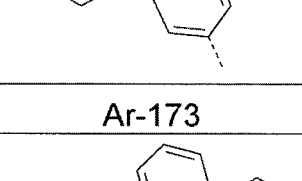
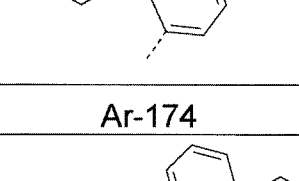
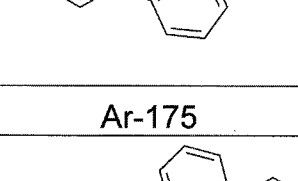
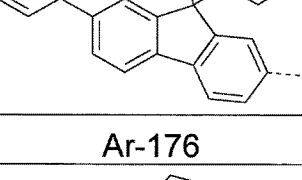
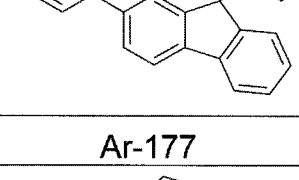
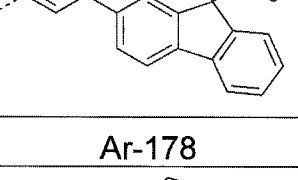
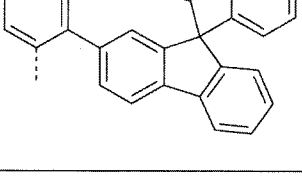
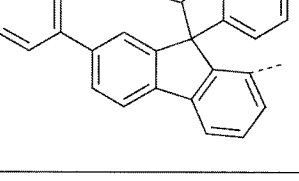
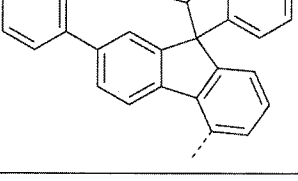
		
Ar-90	Ar-91	Ar-92
		
Ar-93	Ar-94	Ar-95
		
Ar-96	Ar-97	Ar-98
		
Ar-99	Ar-100	Ar-101
		
Ar-102	Ar-103	Ar-104
		
Ar-105		

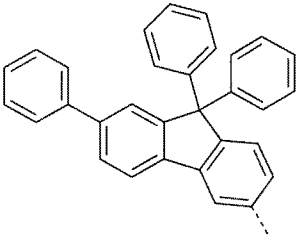
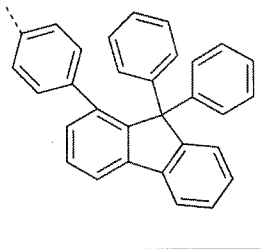
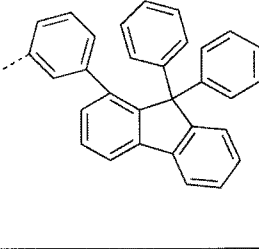
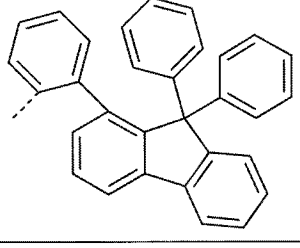
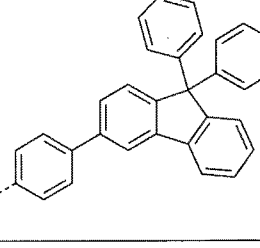
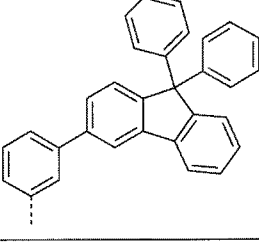
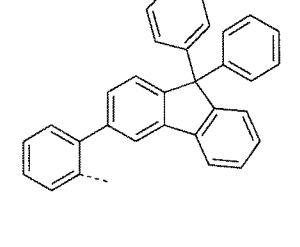
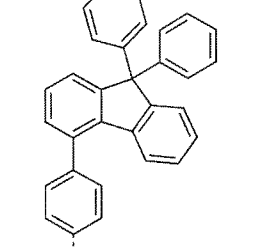
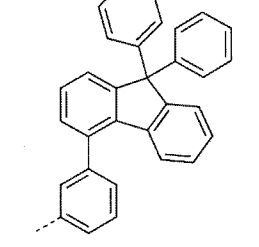
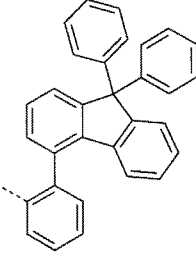
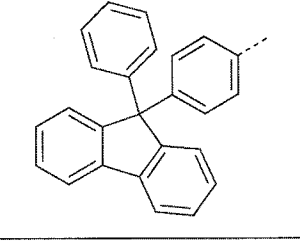
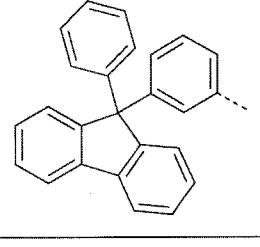
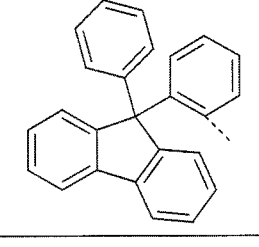
		
Ar-106	Ar-107	Ar-108
		
Ar-109	Ar-110	Ar-111
		
Ar-112	Ar-113	
		
Ar-114	Ar-115	Ar-116
		
Ar-117	Ar-118	Ar-119

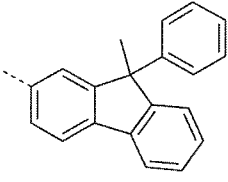
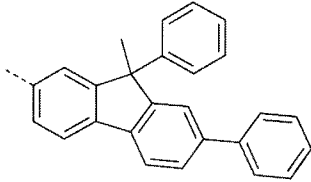
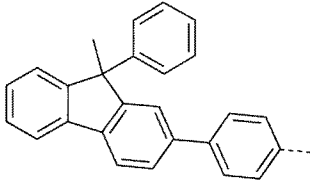
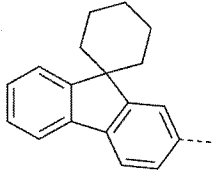
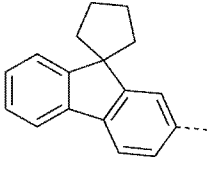
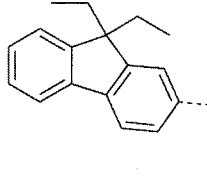
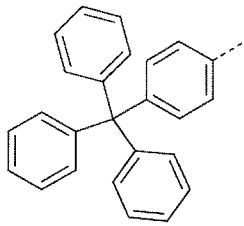
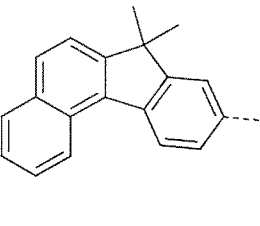
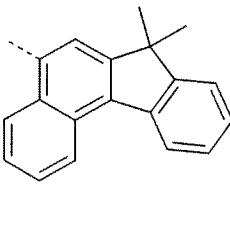
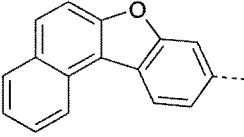
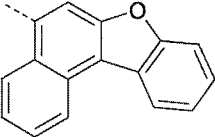
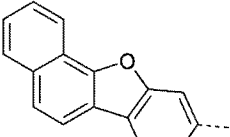
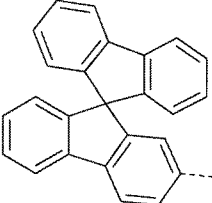
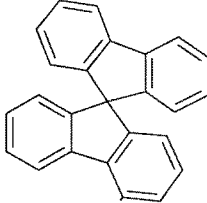
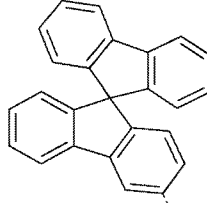
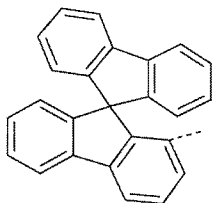
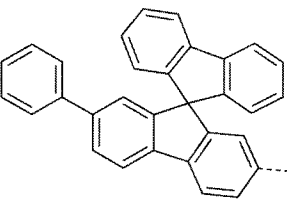
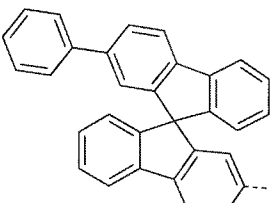
		
Ar-120	Ar-121	Ar-122
		
Ar-123	Ar-124	Ar-125
		
Ar-126	Ar-127	Ar-128
		
Ar-129	Ar-130	Ar-131
		
Ar-132	Ar-133	

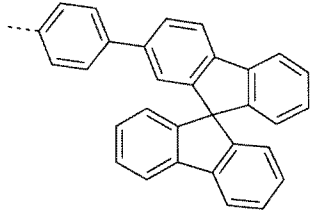
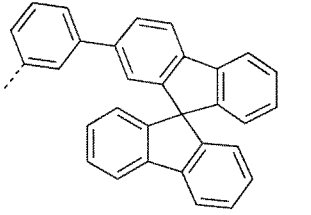
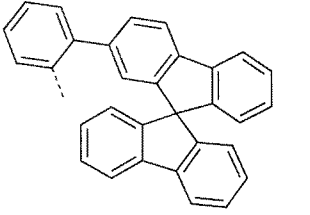
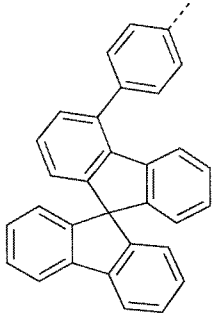
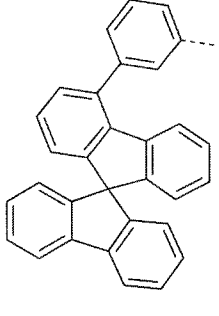
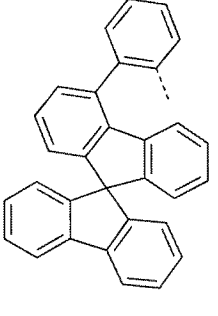
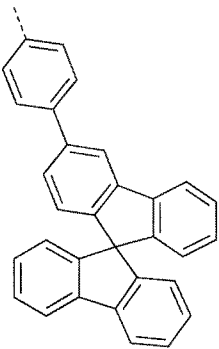
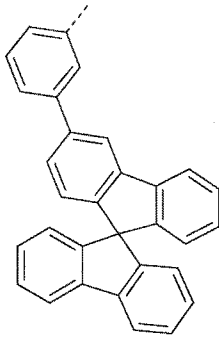
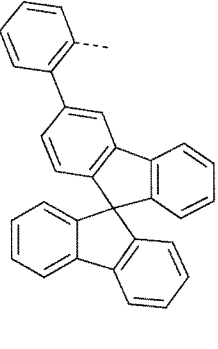
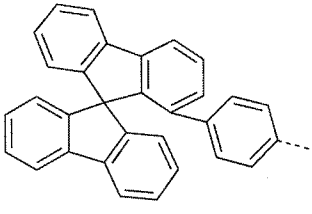
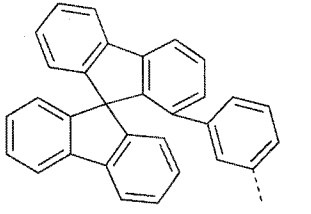
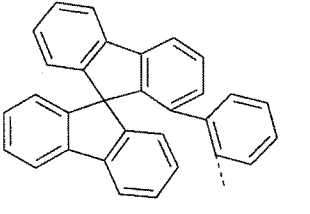
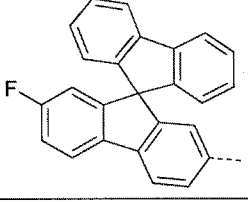
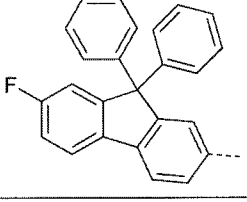
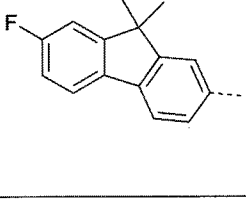
		
Ar-134	Ar-135	Ar-136
		
Ar-137	Ar-138	Ar-139
		
Ar-140	Ar-141	Ar-142
		
Ar-143	Ar-144	Ar-145
		
Ar-146	Ar-147	Ar-148

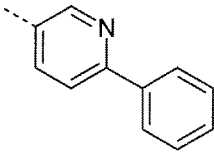
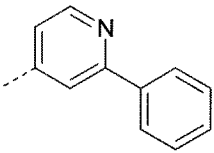
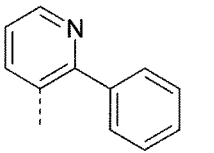
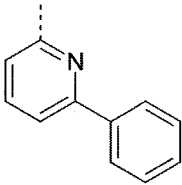
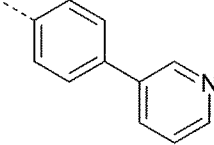
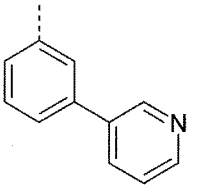
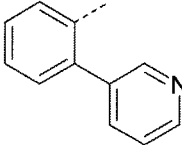
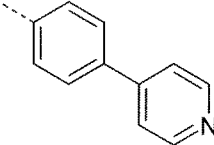
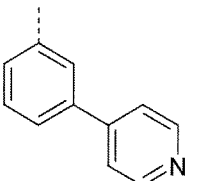
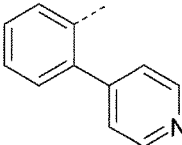
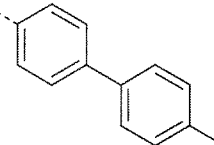
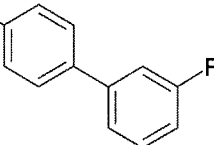
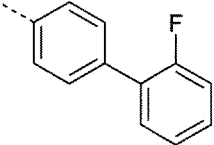
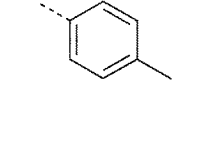
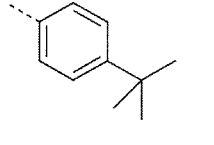
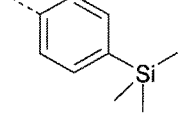
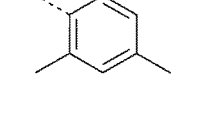
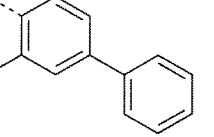
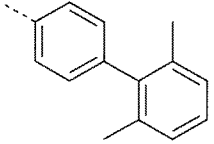
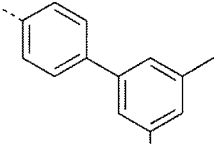
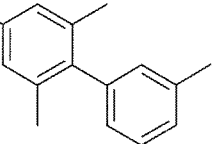
		
Ar-149	Ar-150	Ar-151
		
Ar-152	Ar-153	Ar-154
		
Ar-155	Ar-156	Ar-157
		
Ar-158	Ar-159	Ar-160
		
Ar-161	Ar-162	Ar-163
		

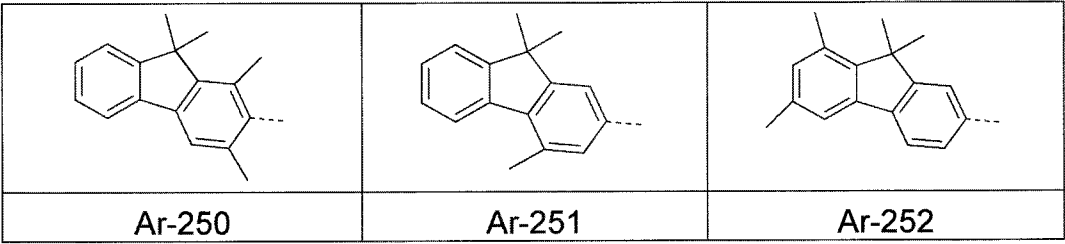
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Ar-167	Ar-168	Ar-169
		
Ar-170	Ar-171	Ar-172
		
Ar-173	Ar-174	Ar-175
		
Ar-176	Ar-177	Ar-178
		
Ar-179	Ar-180	Ar-181
		

		
Ar-182	Ar-183	Ar-184
		
Ar-185	Ar-186	Ar-187
		
Ar-188	Ar-189	Ar-190
		
Ar-191		
		
Ar-192	Ar-193	Ar-194

		
Ar-195	Ar-196	Ar-197
		
Ar-198	Ar-199	Ar-200
		
Ar-201	Ar-202	Ar-203
		
Ar-204	Ar-205	Ar-206
		
Ar-207	Ar-208	Ar-209
		
Ar-210	Ar-211	Ar-212

		
Ar-213	Ar-214	Ar-215
		
Ar-216	Ar-217	Ar-218
		
Ar-219	Ar-220	Ar-221
		
Ar-222	Ar-223	Ar-224
		
Ar-225	Ar-226	Ar-227

		
Ar-228	Ar-229	Ar-230
		
Ar-231	Ar-232	Ar-233
		
Ar-234	Ar-235	Ar-236
		
Ar-237	Ar-238	Ar-239
		
Ar-240	Ar-241	Ar-242
		
Ar-243	Ar-244	Ar-245
		
Ar-246	Ar-247	Ar-248



其中該等基團可在自由位置經基團 R^4 取代，但較佳在此等位置中未取代，及其中虛線代表至氮原子的鍵結位置。

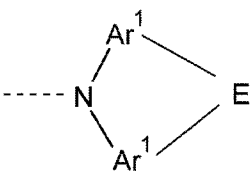
特佳基團 Ar^1 符合上述式 Ar-1、Ar-2、Ar-4、Ar-5、Ar-74、Ar-78、Ar-82、Ar-117、Ar-134、Ar-139、Ar-150、和 Ar-172 中之一者。

根據一較佳實施態樣，標號 m 為 0，意指基團 Ar^1 不以基團 E 連接。

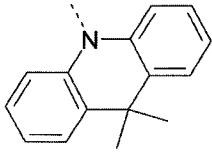
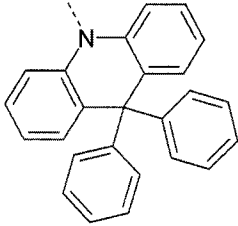
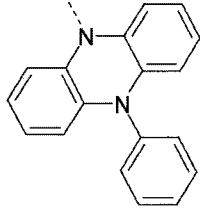
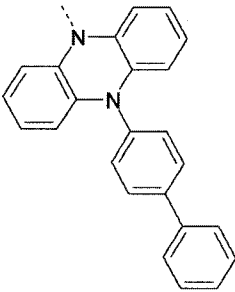
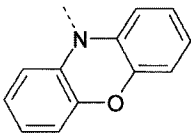
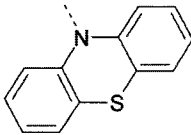
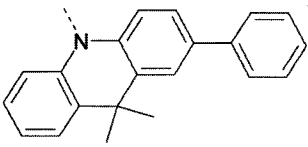
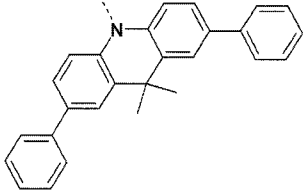
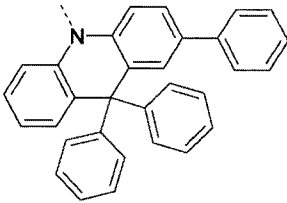
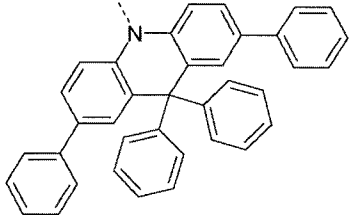
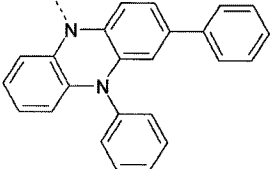
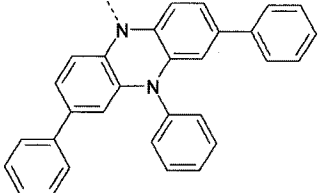
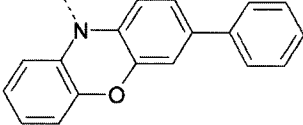
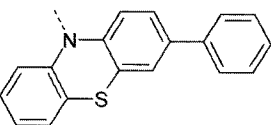
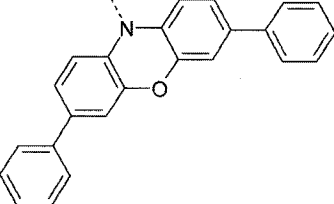
根據一替代實施態樣，其在某些條件下可為較佳，標號 m 為 1，意指團 Ar^1 以基團 E 連接。

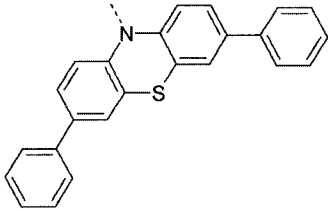
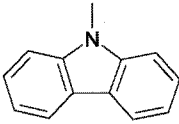
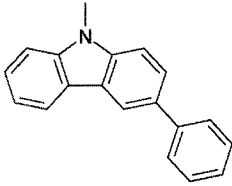
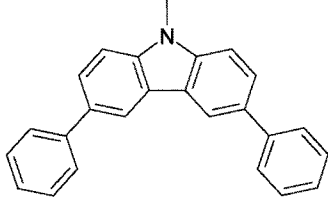
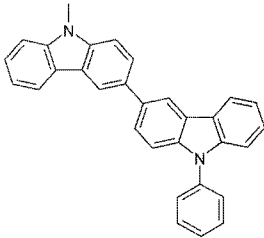
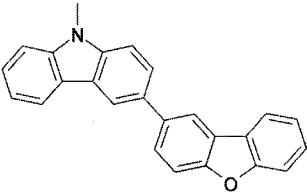
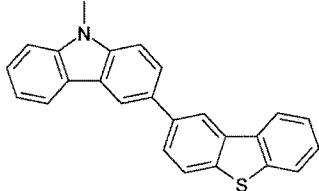
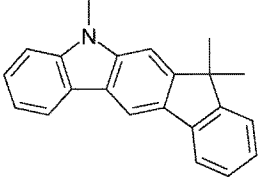
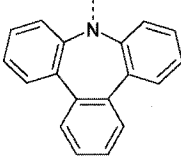
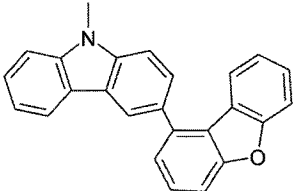
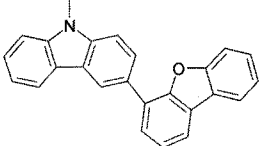
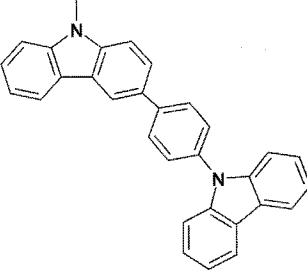
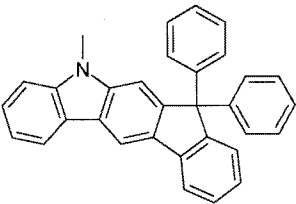
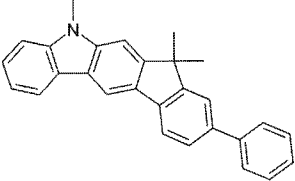
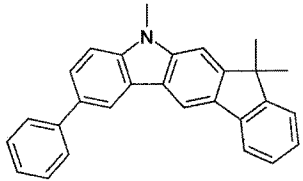
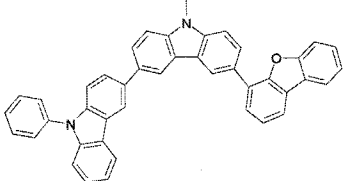
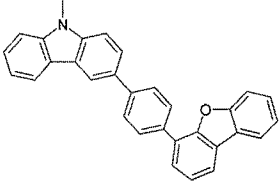
在基團 Ar^1 以基團 E 連接的情況下，較佳的是基團 Ar^1 係相同或不同地選自苯基和萘基，彼等各自可經一或多個 R^4 基團取代。此外，在該情況下，較佳的是連接該基團 Ar^1 之基團 E 係位在個別基團 Ar^1 上，較佳位於為苯基或萘基之個別基團 Ar^1 上，其位於基團 Ar^1 至胺氮原子的鍵之鄰位。此外，較佳地，在該情況下，若 E 係選自 $C(R^4)_2$ 、 NR^4 、O 和 S，則具有胺氮原子的六環係由基團 Ar^1 和 E 形成；及若 E 為單鍵，則形成五環。

在基團 Ar^1 以基團 E 連接的情況下，該等部分



的特佳實施態係選自下列式

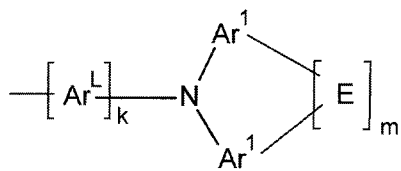
		
N-1	N-2	N-3
		
N-4	N-5	N-6
		
N-7	N-8	N-9
		
N-10	N-11	N-12
		

N-13	N-14	N-15
		
N-16	N-17	N-18
		
N-19	N-20	N-21
		
N-22	N-23	N-24
		
N-25	N-26	N-27
		
N-28	N-29	N-30
		
N-31	N-32	

其中該等基團可在自由位置經基團 R^4 取代，但較佳在

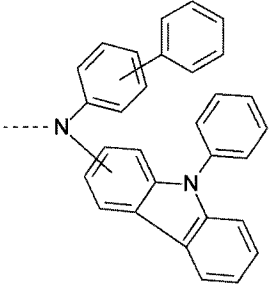
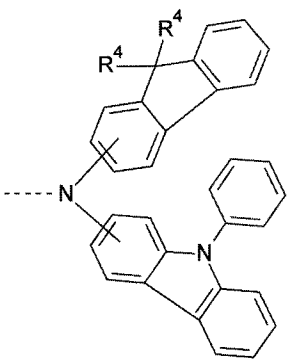
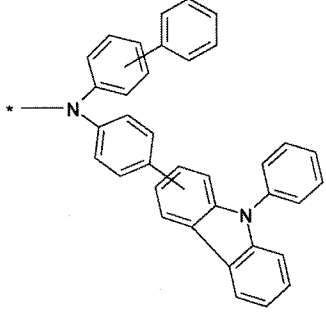
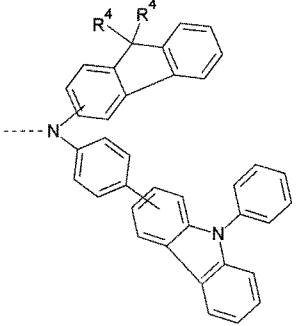
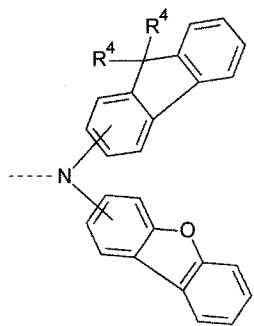
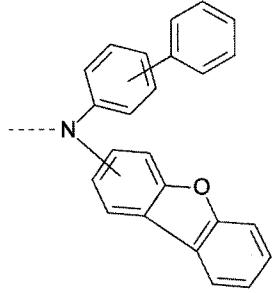
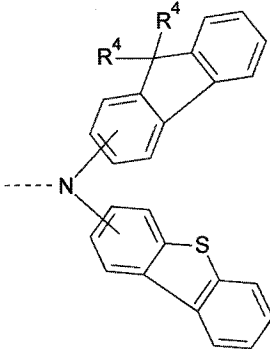
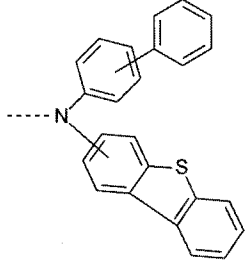
這些位置中未經取代，其中虛線代表至氮原子的鍵結位置。

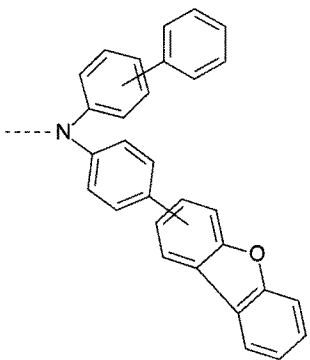
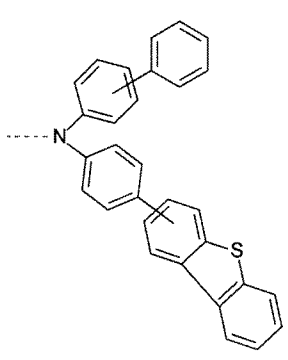
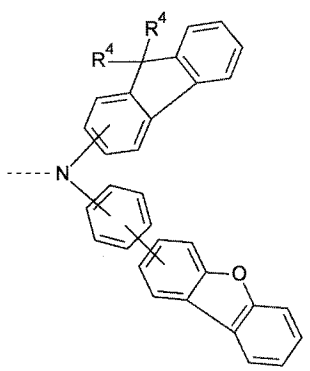
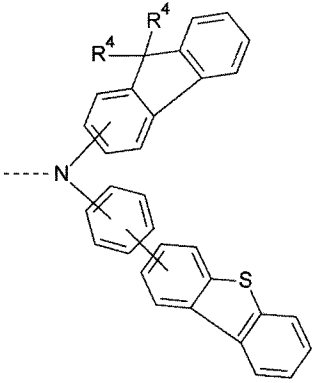
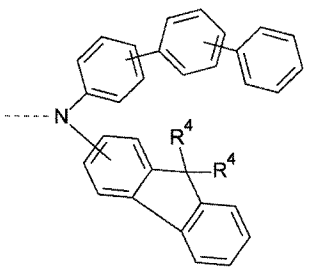
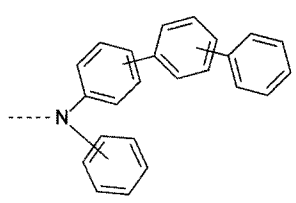
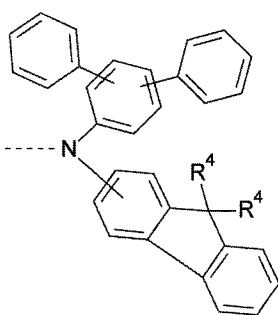
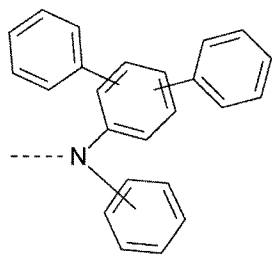
對於 $m = 0$ 之情況，在式(I)中之特佳部分

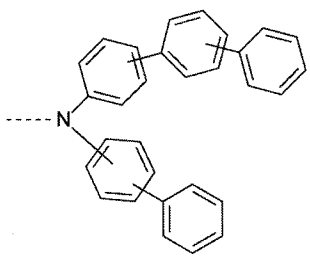
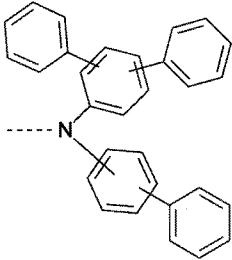
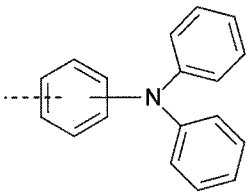
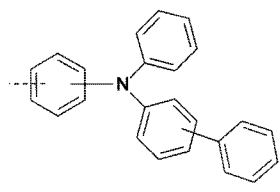
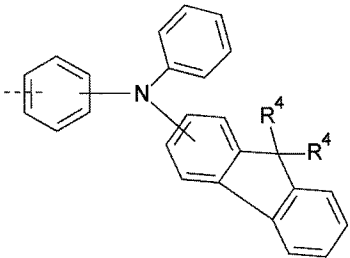
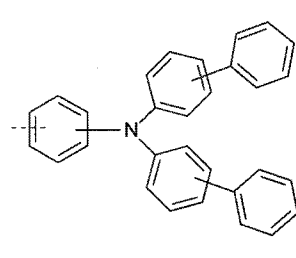
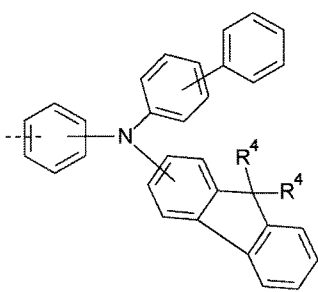
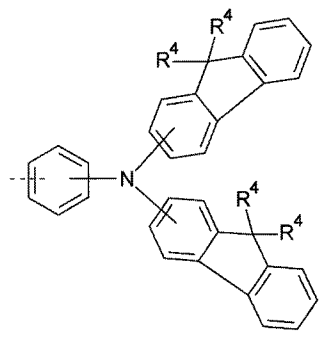
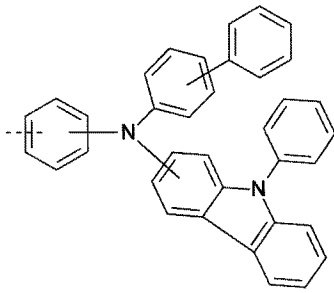
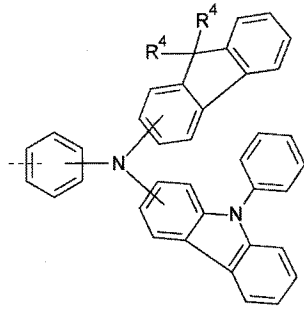


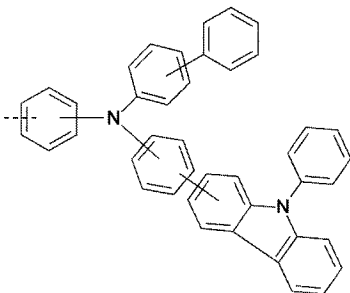
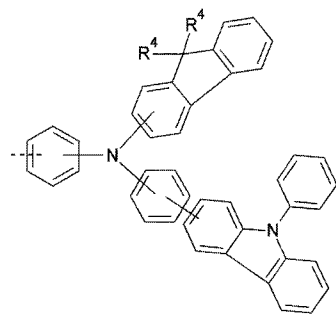
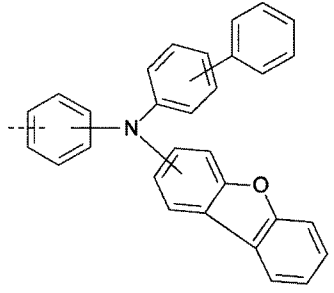
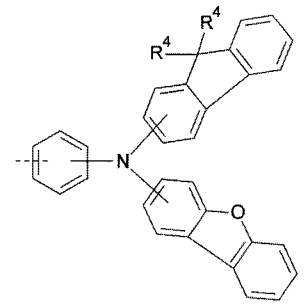
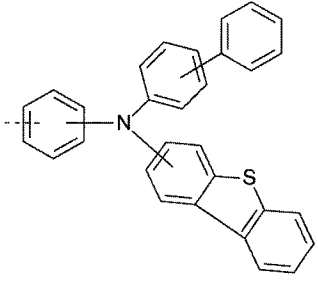
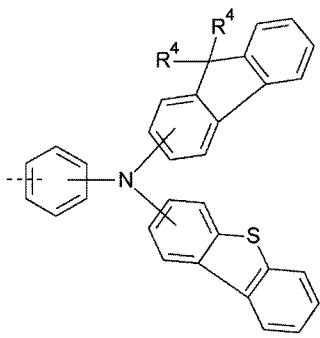
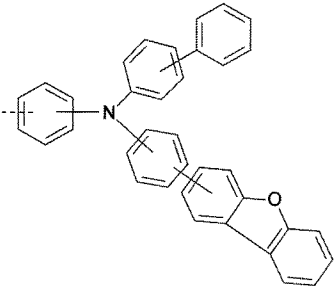
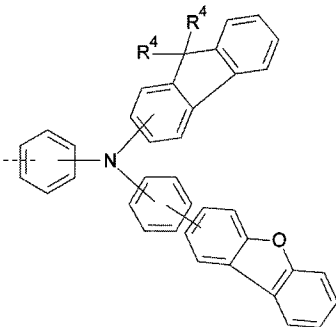
符合下列式

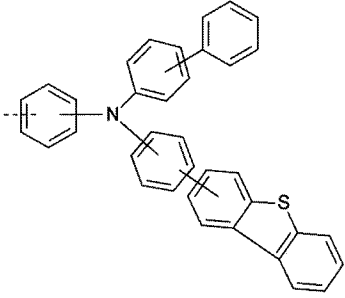
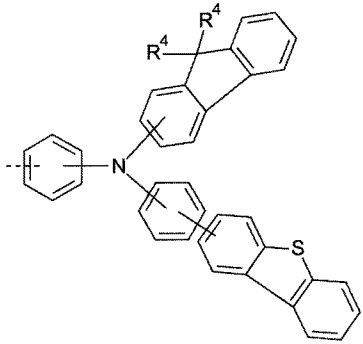
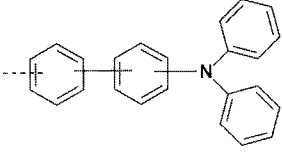
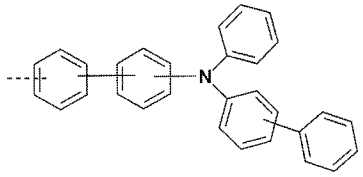
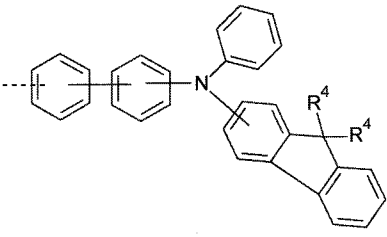
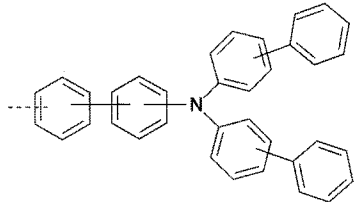
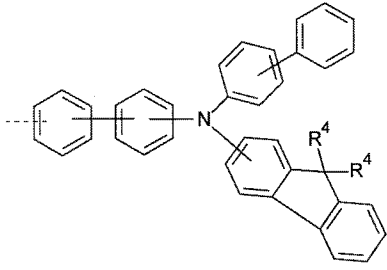
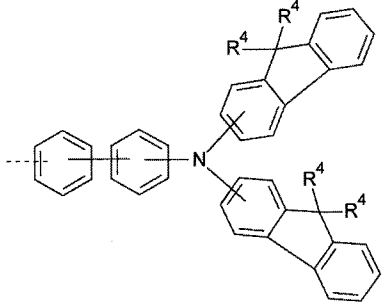
Chemical structure A-1: A nitrogen atom bonded to two phenyl rings. A dashed line is attached to the nitrogen atom.	Chemical structure A-2: A nitrogen atom bonded to a phenyl ring and a biphenyl group. A dashed line is attached to the nitrogen atom.
A-1	A-2
Chemical structure A-3: A nitrogen atom bonded to a phenyl ring and a fluorene derivative with two R^4 groups. A dashed line is attached to the nitrogen atom.	Chemical structure A-4: A nitrogen atom bonded to two biphenyl groups. A dashed line is attached to the nitrogen atom.
A-3	A-4
Chemical structure A-5: A nitrogen atom bonded to a biphenyl group and a fluorene derivative with two R^4 groups. A dashed line is attached to the nitrogen atom.	Chemical structure A-6: A nitrogen atom bonded to a fluorene derivative with two R^4 groups and another fluorene derivative with two R^4 groups. A dashed line is attached to the nitrogen atom.
A-5	A-6

	
A-7	A-8
	
A-9	A-10
	
A-11	A-12
	
A-13	A-14

	
A-15	A-16
	
A-17	A-18
	
A-19	A-20
	
A-21	A-22

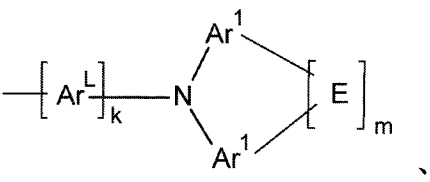
	
A-23	A-24
	
A-25	A-26
	
A-27	A-28
	
A-29	A-30
	
A-31	A-32

	
A-33	A-34
	
A-35	A-36
	
A-37	A-38
	
A-39	A-40

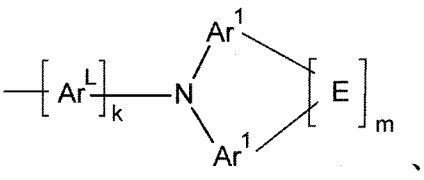
	
A-41	A-42
	
A-43	A-44
	
A-45	A-46
	
A-47	A-48

其中該等基團可在自由位置經基團 R^4 取代，但較佳在這些位置中未經取代，及其中虛線代表至式 (I) 之螺聯萸部分的鍵結位置。

基團 R^1 較佳係相同或不同地選自

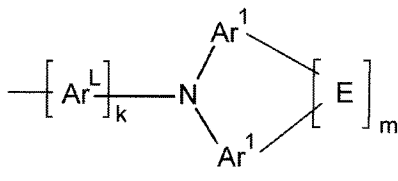


具有6至30個芳族環原子之芳族環系統、和具有5至30個芳族環原子之雜芳族環系統，其中該等芳族和雜芳族環系統在各情況下可經一或多個基團R⁵取代；特佳相同或不同地選自

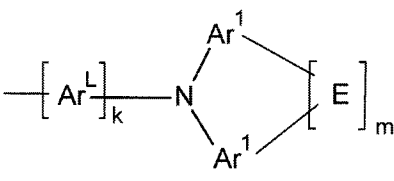


苯基、聯苯基、聯三苯基、聯四苯基、萘基、蒾基(尤其是9,9'-二甲基蒾基和9,9'-二苯基蒾基)、苯並蒾基、螺聯蒾基、茛並蒾基、二苯並呋喃基、二苯並噻吩基、呋唑基、苯並呋喃基、苯並噻吩基、苯並稠合的二苯並呋喃基、苯並稠合的二苯並噻吩基、萘基取代之苯基、蒾基取代之苯基、螺聯蒾基取代之苯基、二苯並呋喃基取代之苯基、二苯並噻吩基取代之苯基、呋唑基取代之苯基、吡啶基取代之苯基、嘧啶基取代之苯基、和三吡基取代之苯基，彼等各自可隨意地經一或多個基團R⁵取代。

對於實施態樣



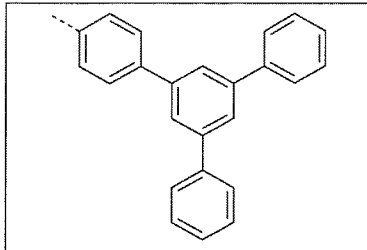
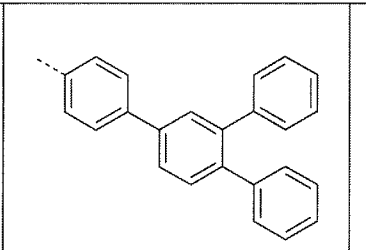
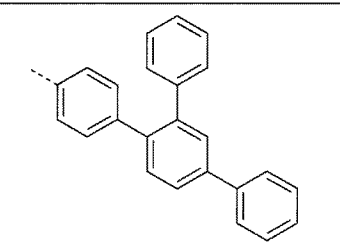
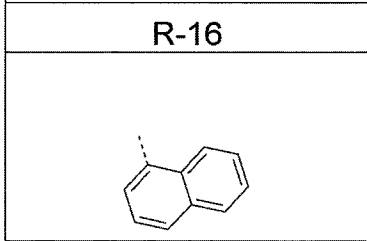
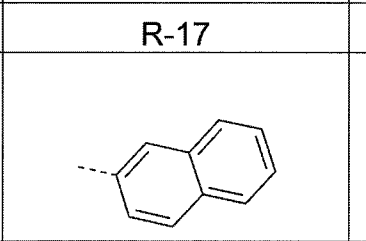
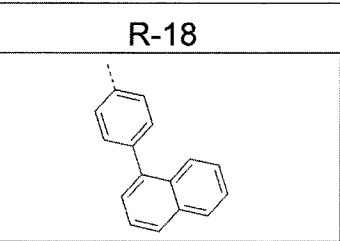
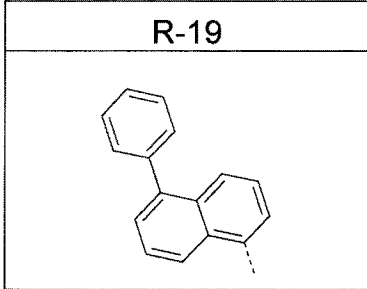
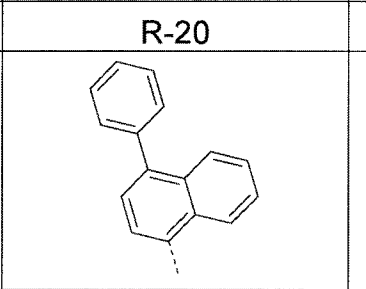
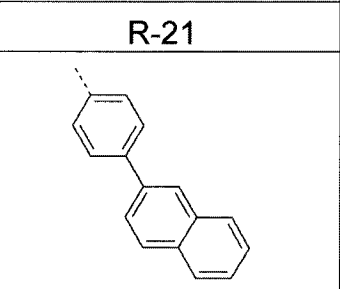
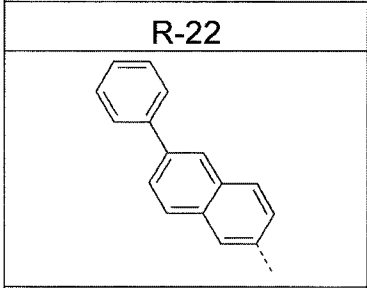
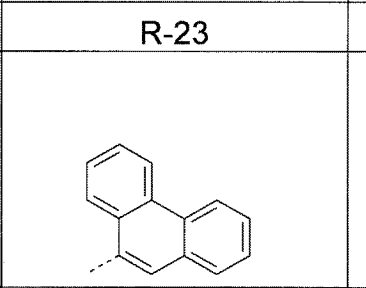
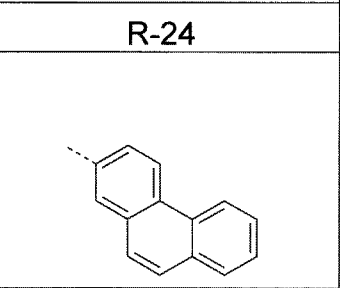
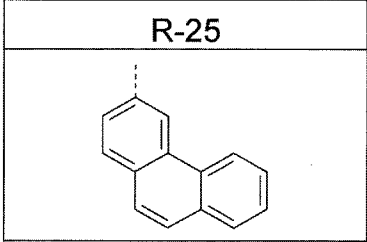
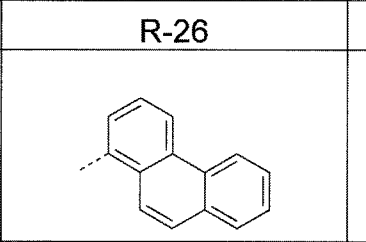
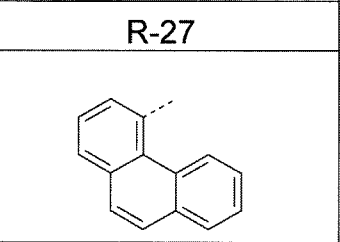
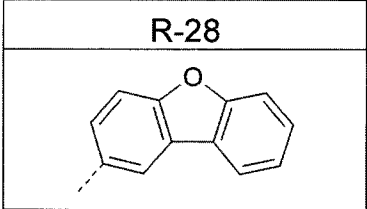
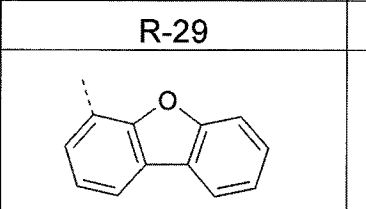
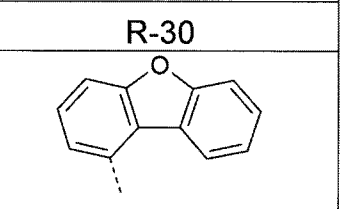
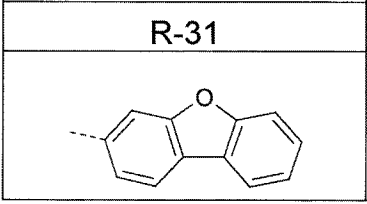
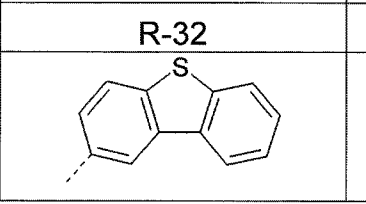
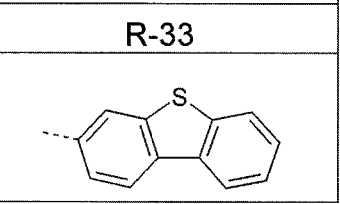
作為基團R¹，關於基團Ar^L、Ar¹、E、及標號k和m的相同較佳實施態樣例適用，如上所述在式(I)之基團

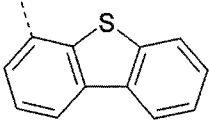
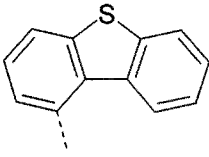
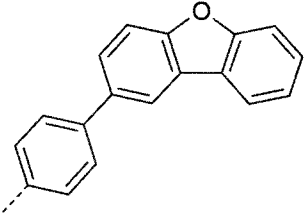
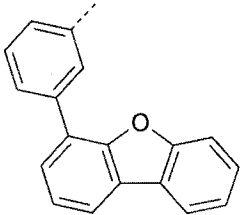
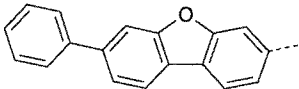
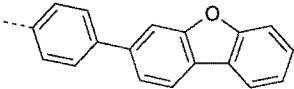
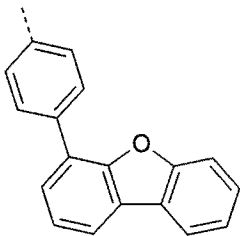
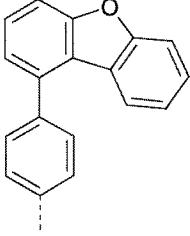
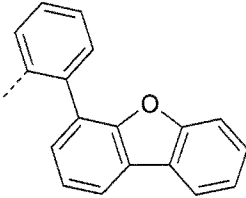
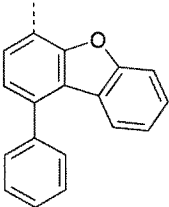
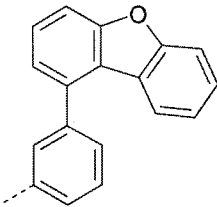
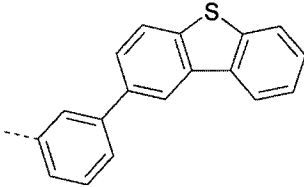
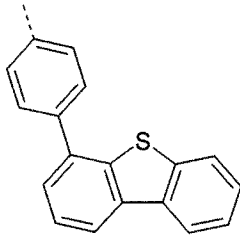
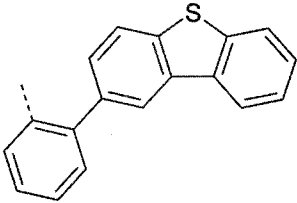
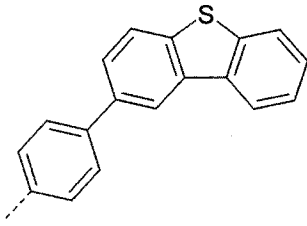


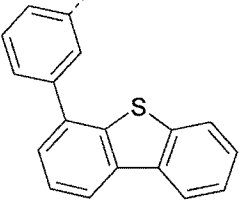
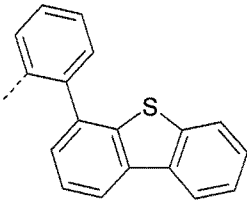
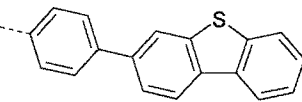
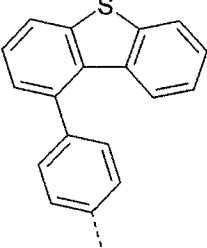
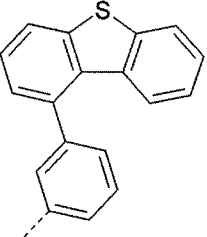
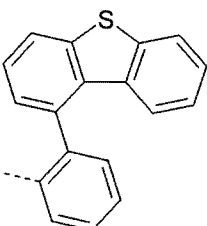
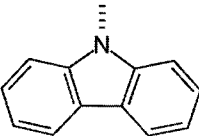
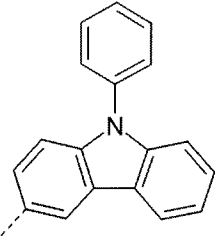
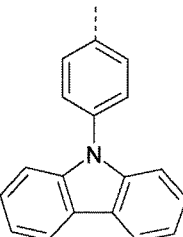
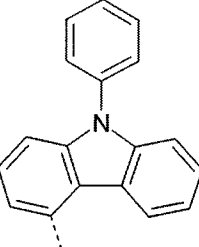
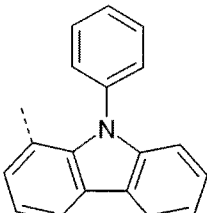
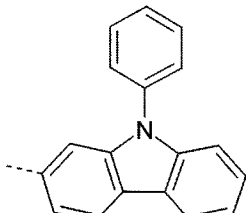
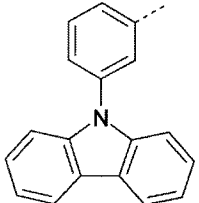
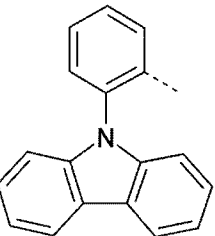
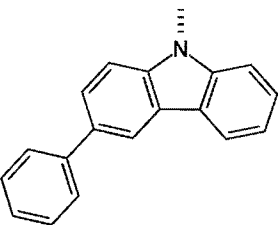
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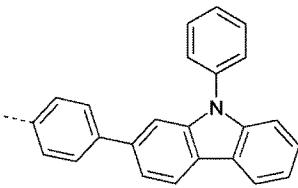
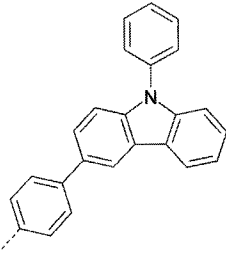
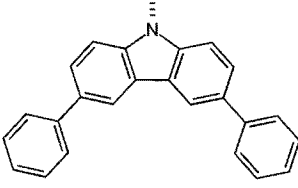
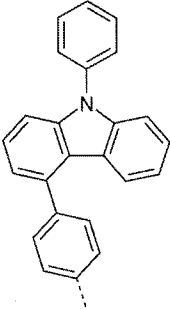
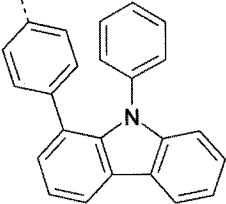
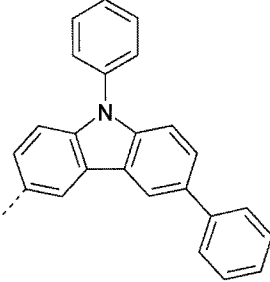
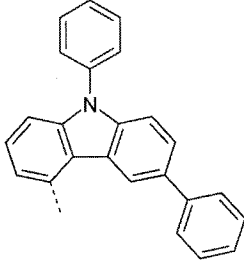
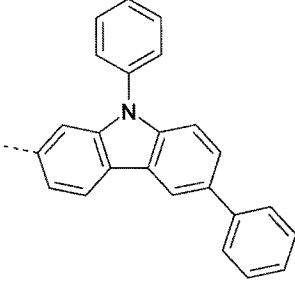
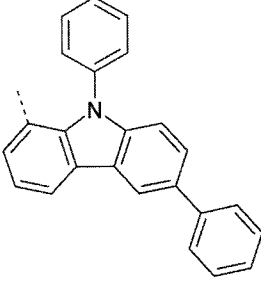
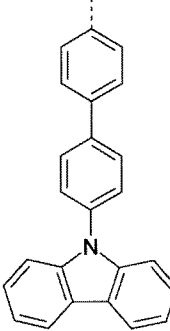
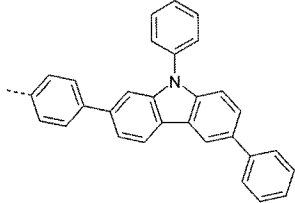
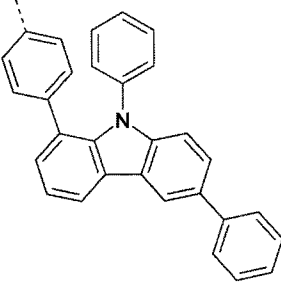
特佳基團 R¹ 為符合以下基團之基團

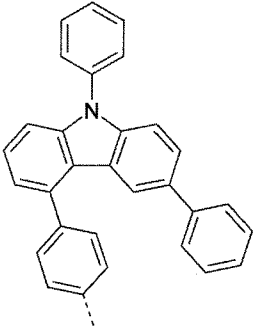
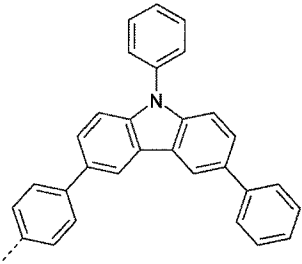
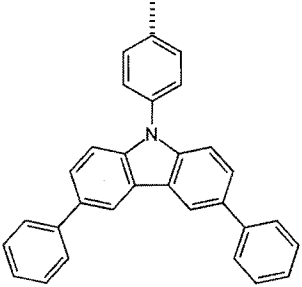
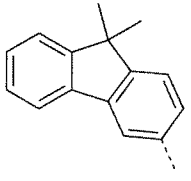
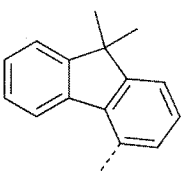
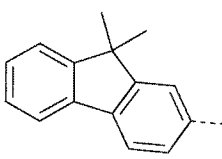
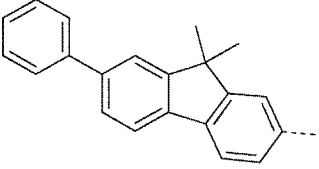
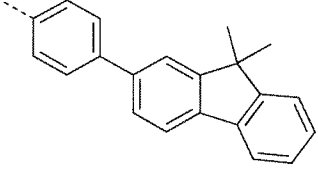
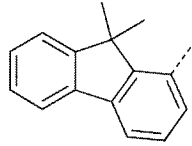
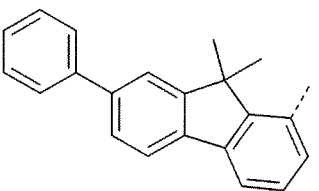
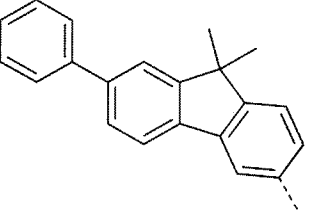
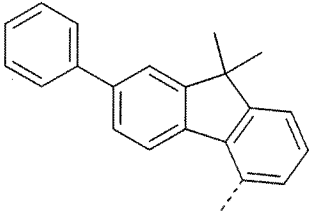
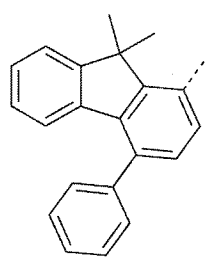
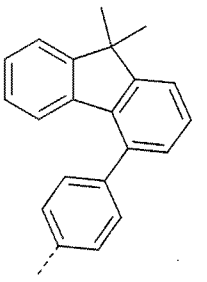
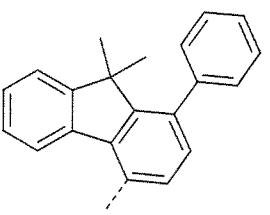
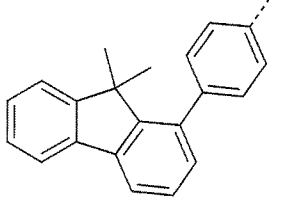
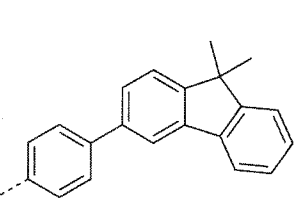
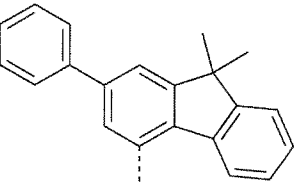
R-1	R-2	R-3
R-4	R-5	R-6
R-7	R-8	R-9
R-10	R-11	R-12
R-13	R-14	R-15

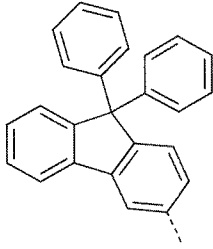
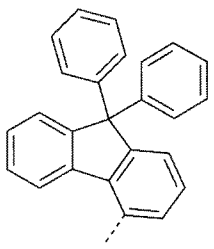
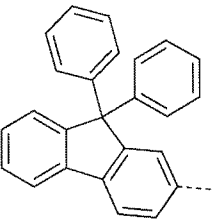
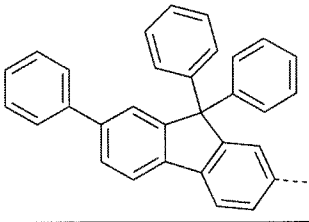
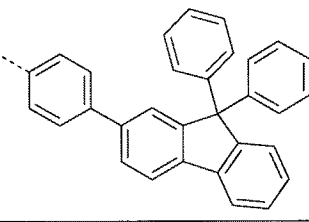
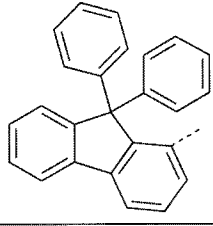
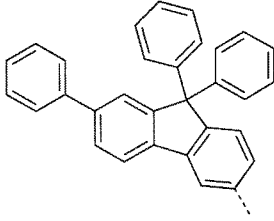
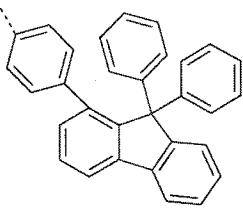
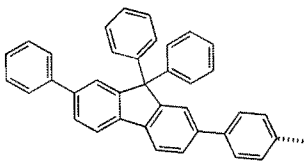
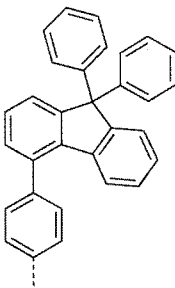
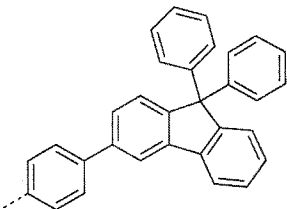
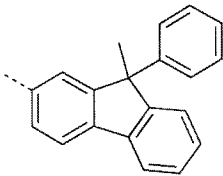
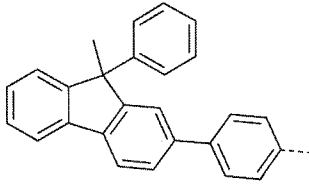
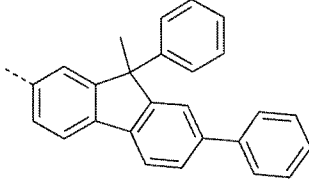
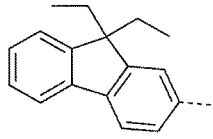
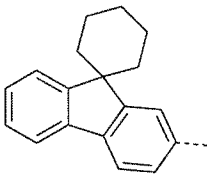
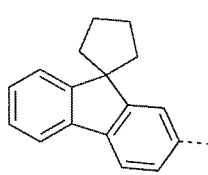
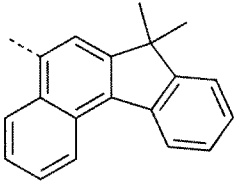
		
R-16	R-17	R-18
		
R-19	R-20	R-21
		
R-22	R-23	R-24
		
R-25	R-26	R-27
		
R-28	R-29	R-30
		
R-31	R-32	R-33
		

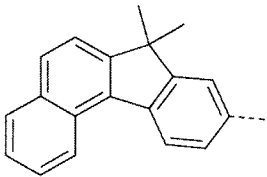
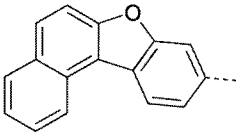
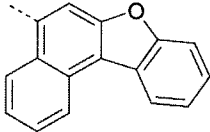
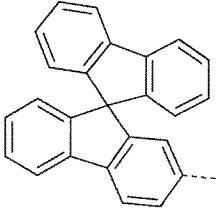
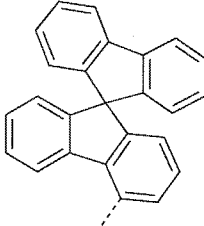
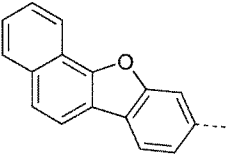
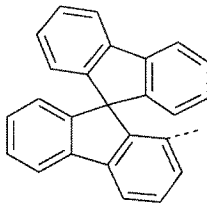
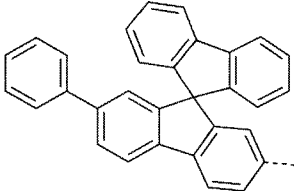
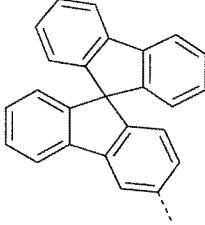
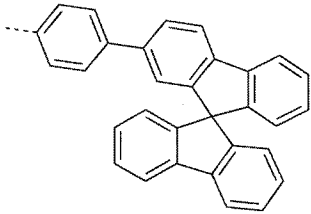
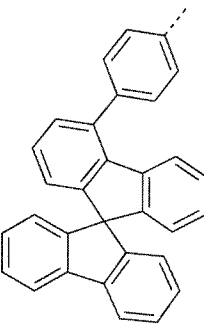
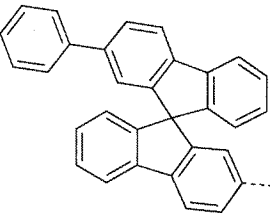
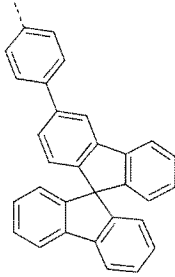
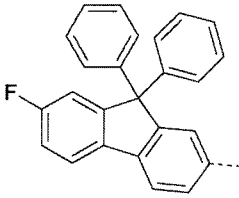
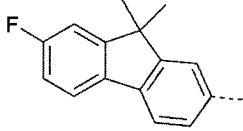
R-34	R-35	R-36
		
R-37	R-38	R-39
		
R-40	R-41	R-42
		
R-43	R-44	R-45
		
R-46	R-47	R-48
		
R-49	R-50	R-51

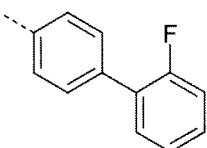
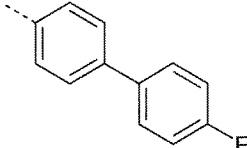
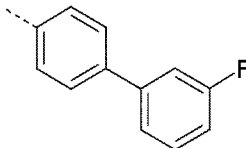
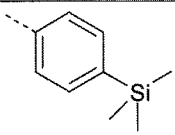
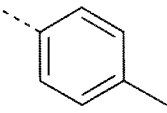
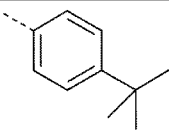
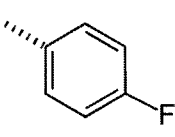
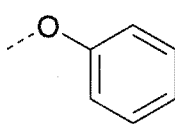
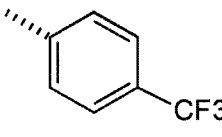
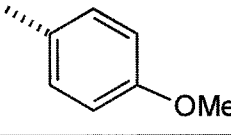
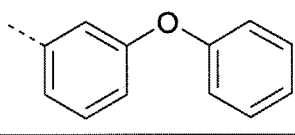
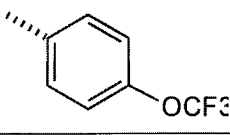
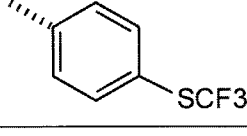
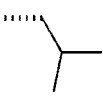
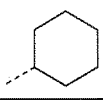
		
R-52	R-53	R-54
		
R-55	R-56	R-57
		
R-58	R-59	R-60
		
R-61	R-62	R-63
		
R-64	R-65	R-66

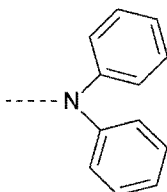
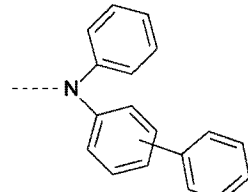
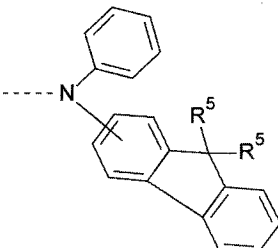
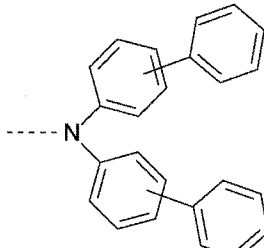
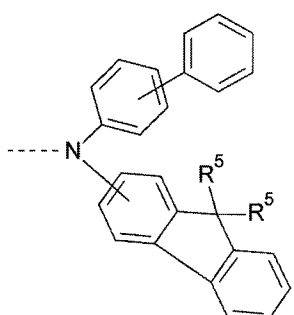
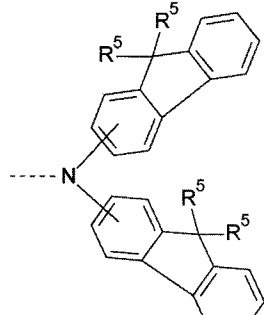
		
R-67	R-68	R-69
		
R-70	R-71	R-72
		
R-73	R-74	R-75
		
R-76	R-77	R-78

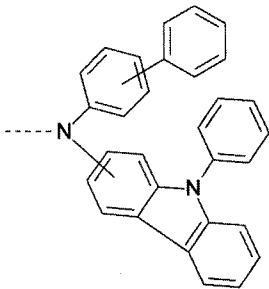
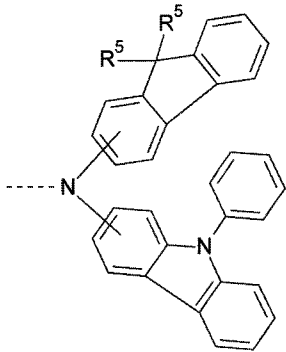
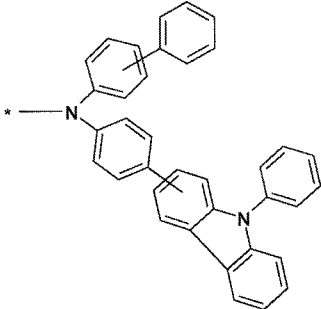
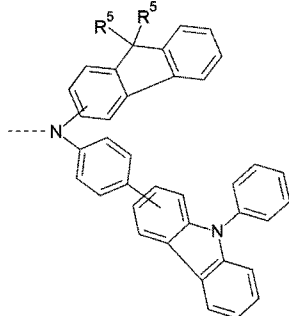
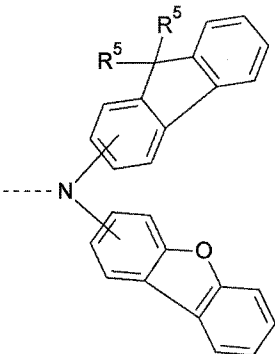
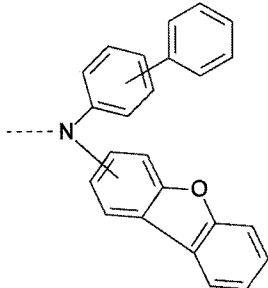
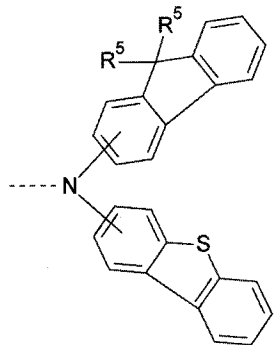
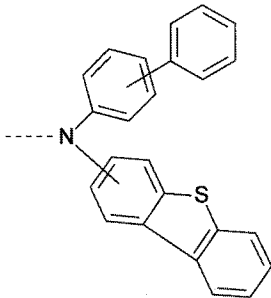
		
R-79	R-80	R-81
		
R-82	R-83	R-84
		
R-85	R-86	R-87
		
R-88	R-89	R-90
		
R-91	R-92	R-93
		

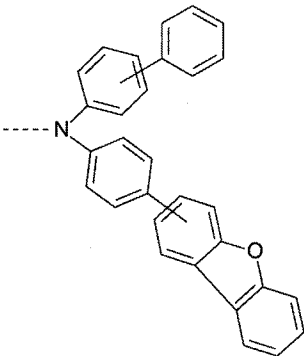
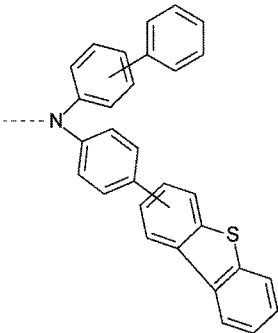
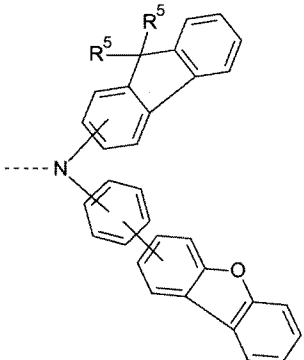
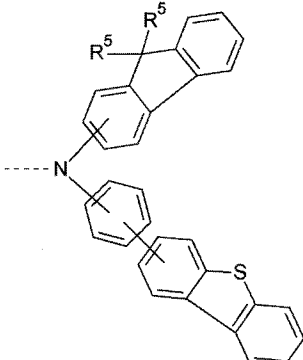
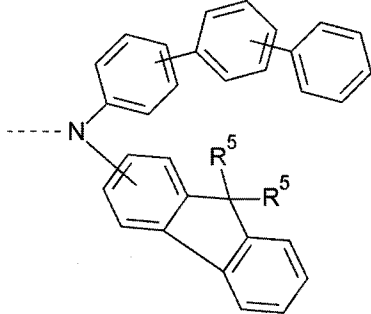
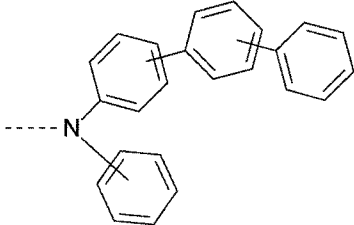
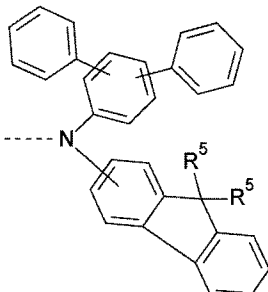
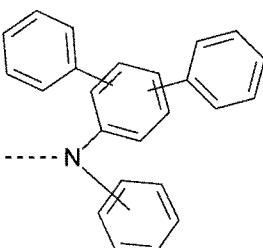
R-94	R-95	R-96
		
R-97	R-98	R-99
		
R-100	R-101	R-102
		
R-103	R-104	R-105
		
R-106	R-107	R-108
		
R-109	R-110	R-111
		

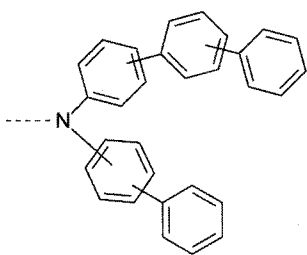
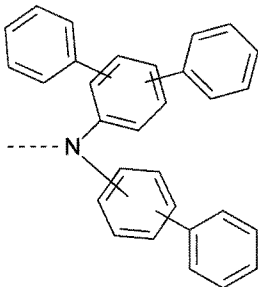
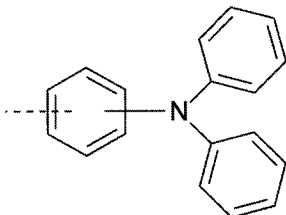
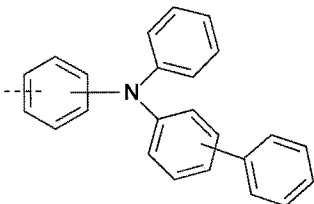
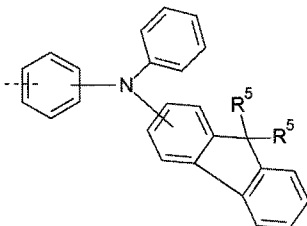
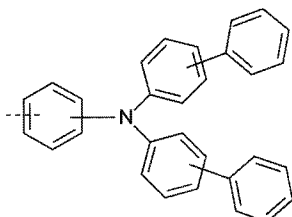
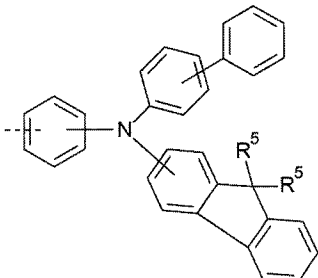
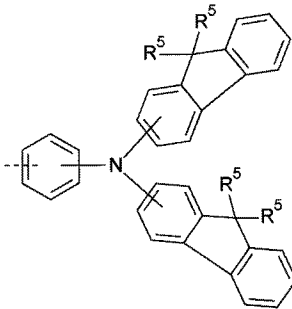
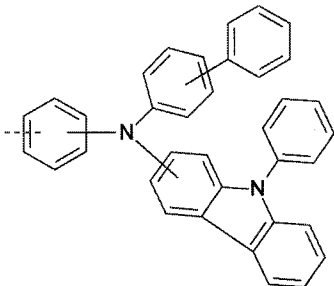
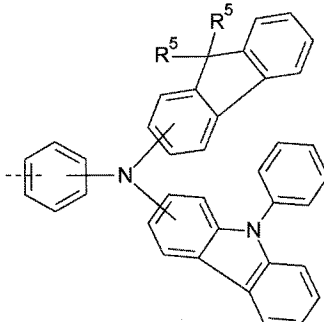
R-112	R-113	R-114
		
R-115	R-116	R-117
		
R-118	R-119	R-120
		
R-121	R-122	R-123
		
R-124	R-125	R-126
		
R-127	R-128	R-129

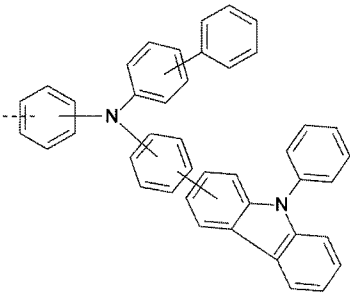
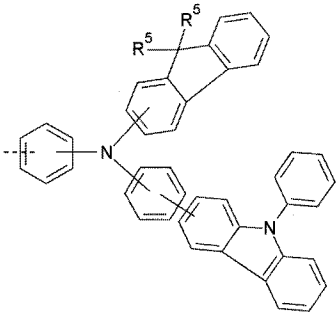
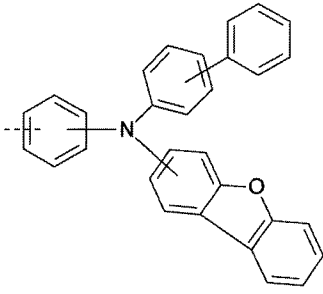
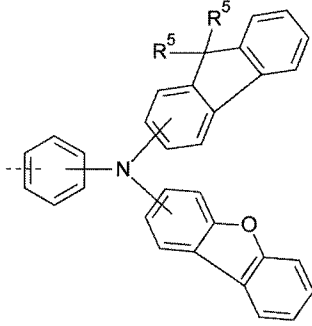
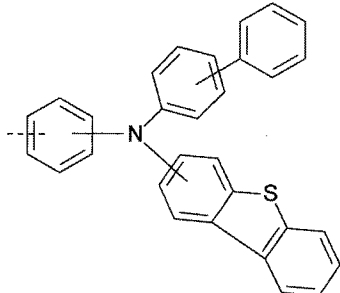
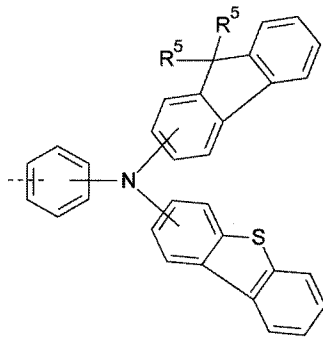
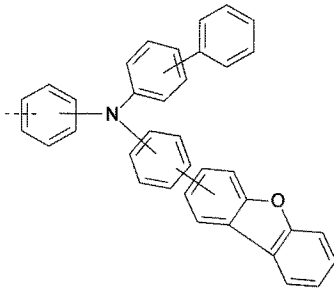
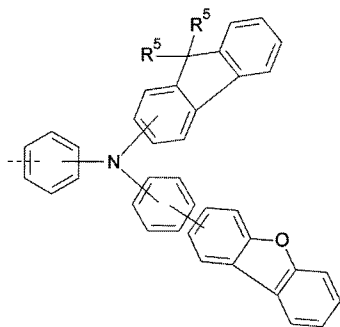
		
R-130	R-131	R-132
		
R-133	R-134	R-135
		
R-136	R-137	R-138
		
R-139	R-140	R-141
	-CH3	-CH2CH3
R-142	R-143	R-144
		
R-145	R-146	R-147
-CF2CF3	-CF3	-SCF3
R-148	R-149	R-150
-OCF3	-OCF2CF3	-SCF2CF3
R-151	R-152	R-153
		
R-154	R-155	R-156

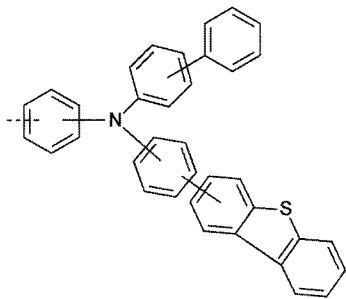
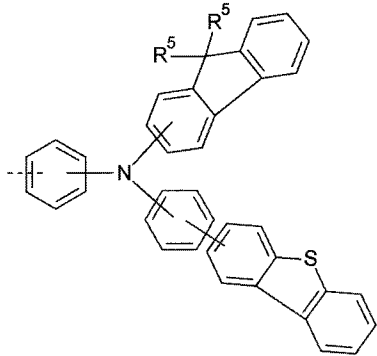
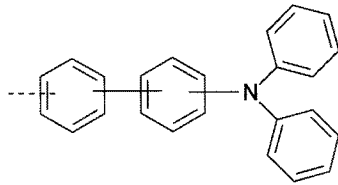
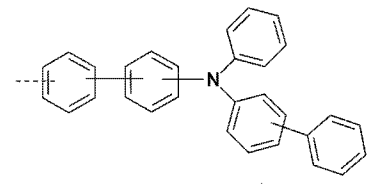
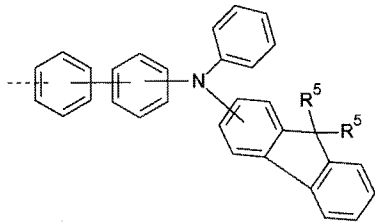
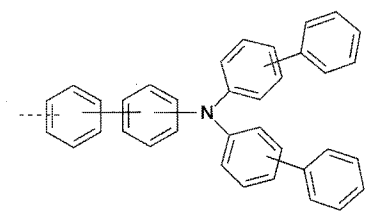
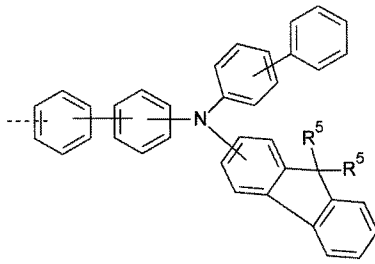
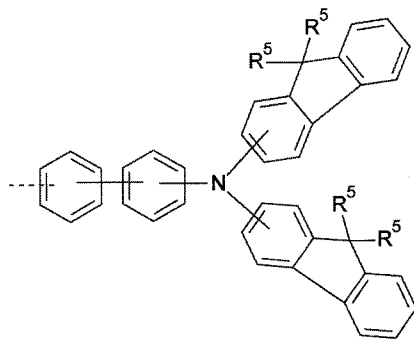
	-SCH ₃	-OCH ₂ CH ₃
R-157	R-158	R-159
-OCH ₃	-Si(CH ₃) ₂ Ph	-Si(CH ₃) ₃
R-160	R-161	R-162
-Si(CH ₃) ₂ t-Bu	-Si(iPr) ₃	
R-163	R-164	
		
R-165	R-166	
		
R-167	R-168	
		
R-169	R-170	

	
R-171	R-172
	
R-173	R-174
	
R-175	R-176
	
R-177	R-178

	
R-179	R-180
	
R-181	R-182
	
R-183	R-184
	
R-185	R-186

	
R-187	R-188
	
R-189	R-190
	
R-191	R-192
	
R-193	R-194
	

R-195 	R-196 
R-197 	R-198 
R-199 	R-200 
R-201 	R-202 
R-203	R-204

	
R-205	R-206
	
R-207	R-208
	
R-209	R-210
	
R-211	R-212

其中該等基團可在自由位置經基團 R^5 取代，但較佳在這些位置中未經取代，及其中虛線代表至式 (I) 之螺聯萸部分的鍵結位置。

特佳基團 R^1 為符合式 R-1、R-2、R-21、R-58、和 R-66 中之一者的基團。

基團 R^2 和 R^3 較佳係相同或不同地選自 H、F、具有 1 至 20 個 C 原子之直鏈烷基、具有 3 至 20 個 C 原子之支鏈或環狀烷基、具有 6 至 30 個芳族環原子之芳族環系統，和具有 5 至 30 個芳族環原子之雜芳族環系統，其中該等烷基、芳族環系統和雜芳族環系統在各情況下可經一或多個基團 R^5 取代。更佳地，基團 R^2 為 H。更佳地，基團 R^3 係相同或不同地選自 H、F、甲基、三級丁基、和苯基。最佳地，基團 R^3 為 H。

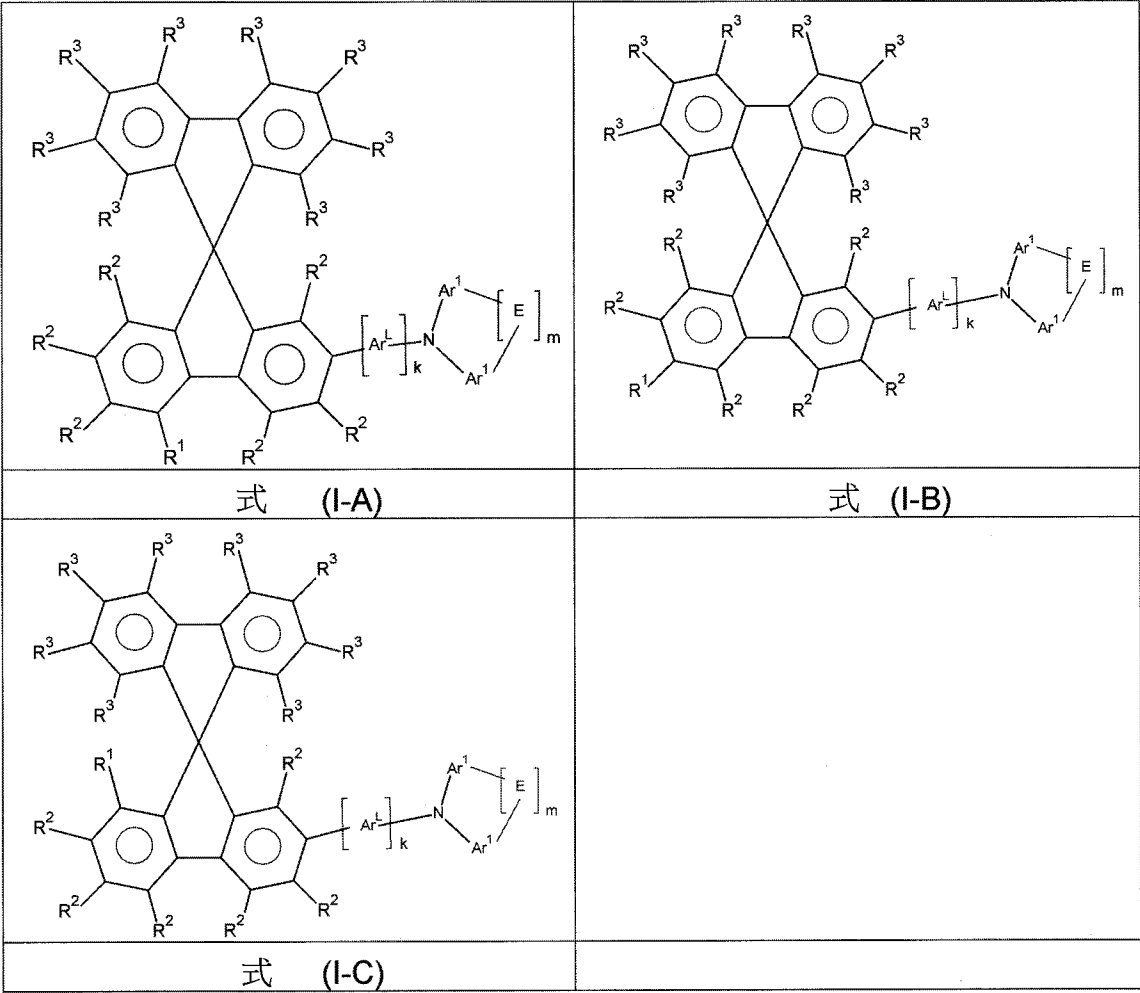
基團 R^4 較佳係相同或不同地選自 H、F、CN、 $Si(R^5)_3$ 、具有 1 至 20 個 C 原子之直鏈烷基、具有 3 至 20 個 C 原子之支鏈或環狀烷基、具有 6 至 40 個芳族環原子之芳族環系統、和具有 5 至 40 個芳族環原子之雜芳族環系統；其中二或多個基團 R^4 可彼此連接以形成環；其中該等烷基及該等芳族和雜芳族環系統在各情況下可經一或多個基團 R^5 取代。

基團 R^5 較佳係相同或不同地選自 H、F、CN、 $Si(R^6)_3$ 、具有 1 至 20 個 C 原子之直鏈烷基、具有 3 至 20 個 C 原子之支鏈或環狀烷基、具有 6 至 40 個芳族環原子之芳族環系統、和具有 5 至 40 個芳族環原子之雜芳族環系統；其中二或多個基團 R^5 可彼此連接以形成環；其中該等烷基及該等芳族和雜芳族環系統在各情況下可經一或多個基團 R^6 取代。

較佳地，式 (I) 中一個，及不大於一個基團 Z^1 為 CR^1 。此外，較佳地，其位於兩個六環之間的鍵之鄰位的基團 Z^1

為 CR^1 。較佳地，在此情況下，其他基團 Z^1 為 CR^2 。

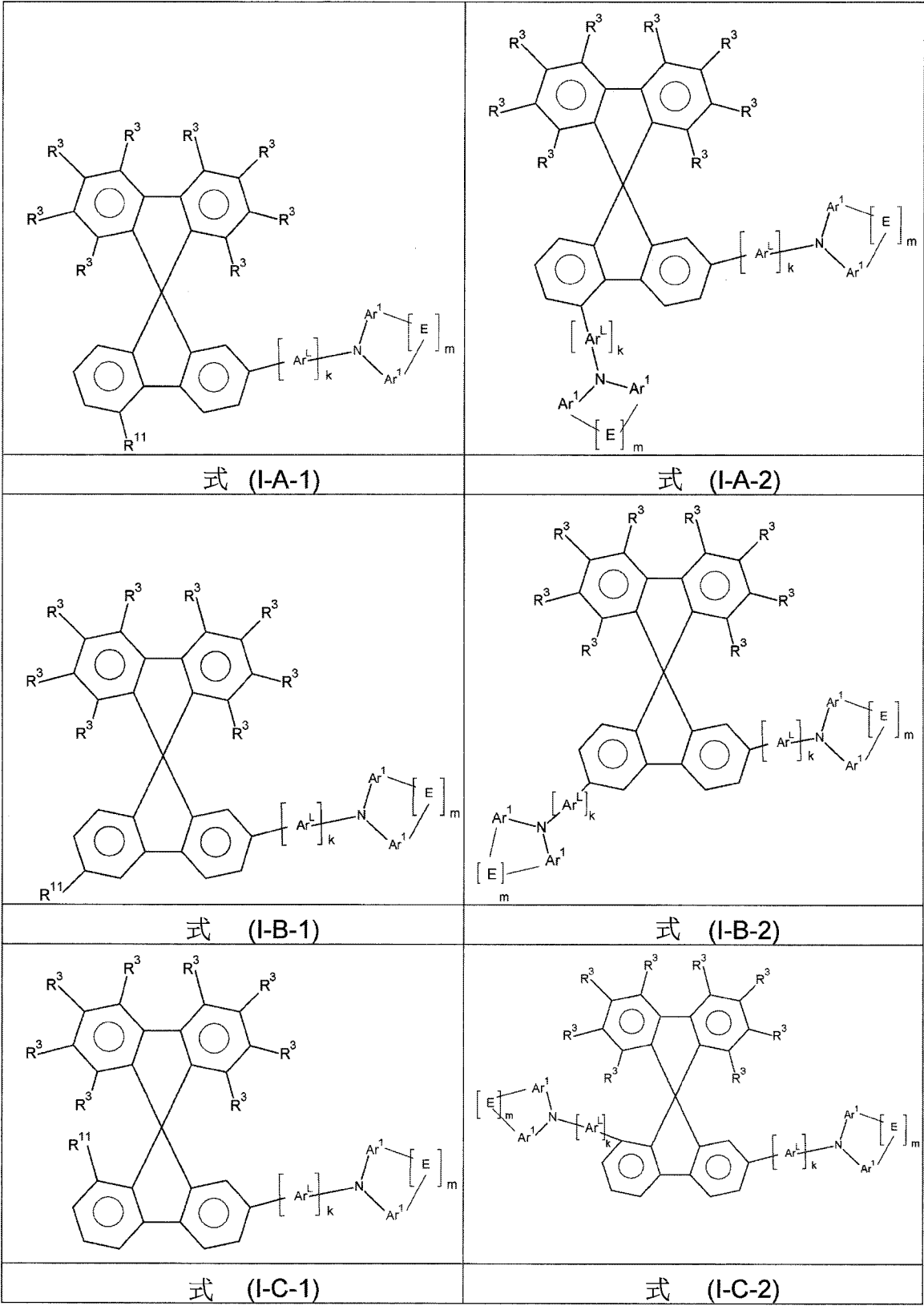
式(I)較佳符合式(I-A)至(I-C)中之一者



其中所出現的變數係如上述所定義。較佳地，該等變數符合彼等之上述實施態樣。

式(I-A)、(I-B)和(I-C)之中，式(I-A)為較佳。

式(I)之較佳實施態樣符合式(I-A-1)至(I-C-2)中之一者

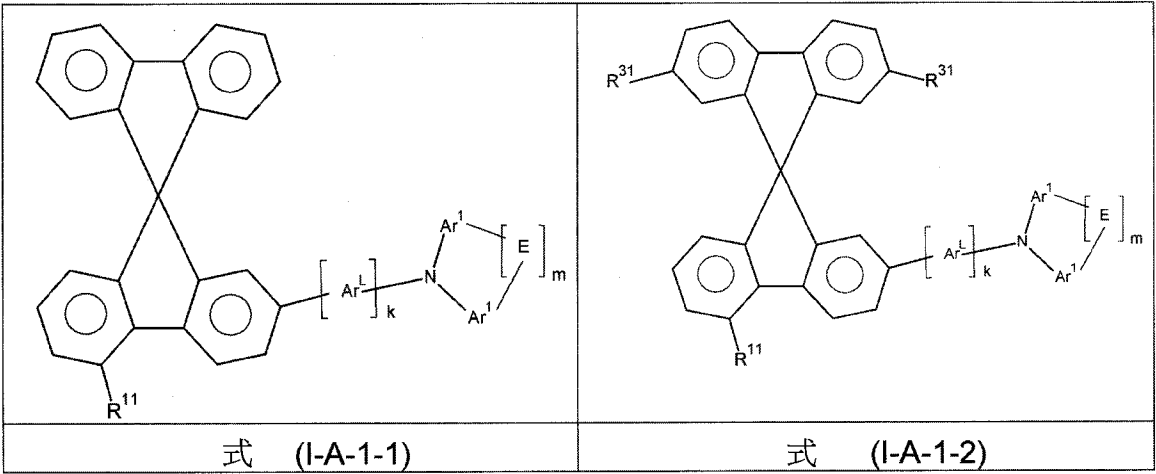


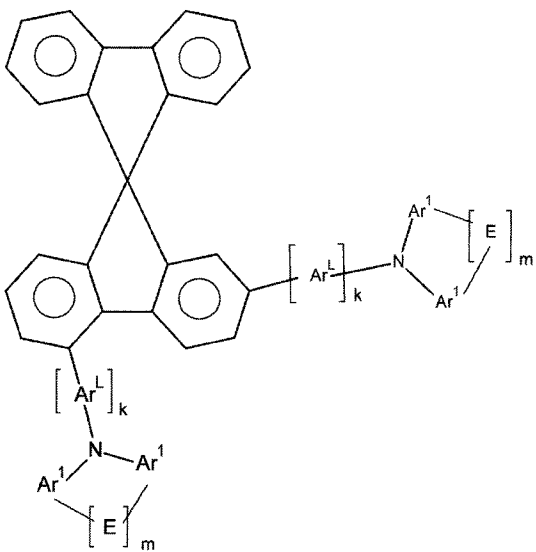
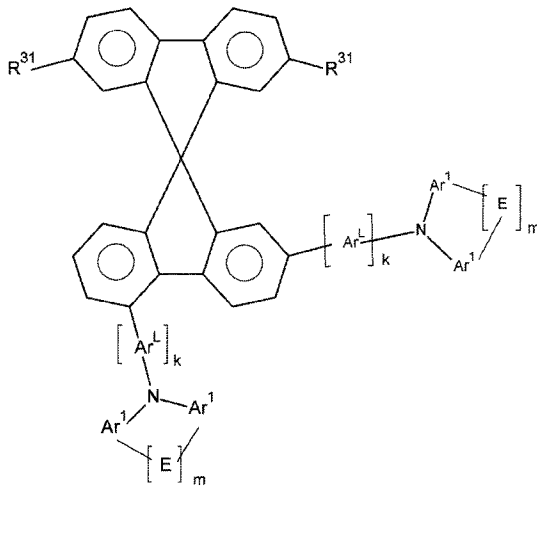
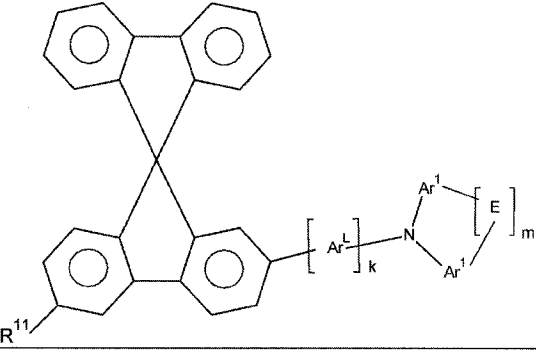
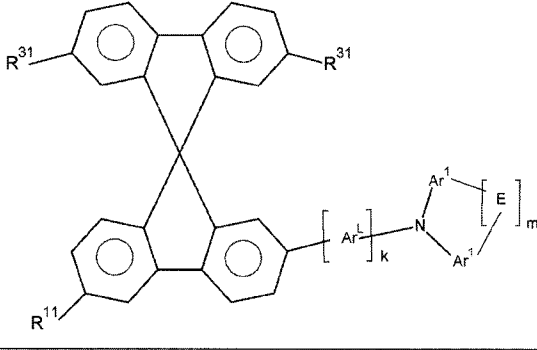
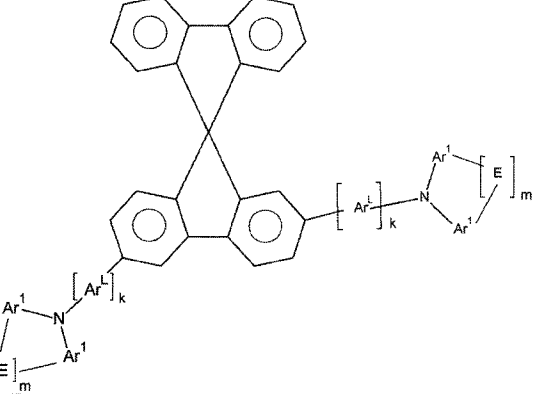
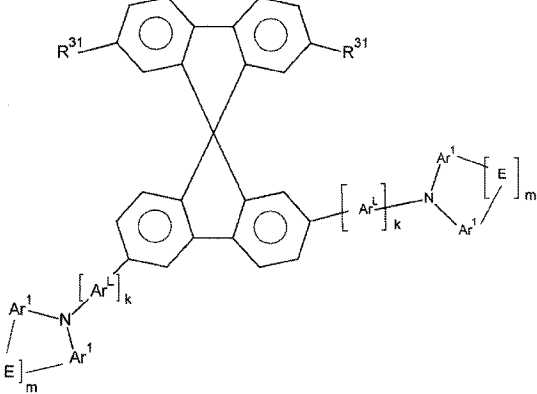
其中所出現的變數係如上述所定義，及R¹¹係選自F、Cl、Br、I、CN、SCN、SF₅、Si(R⁵)₃、具有1至20個C原子

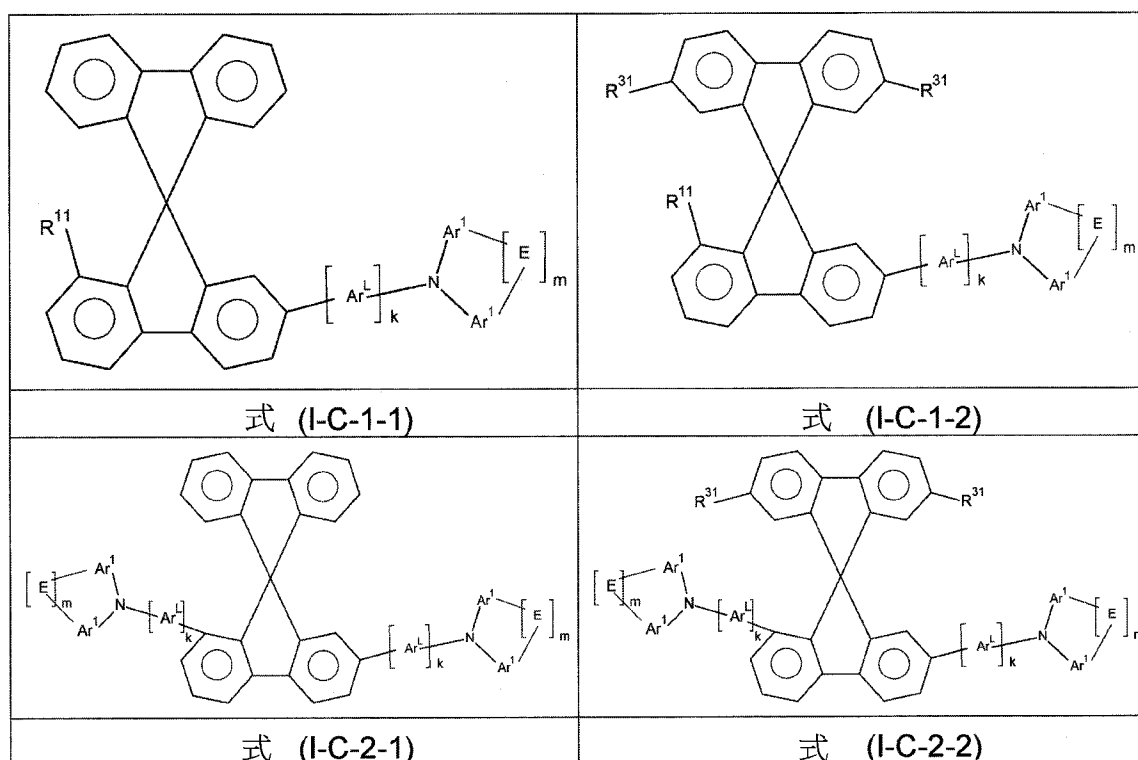
之直鏈烷基、烷氧基或烷硫基、具有3至20個C原子之支鏈或環狀烷基、烷氧基、或烷硫基、具有6至40個芳族環原子之芳族環系統、和具有5至40個芳族環原子之雜芳族環系統，其中該等烷基、烷氧基和烷硫基及該等芳族和雜芳族環系統在各情況下可經一或多個基團 R^5 取代，且較佳係選自具有6至30個芳族環原子之芳族環系統，和具有5至30個芳族環原子之雜芳族環系統，其中該等芳族和雜芳族環系統在各情況下可經一或多個基團 R^5 取代。

上述式之中，式(I-A-1)和(I-A-2)為較佳。

式(I)之特佳實施態樣符合式(I-A-1-1)至(I-C-2-2)中之一者



	
式 (I-A-2-1)	式 (I-A-2-2)
	
式 (I-B-1-1)	式 (I-B-1-2)
	
式 (I-B-2-1)	式 (I-B-2-2)

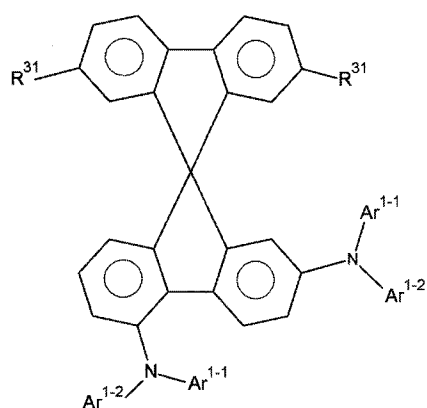


其中所出現的變數係如上述所定義，及其中 R^{31} 係相同或不同地選自 H、D、F、 $C(=O)R^5$ 、CN、 $Si(R^5)_3$ 、 $N(R^5)_2$ 、 $P(=O)(R^5)_2$ 、 OR^5 、 $S(=O)R^5$ 、 $S(=O)_2R^5$ 、具有 1 至 20 個 C 原子之直鏈烷基或烷氧基、具有 3 至 20 個 C 原子之支鏈或環狀烷基或烷氧基、具有 2 至 20 個 C 原子之烯基或炔基、具有 6 至 40 個芳族環原子之芳族環系統、和具有 5 至 40 個芳族環原子之雜芳族環系統；其中二或多個基團 R^{31} 可彼此連接以形成環；其中該等烷基、烷氧基、烯基和炔基及該等芳族和雜芳族環系統在各情況下可經一或多個基團 R^5 取代，及其中該等烷基、烷氧基、烯基和炔基中之一或多個 CH_2 基團在各情況下可經 $-R^5C=CR^5-$ 、 $-C\equiv C-$ 、 $Si(R^5)_2$ 、 $C=O$ 、 $C=NR^5$ 、 $-C(=O)O-$ 、 $-C(=O)NR^5-$ 、 NR^5 、 $P(=O)(R^5)$ 、 $-O-$ 、 $-S-$ 、SO 或 SO_2 置換，其中至少一個基團

R^{31} 與H和D不同。較佳地， R^{31} 在每次出現時係相同或不同地選自H、F、具有1至20個C原子之直鏈烷基、具有3至20個C原子之支鏈或環狀烷基、具有6至30個芳族環原子之芳族環系統、和具有5至30個芳族環原子之雜芳族環系統，其中該等烷基、芳族環系統和雜芳族環系統在各情況下可經一或多個基團 R^5 取代，其中至少一個基團 R^{31} 不同於H。更佳地， R^{31} 在每次出現時係相同或不同地選自H、F、甲基、三級丁基、和苯基，其中至少一個基團 R^{31} 不同於H。最佳地，就上述實施態樣而言，基團 R^{31} 二者皆不同於H及D。

上述式之中，式(I-A-1-1)、(I-A-1-2)、(I-A-2-1)和(I-A-2-2)為較佳。特佳為式(I-A-1-1)和(I-A-2-1)。

特佳特定化合物為下列化合物，其符合下述式(I-A-2-2-1)



式 (I-A-2-2-1) ,

其中 R^{31} 、 Ar^{1-1} 和 Ar^{1-2} 係指定為如以下列表所示(式 $Ar-1$ 至 $Ar-172$ 係如上所指定)：

編號	R ³¹	Ar ¹⁻¹	Ar ¹⁻²	編號	R ³¹	Ar ¹⁻¹	Ar ¹⁻²
C-1	H	Ar-1	Ar-1	C-157	甲基	Ar-1	Ar-1
C-2	"	"	Ar-2	C-158	"	"	Ar-2
C-3	"	"	Ar-4	C-159	"	"	Ar-4
C-4	"	"	Ar-5	C-160	"	"	Ar-5
C-5	"	"	Ar-74	C-161	"	"	Ar-74
C-6	"	"	Ar-78	C-162	"	"	Ar-78

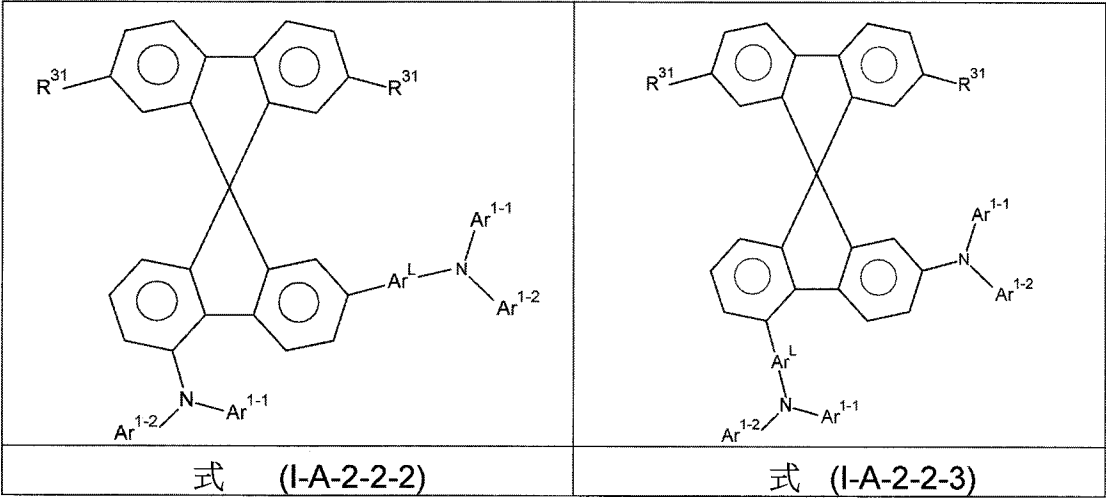
C-7	"	"	Ar-82	C-163	"	"	Ar-82
C-8	"	"	Ar-117	C-164	"	"	Ar-117
C-9	"	"	Ar-134	C-165	"	"	Ar-134
C-10	"	"	Ar-139	C-166	"	"	Ar-139
C-11	"	"	Ar-150	C-167	"	"	Ar-150
C-12	"	"	Ar-172	C-168	"	"	Ar-172
C-13	"	Ar-2	Ar-2	C-169	"	Ar-2	Ar-2
C-14	"	"	Ar-4	C-170	"	"	Ar-4
C-15	"	"	Ar-5	C-171	"	"	Ar-5
C-16	"	"	Ar-74	C-172	"	"	Ar-74
C-17	"	"	Ar-78	C-173	"	"	Ar-78
C-18	"	"	Ar-82	C-174	"	"	Ar-82
C-19	"	"	Ar-117	C-175	"	"	Ar-117
C-20	"	"	Ar-134	C-176	"	"	Ar-134
C-21	"	"	Ar-139	C-177	"	"	Ar-139
C-22	"	"	Ar-150	C-178	"	"	Ar-150
C-23	"	"	Ar-172	C-179	"	"	Ar-172
C-24	"	Ar-4	Ar-4	C-180	"	Ar-4	Ar-4
C-25	"	"	Ar-5	C-181	"	"	Ar-5
C-26	"	"	Ar-74	C-182	"	"	Ar-74
C-27	"	"	Ar-78	C-183	"	"	Ar-78
C-28	"	"	Ar-82	C-184	"	"	Ar-82
C-29	"	"	Ar-117	C-185	"	"	Ar-117
C-30	"	"	Ar-134	C-186	"	"	Ar-134
C-31	"	"	Ar-139	C-187	"	"	Ar-139
C-32	"	"	Ar-150	C-188	"	"	Ar-150
C-33	"	"	Ar-172	C-189	"	"	Ar-172
C-34	"	Ar-5	Ar-5	C-190	"	Ar-5	Ar-5
C-35	"	"	Ar-74	C-191	"	"	Ar-74
C-36	"	"	Ar-78	C-192	"	"	Ar-78
C-37	"	"	Ar-82	C-193	"	"	Ar-82
C-38	"	"	Ar-117	C-194	"	"	Ar-117
C-39	"	"	Ar-134	C-195	"	"	Ar-134
C-40	"	"	Ar-139	C-196	"	"	Ar-139
C-41	"	"	Ar-150	C-197	"	"	Ar-150
C-42	"	"	Ar-172	C-198	"	"	Ar-172
C-43	"	Ar-74	Ar-74	C-199	"	Ar-74	Ar-74
C-44	"	"	Ar-78	C-200	"	"	Ar-78
C-45	"	"	Ar-82	C-201	"	"	Ar-82
C-46	"	"	Ar-117	C-202	"	"	Ar-117
C-47	"	"	Ar-134	C-203	"	"	Ar-134
C-48	"	"	Ar-139	C-204	"	"	Ar-139

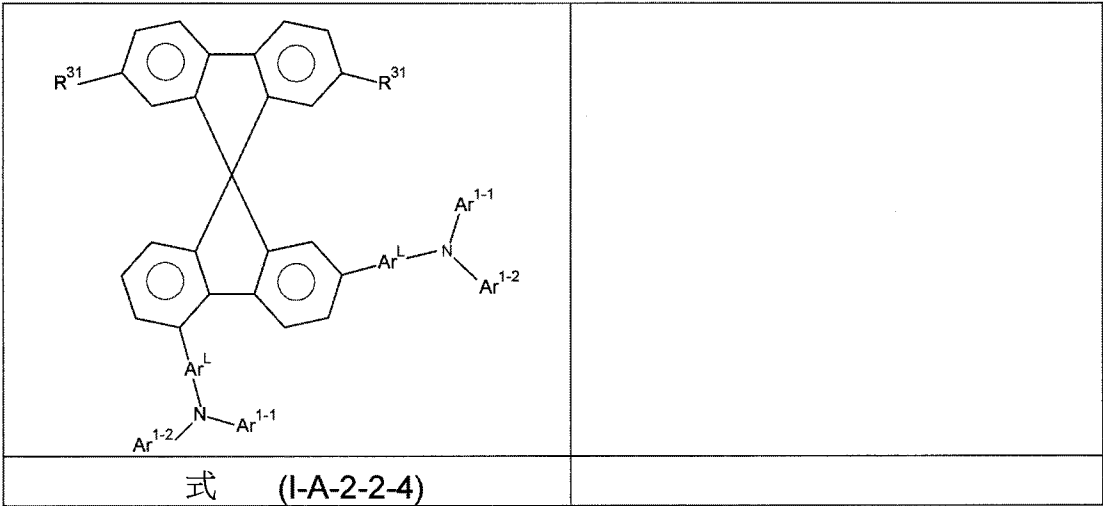
C-49	"	"	Ar-150	C-205	"	"	Ar-150
C-50	"	"	Ar-172	C-206	"	"	Ar-172
C-51	"	Ar-78	Ar-78	C-207	"	Ar-78	Ar-78
C-52	"	"	Ar-82	C-208	"	"	Ar-82
C-53	"	"	Ar-117	C-209	"	"	Ar-117
C-54	"	"	Ar-134	C-210	"	"	Ar-134
C-55	"	"	Ar-139	C-211	"	"	Ar-139
C-56	"	"	Ar-150	C-212	"	"	Ar-150
C-57	"	"	Ar-172	C-213	"	"	Ar-172
C-58	"	Ar-82	Ar-82	C-214	"	Ar-82	Ar-82
C-59	"	"	Ar-117	C-215	"	"	Ar-117
C-60	"	"	Ar-134	C-216	"	"	Ar-134
C-61	"	"	Ar-139	C-217	"	"	Ar-139
C-62	"	"	Ar-150	C-218	"	"	Ar-150
C-63	"	"	Ar-172	C-219	"	"	Ar-172
C-64	"	Ar-117	Ar-117	C-220	"	Ar-117	Ar-117
C-65	"	"	Ar-134	C-221	"	"	Ar-134
C-66	"	"	Ar-139	C-222	"	"	Ar-139
C-67	"	"	Ar-150	C-223	"	"	Ar-150
C-68	"	"	Ar-172	C-224	"	"	Ar-172
C-69	"	Ar-134	Ar-134	C-225	"	Ar-134	Ar-134
C-70	"	"	Ar-139	C-226	"	"	Ar-139
C-71	"	"	Ar-150	C-227	"	"	Ar-150
C-72	"	"	Ar-172	C-228	"	"	Ar-172
C-73	"	Ar-139	Ar-139	C-229	"	Ar-139	Ar-139
C-74	"	"	Ar-150	C-230	"	"	Ar-150
C-75	"	"	Ar-172	C-231	"	"	Ar-172
C-76	"	Ar-150	Ar-150	C-232	"	Ar-150	Ar-150
C-77	"	"	Ar-172	C-233	"	"	Ar-172
C-78	"	Ar-172	Ar-172	C-234	"	Ar-172	Ar-172
C-79	F	Ar-1	Ar-1	C-235	三級丁基	Ar-1	Ar-1
C-80	"	"	Ar-2	C-236	"	"	Ar-2
C-81	"	"	Ar-4	C-237	"	"	Ar-4
C-82	"	"	Ar-5	C-238	"	"	Ar-5
C-83	"	"	Ar-74	C-239	"	"	Ar-74
C-84	"	"	Ar-78	C-240	"	"	Ar-78
C-85	"	"	Ar-82	C-241	"	"	Ar-82
C-86	"	"	Ar-117	C-242	"	"	Ar-117
C-87	"	"	Ar-134	C-243	"	"	Ar-134
C-88	"	"	Ar-139	C-244	"	"	Ar-139
C-89	"	"	Ar-150	C-245	"	"	Ar-150
C-90	"	"	Ar-172	C-246	"	"	Ar-172

C-91	"	Ar-2	Ar-2	C-247	"	Ar-2	Ar-2
C-92	"	"	Ar-4	C-248	"	"	Ar-4
C-93	"	"	Ar-5	C-249	"	"	Ar-5
C-94	"	"	Ar-74	C-250	"	"	Ar-74
C-95	"	"	Ar-78	C-251	"	"	Ar-78
C-96	"	"	Ar-82	C-252	"	"	Ar-82
C-97	"	"	Ar-117	C-253	"	"	Ar-117
C-98	"	"	Ar-134	C-254	"	"	Ar-134
C-99	"	"	Ar-139	C-255	"	"	Ar-139
C-100	"	"	Ar-150	C-256	"	"	Ar-150
C-101	"	"	Ar-172	C-257	"	"	Ar-172
C-102	"	Ar-4	Ar-4	C-258	"	Ar-4	Ar-4
C-103	"	"	Ar-5	C-259	"	"	Ar-5
C-104	"	"	Ar-74	C-260	"	"	Ar-74
C-105	"	"	Ar-78	C-261	"	"	Ar-78
C-106	"	"	Ar-82	C-262	"	"	Ar-82
C-107	"	"	Ar-117	C-263	"	"	Ar-117
C-108	"	"	Ar-134	C-264	"	"	Ar-134
C-109	"	"	Ar-139	C-265	"	"	Ar-139
C-110	"	"	Ar-150	C-266	"	"	Ar-150
C-111	"	"	Ar-172	C-267	"	"	Ar-172
C-112	"	Ar-5	Ar-5	C-268	"	Ar-5	Ar-5
C-113	"	"	Ar-74	C-269	"	"	Ar-74
C-114	"	"	Ar-78	C-270	"	"	Ar-78
C-115	"	"	Ar-82	C-271	"	"	Ar-82
C-116	"	"	Ar-117	C-272	"	"	Ar-117
C-117	"	"	Ar-134	C-273	"	"	Ar-134
C-118	"	"	Ar-139	C-274	"	"	Ar-139
C-119	"	"	Ar-150	C-275	"	"	Ar-150
C-120	"	"	Ar-172	C-276	"	"	Ar-172
C-121	"	Ar-74	Ar-74	C-277	"	Ar-74	Ar-74
C-122	"	"	Ar-78	C-278	"	"	Ar-78
C-123	"	"	Ar-82	C-279	"	"	Ar-82
C-124	"	"	Ar-117	C-280	"	"	Ar-117
C-125	"	"	Ar-134	C-281	"	"	Ar-134
C-126	"	"	Ar-139	C-282	"	"	Ar-139
C-127	"	"	Ar-150	C-283	"	"	Ar-150
C-128	"	"	Ar-172	C-284	"	"	Ar-172
C-129	"	Ar-78	Ar-78	C-285	"	Ar-78	Ar-78
C-130	"	"	Ar-82	C-286	"	"	Ar-82
C-131	"	"	Ar-117	C-287	"	"	Ar-117
C-132	"	"	Ar-134	C-288	"	"	Ar-134

C-133	"	"	Ar-139	C-289	"	"	Ar-139
C-134	"	"	Ar-150	C-290	"	"	Ar-150
C-135	"	"	Ar-172	C-291	"	"	Ar-172
C-136	"	Ar-82	Ar-82	C-292	"	Ar-82	Ar-82
C-137	"	"	Ar-117	C-293	"	"	Ar-117
C-138	"	"	Ar-134	C-294	"	"	Ar-134
C-139	"	"	Ar-139	C-295	"	"	Ar-139
C-140	"	"	Ar-150	C-296	"	"	Ar-150
C-141	"	"	Ar-172	C-297	"	"	Ar-172
C-142	"	Ar-117	Ar-117	C-298	"	Ar-117	Ar-117
C-143	"	"	Ar-134	C-299	"	"	Ar-134
C-144	"	"	Ar-139	C-300	"	"	Ar-139
C-145	"	"	Ar-150	C-301	"	"	Ar-150
C-146	"	"	Ar-172	C-302	"	"	Ar-172
C-147	"	Ar-134	Ar-134	C-303	"	Ar-134	Ar-134
C-148	"	"	Ar-139	C-304	"	"	Ar-139
C-149	"	"	Ar-150	C-305	"	"	Ar-150
C-150	"	"	Ar-172	C-306	"	"	Ar-172
C-151	"	Ar-139	Ar-139	C-307	"	Ar-139	Ar-139
C-152	"	"	Ar-150	C-308	"	"	Ar-150
C-153	"	"	Ar-172	C-309	"	"	Ar-172
C-154	"	Ar-150	Ar-150	C-310	"	Ar-150	Ar-150
C-155	"	"	Ar-172	C-311	"	"	Ar-172
C-156	"	Ar-172	Ar-172	C-312	"	Ar-172	Ar-172

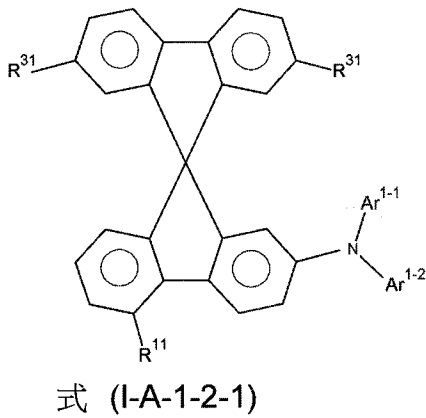
此外較佳的是對應於上述化合物 C-1 至 C-312 之化合物，且不同之處在於彼等係衍生自下列式





其中 Ar^{L} 為伸苯基，較佳為 1,4-伸苯基，及其中 R^{31} 、 Ar^{1-1} 和 Ar^{1-2} 係指定為如對應化合物 C-1 至 C-312 所示。

特佳特定化合物為下列化合物，其符合下述式式 (I-A-1-2-1)



其中 R^{11} 、 R^{31} 、 Ar^{1-1} 和 Ar^{1-2} 係指定為如以下列表所示 (式 Ar-1 至 Ar-172 和 R-1 至 R-66 係如上所指定)：

編號	R^{11}	R^{31}	Ar^{1-1}	Ar^{1-2}	編號	R^{11}	R^{31}	Ar^{1-1}	Ar^{1-2}
C-313	R-1	H	Ar-1	Ar-1	C-1093	"	甲基	Ar-1	Ar-1
C-314	"	"	"	Ar-2	C-1094	"	"	"	Ar-2
C-315	"	"	"	Ar-4	C-1095	"	"	"	Ar-4
C-316	"	"	"	Ar-5	C-1096	"	"	"	Ar-5
C-317	"	"	"	Ar-74	C-1097	"	"	"	Ar-74
C-318	"	"	"	Ar-78	C-1098	"	"	"	Ar-78

C-319	"	"	"	Ar-82	C-1099	"	"	"	Ar-82
C-320	"	"	"	Ar-117	C-1100	"	"	"	Ar-117
C-321	"	"	"	Ar-134	C-1101	"	"	"	Ar-134
C-322	"	"	"	Ar-139	C-1102	"	"	"	Ar-139
C-323	"	"	"	Ar-150	C-1103	"	"	"	Ar-150
C-324	"	"	"	Ar-172	C-1104	"	"	"	Ar-172
C-325	"	"	Ar-2	Ar-2	C-1105	"	"	Ar-2	Ar-2
C-326	"	"	"	Ar-4	C-1106	"	"	"	Ar-4
C-327	"	"	"	Ar-5	C-1107	"	"	"	Ar-5
C-328	"	"	"	Ar-74	C-1108	"	"	"	Ar-74
C-329	"	"	"	Ar-78	C-1109	"	"	"	Ar-78
C-330	"	"	"	Ar-82	C-1110	"	"	"	Ar-82
C-331	"	"	"	Ar-117	C-1111	"	"	"	Ar-117
C-332	"	"	"	Ar-134	C-1112	"	"	"	Ar-134
C-333	"	"	"	Ar-139	C-1113	"	"	"	Ar-139
C-334	"	"	"	Ar-150	C-1114	"	"	"	Ar-150
C-335	"	"	"	Ar-172	C-1115	"	"	"	Ar-172
C-336	"	"	Ar-4	Ar-4	C-1116	"	"	Ar-4	Ar-4
C-337	"	"	"	Ar-5	C-1117	"	"	"	Ar-5
C-338	"	"	"	Ar-74	C-1118	"	"	"	Ar-74
C-339	"	"	"	Ar-78	C-1119	"	"	"	Ar-78
C-340	"	"	"	Ar-82	C-1120	"	"	"	Ar-82
C-341	"	"	"	Ar-117	C-1121	"	"	"	Ar-117
C-342	"	"	"	Ar-134	C-1122	"	"	"	Ar-134
C-343	"	"	"	Ar-139	C-1123	"	"	"	Ar-139
C-344	"	"	"	Ar-150	C-1124	"	"	"	Ar-150
C-345	"	"	"	Ar-172	C-1125	"	"	"	Ar-172
C-346	"	"	Ar-5	Ar-5	C-1126	"	"	Ar-5	Ar-5
C-347	"	"	"	Ar-74	C-1127	"	"	"	Ar-74
C-348	"	"	"	Ar-78	C-1128	"	"	"	Ar-78
C-349	"	"	"	Ar-82	C-1129	"	"	"	Ar-82
C-350	"	"	"	Ar-117	C-1130	"	"	"	Ar-117
C-351	"	"	"	Ar-134	C-1131	"	"	"	Ar-134
C-352	"	"	"	Ar-139	C-1132	"	"	"	Ar-139
C-353	"	"	"	Ar-150	C-1133	"	"	"	Ar-150
C-354	"	"	"	Ar-172	C-1134	"	"	"	Ar-172
C-355	"	"	Ar-74	Ar-74	C-1135	"	"	Ar-74	Ar-74
C-356	"	"	"	Ar-78	C-1136	"	"	"	Ar-78
C-357	"	"	"	Ar-82	C-1137	"	"	"	Ar-82
C-358	"	"	"	Ar-117	C-1138	"	"	"	Ar-117
C-359	"	"	"	Ar-134	C-1139	"	"	"	Ar-134
C-360	"	"	"	Ar-139	C-1140	"	"	"	Ar-139

C-361	"	"	"	Ar-150	C-1141	"	"	"	Ar-150
C-362	"	"	"	Ar-172	C-1142	"	"	"	Ar-172
C-363	"	"	Ar-78	Ar-78	C-1143	"	"	Ar-78	Ar-78
C-364	"	"	"	Ar-82	C-1144	"	"	"	Ar-82
C-365	"	"	"	Ar-117	C-1145	"	"	"	Ar-117
C-366	"	"	"	Ar-134	C-1146	"	"	"	Ar-134
C-367	"	"	"	Ar-139	C-1147	"	"	"	Ar-139
C-368	"	"	"	Ar-150	C-1148	"	"	"	Ar-150
C-369	"	"	"	Ar-172	C-1149	"	"	"	Ar-172
C-370	"	"	Ar-82	Ar-82	C-1150	"	"	Ar-82	Ar-82
C-371	"	"	"	Ar-117	C-1151	"	"	"	Ar-117
C-372	"	"	"	Ar-134	C-1152	"	"	"	Ar-134
C-373	"	"	"	Ar-139	C-1153	"	"	"	Ar-139
C-374	"	"	"	Ar-150	C-1154	"	"	"	Ar-150
C-375	"	"	"	Ar-172	C-1155	"	"	"	Ar-172
C-376	"	"	Ar-117	Ar-117	C-1156	"	"	Ar-117	Ar-117
C-377	"	"	"	Ar-134	C-1157	"	"	"	Ar-134
C-378	"	"	"	Ar-139	C-1158	"	"	"	Ar-139
C-379	"	"	"	Ar-150	C-1159	"	"	"	Ar-150
C-380	"	"	"	Ar-172	C-1160	"	"	"	Ar-172
C-381	"	"	Ar-134	Ar-134	C-1161	"	"	Ar-134	Ar-134
C-382	"	"	"	Ar-139	C-1162	"	"	"	Ar-139
C-383	"	"	"	Ar-150	C-1163	"	"	"	Ar-150
C-384	"	"	"	Ar-172	C-1164	"	"	"	Ar-172
C-385	"	"	Ar-139	Ar-139	C-1165	"	"	Ar-139	Ar-139
C-386	"	"	"	Ar-150	C-1166	"	"	"	Ar-150
C-387	"	"	"	Ar-172	C-1167	"	"	"	Ar-172
C-388	"	"	Ar-150	Ar-150	C-1168	"	"	Ar-150	Ar-150
C-389	"	"	"	Ar-172	C-1169	"	"	"	Ar-172
C-390	"	"	Ar-172	Ar-172	C-1170	"	"	Ar-172	Ar-172
C-391	"	F	Ar-1	Ar-1	C-1171	"	三級丁基	Ar-1	Ar-1
C-392	"	"	"	Ar-2	C-1172	"	"	"	Ar-2
C-393	"	"	"	Ar-4	C-1173	"	"	"	Ar-4
C-394	"	"	"	Ar-5	C-1174	"	"	"	Ar-5
C-395	"	"	"	Ar-74	C-1175	"	"	"	Ar-74
C-396	"	"	"	Ar-78	C-1176	"	"	"	Ar-78
C-397	"	"	"	Ar-82	C-1177	"	"	"	Ar-82
C-398	"	"	"	Ar-117	C-1178	"	"	"	Ar-117
C-399	"	"	"	Ar-134	C-1179	"	"	"	Ar-134
C-400	"	"	"	Ar-139	C-1180	"	"	"	Ar-139
C-401	"	"	"	Ar-150	C-1181	"	"	"	Ar-150
C-402	"	"	"	Ar-172	C-1182	"	"	"	Ar-172

C-403	"	"	Ar-2	Ar-2	C-1183	"	"	Ar-2	Ar-2
C-404	"	"	"	Ar-4	C-1184	"	"	"	Ar-4
C-405	"	"	"	Ar-5	C-1185	"	"	"	Ar-5
C-406	"	"	"	Ar-74	C-1186	"	"	"	Ar-74
C-407	"	"	"	Ar-78	C-1187	"	"	"	Ar-78
C-408	"	"	"	Ar-82	C-1188	"	"	"	Ar-82
C-409	"	"	"	Ar-117	C-1189	"	"	"	Ar-117
C-410	"	"	"	Ar-134	C-1190	"	"	"	Ar-134
C-411	"	"	"	Ar-139	C-1191	"	"	"	Ar-139
C-412	"	"	"	Ar-150	C-1192	"	"	"	Ar-150
C-413	"	"	"	Ar-172	C-1193	"	"	"	Ar-172
C-414	"	"	Ar-4	Ar-4	C-1194	"	"	Ar-4	Ar-4
C-415	"	"	"	Ar-5	C-1195	"	"	"	Ar-5
C-416	"	"	"	Ar-74	C-1196	"	"	"	Ar-74
C-417	"	"	"	Ar-78	C-1197	"	"	"	Ar-78
C-418	"	"	"	Ar-82	C-1198	"	"	"	Ar-82
C-419	"	"	"	Ar-117	C-1199	"	"	"	Ar-117
C-420	"	"	"	Ar-134	C-1200	"	"	"	Ar-134
C-421	"	"	"	Ar-139	C-1201	"	"	"	Ar-139
C-422	"	"	"	Ar-150	C-1202	"	"	"	Ar-150
C-423	"	"	"	Ar-172	C-1203	"	"	"	Ar-172
C-424	"	"	Ar-5	Ar-5	C-1204	"	"	Ar-5	Ar-5
C-425	"	"	"	Ar-74	C-1205	"	"	"	Ar-74
C-426	"	"	"	Ar-78	C-1206	"	"	"	Ar-78
C-427	"	"	"	Ar-82	C-1207	"	"	"	Ar-82
C-428	"	"	"	Ar-117	C-1208	"	"	"	Ar-117
C-429	"	"	"	Ar-134	C-1209	"	"	"	Ar-134
C-430	"	"	"	Ar-139	C-1210	"	"	"	Ar-139
C-431	"	"	"	Ar-150	C-1211	"	"	"	Ar-150
C-432	"	"	"	Ar-172	C-1212	"	"	"	Ar-172
C-433	"	"	Ar-74	Ar-74	C-1213	"	"	Ar-74	Ar-74
C-434	"	"	"	Ar-78	C-1214	"	"	"	Ar-78
C-435	"	"	"	Ar-82	C-1215	"	"	"	Ar-82
C-436	"	"	"	Ar-117	C-1216	"	"	"	Ar-117
C-437	"	"	"	Ar-134	C-1217	"	"	"	Ar-134
C-438	"	"	"	Ar-139	C-1218	"	"	"	Ar-139
C-439	"	"	"	Ar-150	C-1219	"	"	"	Ar-150
C-440	"	"	"	Ar-172	C-1220	"	"	"	Ar-172
C-441	"	"	Ar-78	Ar-78	C-1221	"	"	Ar-78	Ar-78
C-442	"	"	"	Ar-82	C-1222	"	"	"	Ar-82
C-443	"	"	"	Ar-117	C-1223	"	"	"	Ar-117
C-444	"	"	"	Ar-134	C-1224	"	"	"	Ar-134

C-445	"	"	"	Ar-139	C-1225	"	"	"	Ar-139
C-446	"	"	"	Ar-150	C-1226	"	"	"	Ar-150
C-447	"	"	"	Ar-172	C-1227	"	"	"	Ar-172
C-448	"	"	Ar-82	Ar-82	C-1228	"	"	Ar-82	Ar-82
C-449	"	"	"	Ar-117	C-1229	"	"	"	Ar-117
C-450	"	"	"	Ar-134	C-1230	"	"	"	Ar-134
C-451	"	"	"	Ar-139	C-1231	"	"	"	Ar-139
C-452	"	"	"	Ar-150	C-1232	"	"	"	Ar-150
C-453	"	"	"	Ar-172	C-1233	"	"	"	Ar-172
C-454	"	"	Ar-117	Ar-117	C-1234	"	"	Ar-117	Ar-117
C-455	"	"	"	Ar-134	C-1235	"	"	"	Ar-134
C-456	"	"	"	Ar-139	C-1236	"	"	"	Ar-139
C-457	"	"	"	Ar-150	C-1237	"	"	"	Ar-150
C-458	"	"	"	Ar-172	C-1238	"	"	"	Ar-172
C-459	"	"	Ar-134	Ar-134	C-1239	"	"	Ar-134	Ar-134
C-460	"	"	"	Ar-139	C-1240	"	"	"	Ar-139
C-461	"	"	"	Ar-150	C-1241	"	"	"	Ar-150
C-462	"	"	"	Ar-172	C-1242	"	"	"	Ar-172
C-463	"	"	Ar-139	Ar-139	C-1243	"	"	Ar-139	Ar-139
C-464	"	"	"	Ar-150	C-1244	"	"	"	Ar-150
C-465	"	"	"	Ar-172	C-1245	"	"	"	Ar-172
C-466	"	"	Ar-150	Ar-150	C-1246	"	"	Ar-150	Ar-150
C-467	"	"	"	Ar-172	C-1247	"	"	"	Ar-172
C-468	"	"	Ar-172	Ar-172	C-1248	"	"	Ar-172	Ar-172
C-469	"	甲基	Ar-1	Ar-1	C-1249	R-58	H	Ar-1	Ar-1
C-470	"	"	"	Ar-2	C-1250	"	"	"	Ar-2
C-471	"	"	"	Ar-4	C-1251	"	"	"	Ar-4
C-472	"	"	"	Ar-5	C-1252	"	"	"	Ar-5
C-473	"	"	"	Ar-74	C-1253	"	"	"	Ar-74
C-474	"	"	"	Ar-78	C-1254	"	"	"	Ar-78
C-475	"	"	"	Ar-82	C-1255	"	"	"	Ar-82
C-476	"	"	"	Ar-117	C-1256	"	"	"	Ar-117
C-477	"	"	"	Ar-134	C-1257	"	"	"	Ar-134
C-478	"	"	"	Ar-139	C-1258	"	"	"	Ar-139
C-479	"	"	"	Ar-150	C-1259	"	"	"	Ar-150
C-480	"	"	"	Ar-172	C-1260	"	"	"	Ar-172
C-481	"	"	Ar-2	Ar-2	C-1261	"	"	Ar-2	Ar-2
C-482	"	"	"	Ar-4	C-1262	"	"	"	Ar-4
C-483	"	"	"	Ar-5	C-1263	"	"	"	Ar-5
C-484	"	"	"	Ar-74	C-1264	"	"	"	Ar-74
C-485	"	"	"	Ar-78	C-1265	"	"	"	Ar-78
C-486	"	"	"	Ar-82	C-1266	"	"	"	Ar-82

C-487	"	"	"	Ar-117	C-1267	"	"	"	Ar-117
C-488	"	"	"	Ar-134	C-1268	"	"	"	Ar-134
C-489	"	"	"	Ar-139	C-1269	"	"	"	Ar-139
C-490	"	"	"	Ar-150	C-1270	"	"	"	Ar-150
C-491	"	"	"	Ar-172	C-1271	"	"	"	Ar-172
C-492	"	"	Ar-4	Ar-4	C-1272	"	"	Ar-4	Ar-4
C-493	"	"	"	Ar-5	C-1273	"	"	"	Ar-5
C-494	"	"	"	Ar-74	C-1274	"	"	"	Ar-74
C-495	"	"	"	Ar-78	C-1275	"	"	"	Ar-78
C-496	"	"	"	Ar-82	C-1276	"	"	"	Ar-82
C-497	"	"	"	Ar-117	C-1277	"	"	"	Ar-117
C-498	"	"	"	Ar-134	C-1278	"	"	"	Ar-134
C-499	"	"	"	Ar-139	C-1279	"	"	"	Ar-139
C-500	"	"	"	Ar-150	C-1280	"	"	"	Ar-150
C-501	"	"	"	Ar-172	C-1281	"	"	"	Ar-172
C-502	"	"	Ar-5	Ar-5	C-1282	"	"	Ar-5	Ar-5
C-503	"	"	"	Ar-74	C-1283	"	"	"	Ar-74
C-504	"	"	"	Ar-78	C-1284	"	"	"	Ar-78
C-505	"	"	"	Ar-82	C-1285	"	"	"	Ar-82
C-506	"	"	"	Ar-117	C-1286	"	"	"	Ar-117
C-507	"	"	"	Ar-134	C-1287	"	"	"	Ar-134
C-508	"	"	"	Ar-139	C-1288	"	"	"	Ar-139
C-509	"	"	"	Ar-150	C-1289	"	"	"	Ar-150
C-510	"	"	"	Ar-172	C-1290	"	"	"	Ar-172
C-511	"	"	Ar-74	Ar-74	C-1291	"	"	Ar-74	Ar-74
C-512	"	"	"	Ar-78	C-1292	"	"	"	Ar-78
C-513	"	"	"	Ar-82	C-1293	"	"	"	Ar-82
C-514	"	"	"	Ar-117	C-1294	"	"	"	Ar-117
C-515	"	"	"	Ar-134	C-1295	"	"	"	Ar-134
C-516	"	"	"	Ar-139	C-1296	"	"	"	Ar-139
C-517	"	"	"	Ar-150	C-1297	"	"	"	Ar-150
C-518	"	"	"	Ar-172	C-1298	"	"	"	Ar-172
C-519	"	"	Ar-78	Ar-78	C-1299	"	"	Ar-78	Ar-78
C-520	"	"	"	Ar-82	C-1300	"	"	"	Ar-82
C-521	"	"	"	Ar-117	C-1301	"	"	"	Ar-117
C-522	"	"	"	Ar-134	C-1302	"	"	"	Ar-134
C-523	"	"	"	Ar-139	C-1303	"	"	"	Ar-139
C-524	"	"	"	Ar-150	C-1304	"	"	"	Ar-150
C-525	"	"	"	Ar-172	C-1305	"	"	"	Ar-172
C-526	"	"	Ar-82	Ar-82	C-1306	"	"	Ar-82	Ar-82
C-527	"	"	"	Ar-117	C-1307	"	"	"	Ar-117
C-528	"	"	"	Ar-134	C-1308	"	"	"	Ar-134

C-529	"	"	"	Ar-139	C-1309	"	"	"	Ar-139
C-530	"	"	"	Ar-150	C-1310	"	"	"	Ar-150
C-531	"	"	"	Ar-172	C-1311	"	"	"	Ar-172
C-532	"	"	Ar-117	Ar-117	C-1312	"	"	Ar-117	Ar-117
C-533	"	"	"	Ar-134	C-1313	"	"	"	Ar-134
C-534	"	"	"	Ar-139	C-1314	"	"	"	Ar-139
C-535	"	"	"	Ar-150	C-1315	"	"	"	Ar-150
C-536	"	"	"	Ar-172	C-1316	"	"	"	Ar-172
C-537	"	"	Ar-134	Ar-134	C-1317	"	"	Ar-134	Ar-134
C-538	"	"	"	Ar-139	C-1318	"	"	"	Ar-139
C-539	"	"	"	Ar-150	C-1319	"	"	"	Ar-150
C-540	"	"	"	Ar-172	C-1320	"	"	"	Ar-172
C-541	"	"	Ar-139	Ar-139	C-1321	"	"	Ar-139	Ar-139
C-542	"	"	"	Ar-150	C-1322	"	"	"	Ar-150
C-543	"	"	"	Ar-172	C-1323	"	"	"	Ar-172
C-544	"	"	Ar-150	Ar-150	C-1324	"	"	Ar-150	Ar-150
C-545	"	"	"	Ar-172	C-1325	"	"	"	Ar-172
C-546	"	"	Ar-172	Ar-172	C-1326	"	"	Ar-172	Ar-172
C-547	"	三級丁基	Ar-1	Ar-1	C-1327	"	F	Ar-1	Ar-1
C-548	"	"	"	Ar-2	C-1328	"	"	"	Ar-2
C-549	"	"	"	Ar-4	C-1329	"	"	"	Ar-4
C-550	"	"	"	Ar-5	C-1330	"	"	"	Ar-5
C-551	"	"	"	Ar-74	C-1331	"	"	"	Ar-74
C-552	"	"	"	Ar-78	C-1332	"	"	"	Ar-78
C-553	"	"	"	Ar-82	C-1333	"	"	"	Ar-82
C-554	"	"	"	Ar-117	C-1334	"	"	"	Ar-117
C-555	"	"	"	Ar-134	C-1335	"	"	"	Ar-134
C-556	"	"	"	Ar-139	C-1336	"	"	"	Ar-139
C-557	"	"	"	Ar-150	C-1337	"	"	"	Ar-150
C-558	"	"	"	Ar-172	C-1338	"	"	"	Ar-172
C-559	"	"	Ar-2	Ar-2	C-1339	"	"	Ar-2	Ar-2
C-560	"	"	"	Ar-4	C-1340	"	"	"	Ar-4
C-561	"	"	"	Ar-5	C-1341	"	"	"	Ar-5
C-562	"	"	"	Ar-74	C-1342	"	"	"	Ar-74
C-563	"	"	"	Ar-78	C-1343	"	"	"	Ar-78
C-564	"	"	"	Ar-82	C-1344	"	"	"	Ar-82
C-565	"	"	"	Ar-117	C-1345	"	"	"	Ar-117
C-566	"	"	"	Ar-134	C-1346	"	"	"	Ar-134
C-567	"	"	"	Ar-139	C-1347	"	"	"	Ar-139
C-568	"	"	"	Ar-150	C-1348	"	"	"	Ar-150
C-569	"	"	"	Ar-172	C-1349	"	"	"	Ar-172
C-570	"	"	Ar-4	Ar-4	C-1350	"	"	Ar-4	Ar-4

C-571	"	"	"	Ar-5	C-1351	"	"	"	Ar-5
C-572	"	"	"	Ar-74	C-1352	"	"	"	Ar-74
C-573	"	"	"	Ar-78	C-1353	"	"	"	Ar-78
C-574	"	"	"	Ar-82	C-1354	"	"	"	Ar-82
C-575	"	"	"	Ar-117	C-1355	"	"	"	Ar-117
C-576	"	"	"	Ar-134	C-1356	"	"	"	Ar-134
C-577	"	"	"	Ar-139	C-1357	"	"	"	Ar-139
C-578	"	"	"	Ar-150	C-1358	"	"	"	Ar-150
C-579	"	"	"	Ar-172	C-1359	"	"	"	Ar-172
C-580	"	"	Ar-5	Ar-5	C-1360	"	"	Ar-5	Ar-5
C-581	"	"	"	Ar-74	C-1361	"	"	"	Ar-74
C-582	"	"	"	Ar-78	C-1362	"	"	"	Ar-78
C-583	"	"	"	Ar-82	C-1363	"	"	"	Ar-82
C-584	"	"	"	Ar-117	C-1364	"	"	"	Ar-117
C-585	"	"	"	Ar-134	C-1365	"	"	"	Ar-134
C-586	"	"	"	Ar-139	C-1366	"	"	"	Ar-139
C-587	"	"	"	Ar-150	C-1367	"	"	"	Ar-150
C-588	"	"	"	Ar-172	C-1368	"	"	"	Ar-172
C-589	"	"	Ar-74	Ar-74	C-1369	"	"	Ar-74	Ar-74
C-590	"	"	"	Ar-78	C-1370	"	"	"	Ar-78
C-591	"	"	"	Ar-82	C-1371	"	"	"	Ar-82
C-592	"	"	"	Ar-117	C-1372	"	"	"	Ar-117
C-593	"	"	"	Ar-134	C-1373	"	"	"	Ar-134
C-594	"	"	"	Ar-139	C-1374	"	"	"	Ar-139
C-595	"	"	"	Ar-150	C-1375	"	"	"	Ar-150
C-596	"	"	"	Ar-172	C-1376	"	"	"	Ar-172
C-597	"	"	Ar-78	Ar-78	C-1377	"	"	Ar-78	Ar-78
C-598	"	"	"	Ar-82	C-1378	"	"	"	Ar-82
C-599	"	"	"	Ar-117	C-1379	"	"	"	Ar-117
C-600	"	"	"	Ar-134	C-1380	"	"	"	Ar-134
C-601	"	"	"	Ar-139	C-1381	"	"	"	Ar-139
C-602	"	"	"	Ar-150	C-1382	"	"	"	Ar-150
C-603	"	"	"	Ar-172	C-1383	"	"	"	Ar-172
C-604	"	"	Ar-82	Ar-82	C-1384	"	"	Ar-82	Ar-82
C-605	"	"	"	Ar-117	C-1385	"	"	"	Ar-117
C-606	"	"	"	Ar-134	C-1386	"	"	"	Ar-134
C-607	"	"	"	Ar-139	C-1387	"	"	"	Ar-139
C-608	"	"	"	Ar-150	C-1388	"	"	"	Ar-150
C-609	"	"	"	Ar-172	C-1389	"	"	"	Ar-172
C-610	"	"	Ar-117	Ar-117	C-1390	"	"	Ar-117	Ar-117
C-611	"	"	"	Ar-134	C-1391	"	"	"	Ar-134
C-612	"	"	"	Ar-139	C-1392	"	"	"	Ar-139

C-613	"	"	"	Ar-150	C-1393	"	"	"	Ar-150
C-614	"	"	"	Ar-172	C-1394	"	"	"	Ar-172
C-615	"	"	Ar-134	Ar-134	C-1395	"	"	Ar-134	Ar-134
C-616	"	"	"	Ar-139	C-1396	"	"	"	Ar-139
C-617	"	"	"	Ar-150	C-1397	"	"	"	Ar-150
C-618	"	"	"	Ar-172	C-1398	"	"	"	Ar-172
C-619	"	"	Ar-139	Ar-139	C-1399	"	"	Ar-139	Ar-139
C-620	"	"	"	Ar-150	C-1400	"	"	"	Ar-150
C-621	"	"	"	Ar-172	C-1401	"	"	"	Ar-172
C-622	"	"	Ar-150	Ar-150	C-1402	"	"	Ar-150	Ar-150
C-623	"	"	"	Ar-172	C-1403	"	"	"	Ar-172
C-624	"	"	Ar-172	Ar-172	C-1404	"	"	Ar-172	Ar-172
C-625	R-2	H	Ar-1	Ar-1	C-1405	"	甲基	Ar-1	Ar-1
C-626	"	"	"	Ar-2	C-1406	"	"	"	Ar-2
C-627	"	"	"	Ar-4	C-1407	"	"	"	Ar-4
C-628	"	"	"	Ar-5	C-1408	"	"	"	Ar-5
C-629	"	"	"	Ar-74	C-1409	"	"	"	Ar-74
C-630	"	"	"	Ar-78	C-1410	"	"	"	Ar-78
C-631	"	"	"	Ar-82	C-1411	"	"	"	Ar-82
C-632	"	"	"	Ar-117	C-1412	"	"	"	Ar-117
C-633	"	"	"	Ar-134	C-1413	"	"	"	Ar-134
C-634	"	"	"	Ar-139	C-1414	"	"	"	Ar-139
C-635	"	"	"	Ar-150	C-1415	"	"	"	Ar-150
C-636	"	"	"	Ar-172	C-1416	"	"	"	Ar-172
C-637	"	"	Ar-2	Ar-2	C-1417	"	"	Ar-2	Ar-2
C-638	"	"	"	Ar-4	C-1418	"	"	"	Ar-4
C-639	"	"	"	Ar-5	C-1419	"	"	"	Ar-5
C-640	"	"	"	Ar-74	C-1420	"	"	"	Ar-74
C-641	"	"	"	Ar-78	C-1421	"	"	"	Ar-78
C-642	"	"	"	Ar-82	C-1422	"	"	"	Ar-82
C-643	"	"	"	Ar-117	C-1423	"	"	"	Ar-117
C-644	"	"	"	Ar-134	C-1424	"	"	"	Ar-134
C-645	"	"	"	Ar-139	C-1425	"	"	"	Ar-139
C-646	"	"	"	Ar-150	C-1426	"	"	"	Ar-150
C-647	"	"	"	Ar-172	C-1427	"	"	"	Ar-172
C-648	"	"	Ar-4	Ar-4	C-1428	"	"	Ar-4	Ar-4
C-649	"	"	"	Ar-5	C-1429	"	"	"	Ar-5
C-650	"	"	"	Ar-74	C-1430	"	"	"	Ar-74
C-651	"	"	"	Ar-78	C-1431	"	"	"	Ar-78
C-652	"	"	"	Ar-82	C-1432	"	"	"	Ar-82
C-653	"	"	"	Ar-117	C-1433	"	"	"	Ar-117
C-654	"	"	"	Ar-134	C-1434	"	"	"	Ar-134

C-655	"	"	"	Ar-139	C-1435	"	"	"	Ar-139
C-656	"	"	"	Ar-150	C-1436	"	"	"	Ar-150
C-657	"	"	"	Ar-172	C-1437	"	"	"	Ar-172
C-658	"	"	Ar-5	Ar-5	C-1438	"	"	Ar-5	Ar-5
C-659	"	"	"	Ar-74	C-1439	"	"	"	Ar-74
C-660	"	"	"	Ar-78	C-1440	"	"	"	Ar-78
C-661	"	"	"	Ar-82	C-1441	"	"	"	Ar-82
C-662	"	"	"	Ar-117	C-1442	"	"	"	Ar-117
C-663	"	"	"	Ar-134	C-1443	"	"	"	Ar-134
C-664	"	"	"	Ar-139	C-1444	"	"	"	Ar-139
C-665	"	"	"	Ar-150	C-1445	"	"	"	Ar-150
C-666	"	"	"	Ar-172	C-1446	"	"	"	Ar-172
C-667	"	"	Ar-74	Ar-74	C-1447	"	"	Ar-74	Ar-74
C-668	"	"	"	Ar-78	C-1448	"	"	"	Ar-78
C-669	"	"	"	Ar-82	C-1449	"	"	"	Ar-82
C-670	"	"	"	Ar-117	C-1450	"	"	"	Ar-117
C-671	"	"	"	Ar-134	C-1451	"	"	"	Ar-134
C-672	"	"	"	Ar-139	C-1452	"	"	"	Ar-139
C-673	"	"	"	Ar-150	C-1453	"	"	"	Ar-150
C-674	"	"	"	Ar-172	C-1454	"	"	"	Ar-172
C-675	"	"	Ar-78	Ar-78	C-1455	"	"	Ar-78	Ar-78
C-676	"	"	"	Ar-82	C-1456	"	"	"	Ar-82
C-677	"	"	"	Ar-117	C-1457	"	"	"	Ar-117
C-678	"	"	"	Ar-134	C-1458	"	"	"	Ar-134
C-679	"	"	"	Ar-139	C-1459	"	"	"	Ar-139
C-680	"	"	"	Ar-150	C-1460	"	"	"	Ar-150
C-681	"	"	"	Ar-172	C-1461	"	"	"	Ar-172
C-682	"	"	Ar-82	Ar-82	C-1462	"	"	Ar-82	Ar-82
C-683	"	"	"	Ar-117	C-1463	"	"	"	Ar-117
C-684	"	"	"	Ar-134	C-1464	"	"	"	Ar-134
C-685	"	"	"	Ar-139	C-1465	"	"	"	Ar-139
C-686	"	"	"	Ar-150	C-1466	"	"	"	Ar-150
C-687	"	"	"	Ar-172	C-1467	"	"	"	Ar-172
C-688	"	"	Ar-117	Ar-117	C-1468	"	"	Ar-117	Ar-117
C-689	"	"	"	Ar-134	C-1469	"	"	"	Ar-134
C-690	"	"	"	Ar-139	C-1470	"	"	"	Ar-139
C-691	"	"	"	Ar-150	C-1471	"	"	"	Ar-150
C-692	"	"	"	Ar-172	C-1472	"	"	"	Ar-172
C-693	"	"	Ar-134	Ar-134	C-1473	"	"	Ar-134	Ar-134
C-694	"	"	"	Ar-139	C-1474	"	"	"	Ar-139
C-695	"	"	"	Ar-150	C-1475	"	"	"	Ar-150
C-696	"	"	"	Ar-172	C-1476	"	"	"	Ar-172

C-697	"	"	Ar-139	Ar-139	C-1477	"	"	Ar-139	Ar-139
C-698	"	"	"	Ar-150	C-1478	"	"	"	Ar-150
C-699	"	"	"	Ar-172	C-1479	"	"	"	Ar-172
C-700	"	"	Ar-150	Ar-150	C-1480	"	"	Ar-150	Ar-150
C-701	"	"	"	Ar-172	C-1481	"	"	"	Ar-172
C-702	"	"	Ar-172	Ar-172	C-1482	"	"	Ar-172	Ar-172
C-703	"	F	Ar-1	Ar-1	C-1483	"	三級丁基	Ar-1	Ar-1
C-704	"	"	"	Ar-2	C-1484	"	"	"	Ar-2
C-705	"	"	"	Ar-4	C-1485	"	"	"	Ar-4
C-706	"	"	"	Ar-5	C-1486	"	"	"	Ar-5
C-707	"	"	"	Ar-74	C-1487	"	"	"	Ar-74
C-708	"	"	"	Ar-78	C-1488	"	"	"	Ar-78
C-709	"	"	"	Ar-82	C-1489	"	"	"	Ar-82
C-710	"	"	"	Ar-117	C-1490	"	"	"	Ar-117
C-711	"	"	"	Ar-134	C-1491	"	"	"	Ar-134
C-712	"	"	"	Ar-139	C-1492	"	"	"	Ar-139
C-713	"	"	"	Ar-150	C-1493	"	"	"	Ar-150
C-714	"	"	"	Ar-172	C-1494	"	"	"	Ar-172
C-715	"	"	Ar-2	Ar-2	C-1495	"	"	Ar-2	Ar-2
C-716	"	"	"	Ar-4	C-1496	"	"	"	Ar-4
C-717	"	"	"	Ar-5	C-1497	"	"	"	Ar-5
C-718	"	"	"	Ar-74	C-1498	"	"	"	Ar-74
C-719	"	"	"	Ar-78	C-1499	"	"	"	Ar-78
C-720	"	"	"	Ar-82	C-1500	"	"	"	Ar-82
C-721	"	"	"	Ar-117	C-1501	"	"	"	Ar-117
C-722	"	"	"	Ar-134	C-1502	"	"	"	Ar-134
C-723	"	"	"	Ar-139	C-1503	"	"	"	Ar-139
C-724	"	"	"	Ar-150	C-1504	"	"	"	Ar-150
C-725	"	"	"	Ar-172	C-1505	"	"	"	Ar-172
C-726	"	"	Ar-4	Ar-4	C-1506	"	"	Ar-4	Ar-4
C-727	"	"	"	Ar-5	C-1507	"	"	"	Ar-5
C-728	"	"	"	Ar-74	C-1508	"	"	"	Ar-74
C-729	"	"	"	Ar-78	C-1509	"	"	"	Ar-78
C-730	"	"	"	Ar-82	C-1510	"	"	"	Ar-82
C-731	"	"	"	Ar-117	C-1511	"	"	"	Ar-117
C-732	"	"	"	Ar-134	C-1512	"	"	"	Ar-134
C-733	"	"	"	Ar-139	C-1513	"	"	"	Ar-139
C-734	"	"	"	Ar-150	C-1514	"	"	"	Ar-150
C-735	"	"	"	Ar-172	C-1515	"	"	"	Ar-172
C-736	"	"	Ar-5	Ar-5	C-1516	"	"	Ar-5	Ar-5
C-737	"	"	"	Ar-74	C-1517	"	"	"	Ar-74
C-738	"	"	"	Ar-78	C-1518	"	"	"	Ar-78

C-739	"	"	"	Ar-82	C-1519	"	"	"	Ar-82
C-740	"	"	"	Ar-117	C-1520	"	"	"	Ar-117
C-741	"	"	"	Ar-134	C-1521	"	"	"	Ar-134
C-742	"	"	"	Ar-139	C-1522	"	"	"	Ar-139
C-743	"	"	"	Ar-150	C-1523	"	"	"	Ar-150
C-744	"	"	"	Ar-172	C-1524	"	"	"	Ar-172
C-745	"	"	Ar-74	Ar-74	C-1525	"	"	Ar-74	Ar-74
C-746	"	"	"	Ar-78	C-1526	"	"	"	Ar-78
C-747	"	"	"	Ar-82	C-1527	"	"	"	Ar-82
C-748	"	"	"	Ar-117	C-1528	"	"	"	Ar-117
C-749	"	"	"	Ar-134	C-1529	"	"	"	Ar-134
C-750	"	"	"	Ar-139	C-1530	"	"	"	Ar-139
C-751	"	"	"	Ar-150	C-1531	"	"	"	Ar-150
C-752	"	"	"	Ar-172	C-1532	"	"	"	Ar-172
C-753	"	"	Ar-78	Ar-78	C-1533	"	"	Ar-78	Ar-78
C-754	"	"	"	Ar-82	C-1534	"	"	"	Ar-82
C-755	"	"	"	Ar-117	C-1535	"	"	"	Ar-117
C-756	"	"	"	Ar-134	C-1536	"	"	"	Ar-134
C-757	"	"	"	Ar-139	C-1537	"	"	"	Ar-139
C-758	"	"	"	Ar-150	C-1538	"	"	"	Ar-150
C-759	"	"	"	Ar-172	C-1539	"	"	"	Ar-172
C-760	"	"	Ar-82	Ar-82	C-1540	"	"	Ar-82	Ar-82
C-761	"	"	"	Ar-117	C-1541	"	"	"	Ar-117
C-762	"	"	"	Ar-134	C-1542	"	"	"	Ar-134
C-763	"	"	"	Ar-139	C-1543	"	"	"	Ar-139
C-764	"	"	"	Ar-150	C-1544	"	"	"	Ar-150
C-765	"	"	"	Ar-172	C-1545	"	"	"	Ar-172
C-766	"	"	Ar-117	Ar-117	C-1546	"	"	Ar-117	Ar-117
C-767	"	"	"	Ar-134	C-1547	"	"	"	Ar-134
C-768	"	"	"	Ar-139	C-1548	"	"	"	Ar-139
C-769	"	"	"	Ar-150	C-1549	"	"	"	Ar-150
C-770	"	"	"	Ar-172	C-1550	"	"	"	Ar-172
C-771	"	"	Ar-134	Ar-134	C-1551	"	"	Ar-134	Ar-134
C-772	"	"	"	Ar-139	C-1552	"	"	"	Ar-139
C-773	"	"	"	Ar-150	C-1553	"	"	"	Ar-150
C-774	"	"	"	Ar-172	C-1554	"	"	"	Ar-172
C-775	"	"	Ar-139	Ar-139	C-1555	"	"	Ar-139	Ar-139
C-776	"	"	"	Ar-150	C-1556	"	"	"	Ar-150
C-777	"	"	"	Ar-172	C-1557	"	"	"	Ar-172
C-778	"	"	Ar-150	Ar-150	C-1558	"	"	Ar-150	Ar-150
C-779	"	"	"	Ar-172	C-1559	"	"	"	Ar-172
C-780	"	"	Ar-172	Ar-172	C-1560	"	"	Ar-172	Ar-172

C-781	"	甲基	Ar-1	Ar-1	C-1561	R-66	H	Ar-1	Ar-1
C-782	"	"	"	Ar-2	C-1562	"	"	"	Ar-2
C-783	"	"	"	Ar-4	C-1563	"	"	"	Ar-4
C-784	"	"	"	Ar-5	C-1564	"	"	"	Ar-5
C-785	"	"	"	Ar-74	C-1565	"	"	"	Ar-74
C-786	"	"	"	Ar-78	C-1566	"	"	"	Ar-78
C-787	"	"	"	Ar-82	C-1567	"	"	"	Ar-82
C-788	"	"	"	Ar-117	C-1568	"	"	"	Ar-117
C-789	"	"	"	Ar-134	C-1569	"	"	"	Ar-134
C-790	"	"	"	Ar-139	C-1570	"	"	"	Ar-139
C-791	"	"	"	Ar-150	C-1571	"	"	"	Ar-150
C-792	"	"	"	Ar-172	C-1572	"	"	"	Ar-172
C-793	"	"	Ar-2	Ar-2	C-1573	"	"	Ar-2	Ar-2
C-794	"	"	"	Ar-4	C-1574	"	"	"	Ar-4
C-795	"	"	"	Ar-5	C-1575	"	"	"	Ar-5
C-796	"	"	"	Ar-74	C-1576	"	"	"	Ar-74
C-797	"	"	"	Ar-78	C-1577	"	"	"	Ar-78
C-798	"	"	"	Ar-82	C-1578	"	"	"	Ar-82
C-799	"	"	"	Ar-117	C-1579	"	"	"	Ar-117
C-800	"	"	"	Ar-134	C-1580	"	"	"	Ar-134
C-801	"	"	"	Ar-139	C-1581	"	"	"	Ar-139
C-802	"	"	"	Ar-150	C-1582	"	"	"	Ar-150
C-803	"	"	"	Ar-172	C-1583	"	"	"	Ar-172
C-804	"	"	Ar-4	Ar-4	C-1584	"	"	Ar-4	Ar-4
C-805	"	"	"	Ar-5	C-1585	"	"	"	Ar-5
C-806	"	"	"	Ar-74	C-1586	"	"	"	Ar-74
C-807	"	"	"	Ar-78	C-1587	"	"	"	Ar-78
C-808	"	"	"	Ar-82	C-1588	"	"	"	Ar-82
C-809	"	"	"	Ar-117	C-1589	"	"	"	Ar-117
C-810	"	"	"	Ar-134	C-1590	"	"	"	Ar-134
C-811	"	"	"	Ar-139	C-1591	"	"	"	Ar-139
C-812	"	"	"	Ar-150	C-1592	"	"	"	Ar-150
C-813	"	"	"	Ar-172	C-1593	"	"	"	Ar-172
C-814	"	"	Ar-5	Ar-5	C-1594	"	"	Ar-5	Ar-5
C-815	"	"	"	Ar-74	C-1595	"	"	"	Ar-74
C-816	"	"	"	Ar-78	C-1596	"	"	"	Ar-78
C-817	"	"	"	Ar-82	C-1597	"	"	"	Ar-82
C-818	"	"	"	Ar-117	C-1598	"	"	"	Ar-117
C-819	"	"	"	Ar-134	C-1599	"	"	"	Ar-134
C-820	"	"	"	Ar-139	C-1600	"	"	"	Ar-139
C-821	"	"	"	Ar-150	C-1601	"	"	"	Ar-150
C-822	"	"	"	Ar-172	C-1602	"	"	"	Ar-172

C-823	"	"	Ar-74	Ar-74	C-1603	"	"	Ar-74	Ar-74
C-824	"	"	"	Ar-78	C-1604	"	"	"	Ar-78
C-825	"	"	"	Ar-82	C-1605	"	"	"	Ar-82
C-826	"	"	"	Ar-117	C-1606	"	"	"	Ar-117
C-827	"	"	"	Ar-134	C-1607	"	"	"	Ar-134
C-828	"	"	"	Ar-139	C-1608	"	"	"	Ar-139
C-829	"	"	"	Ar-150	C-1609	"	"	"	Ar-150
C-830	"	"	"	Ar-172	C-1610	"	"	"	Ar-172
C-831	"	"	Ar-78	Ar-78	C-1611	"	"	Ar-78	Ar-78
C-832	"	"	"	Ar-82	C-1612	"	"	"	Ar-82
C-833	"	"	"	Ar-117	C-1613	"	"	"	Ar-117
C-834	"	"	"	Ar-134	C-1614	"	"	"	Ar-134
C-835	"	"	"	Ar-139	C-1615	"	"	"	Ar-139
C-836	"	"	"	Ar-150	C-1616	"	"	"	Ar-150
C-837	"	"	"	Ar-172	C-1617	"	"	"	Ar-172
C-838	"	"	Ar-82	Ar-82	C-1618	"	"	Ar-82	Ar-82
C-839	"	"	"	Ar-117	C-1619	"	"	"	Ar-117
C-840	"	"	"	Ar-134	C-1620	"	"	"	Ar-134
C-841	"	"	"	Ar-139	C-1621	"	"	"	Ar-139
C-842	"	"	"	Ar-150	C-1622	"	"	"	Ar-150
C-843	"	"	"	Ar-172	C-1623	"	"	"	Ar-172
C-844	"	"	Ar-117	Ar-117	C-1624	"	"	Ar-117	Ar-117
C-845	"	"	"	Ar-134	C-1625	"	"	"	Ar-134
C-846	"	"	"	Ar-139	C-1626	"	"	"	Ar-139
C-847	"	"	"	Ar-150	C-1627	"	"	"	Ar-150
C-848	"	"	"	Ar-172	C-1628	"	"	"	Ar-172
C-849	"	"	Ar-134	Ar-134	C-1629	"	"	Ar-134	Ar-134
C-850	"	"	"	Ar-139	C-1630	"	"	"	Ar-139
C-851	"	"	"	Ar-150	C-1631	"	"	"	Ar-150
C-852	"	"	"	Ar-172	C-1632	"	"	"	Ar-172
C-853	"	"	Ar-139	Ar-139	C-1633	"	"	Ar-139	Ar-139
C-854	"	"	"	Ar-150	C-1634	"	"	"	Ar-150
C-855	"	"	"	Ar-172	C-1635	"	"	"	Ar-172
C-856	"	"	Ar-150	Ar-150	C-1636	"	"	Ar-150	Ar-150
C-857	"	"	"	Ar-172	C-1637	"	"	"	Ar-172
C-858	"	"	Ar-172	Ar-172	C-1638	"	"	Ar-172	Ar-172
C-859	"	三級丁基	Ar-1	Ar-1	C-1639	"	F	Ar-1	Ar-1
C-860	"	"	"	Ar-2	C-1640	"	"	"	Ar-2
C-861	"	"	"	Ar-4	C-1641	"	"	"	Ar-4
C-862	"	"	"	Ar-5	C-1642	"	"	"	Ar-5
C-863	"	"	"	Ar-74	C-1643	"	"	"	Ar-74
C-864	"	"	"	Ar-78	C-1644	"	"	"	Ar-78

C-865	"	"	"	Ar-82	C-1645	"	"	"	Ar-82
C-866	"	"	"	Ar-117	C-1646	"	"	"	Ar-117
C-867	"	"	"	Ar-134	C-1647	"	"	"	Ar-134
C-868	"	"	"	Ar-139	C-1648	"	"	"	Ar-139
C-869	"	"	"	Ar-150	C-1649	"	"	"	Ar-150
C-870	"	"	"	Ar-172	C-1650	"	"	"	Ar-172
C-871	"	"	Ar-2	Ar-2	C-1651	"	"	Ar-2	Ar-2
C-872	"	"	"	Ar-4	C-1652	"	"	"	Ar-4
C-873	"	"	"	Ar-5	C-1653	"	"	"	Ar-5
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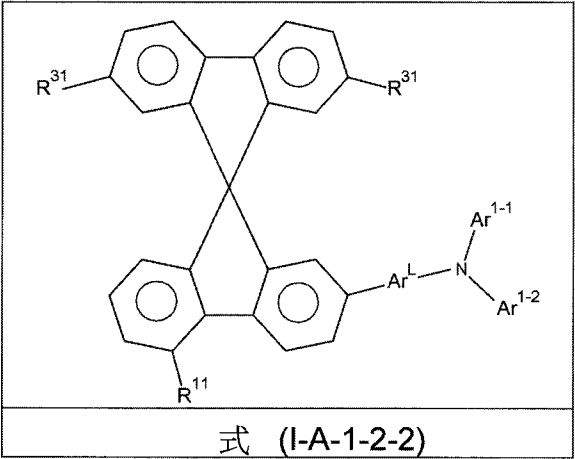
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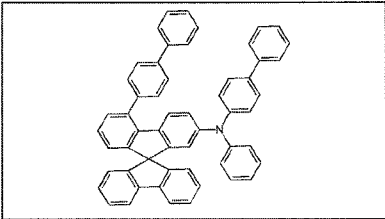
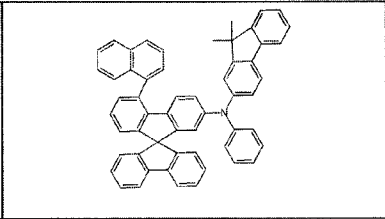
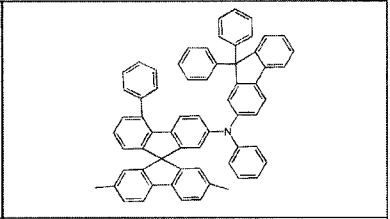
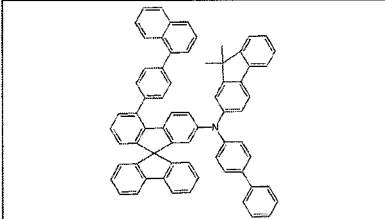
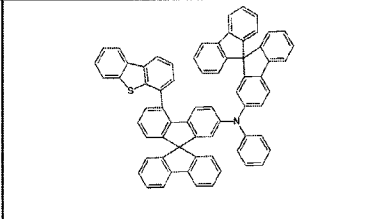
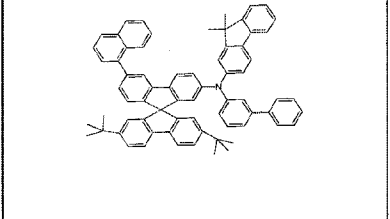
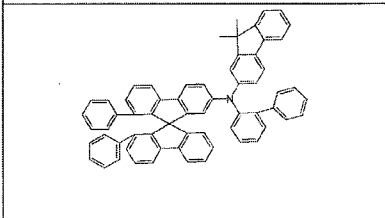
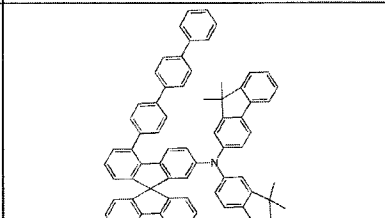
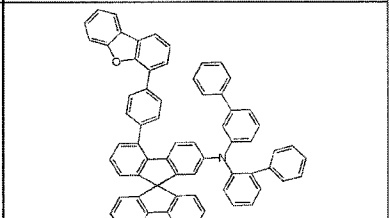
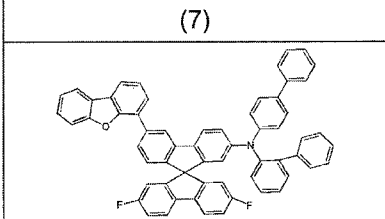
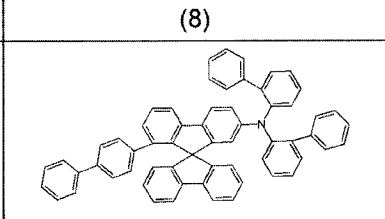
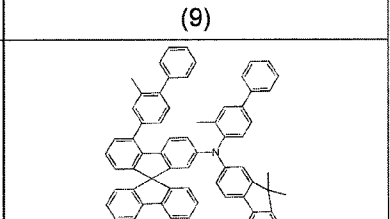
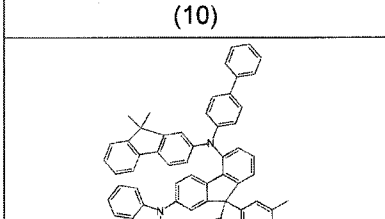
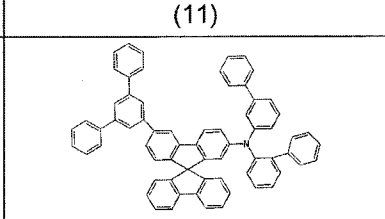
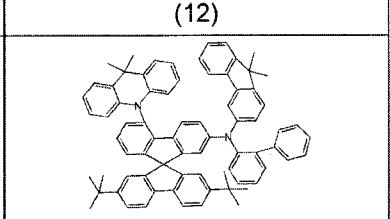
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C-1090	"	"	Ar-150	Ar-150	C-1870	"	"	Ar-150	Ar-150
C-1091	"	"	"	Ar-172	C-1871	"	"	"	Ar-172
C-1092	"	"	Ar-172	Ar-172	C-1872	"	"	Ar-172	Ar-172

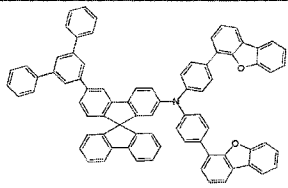
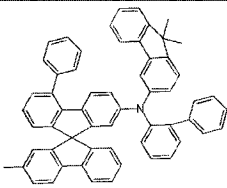
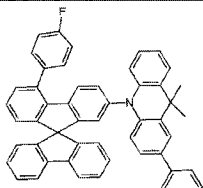
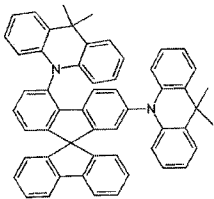
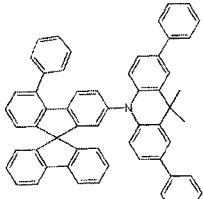
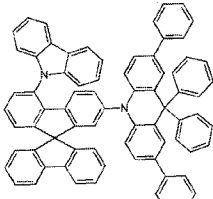
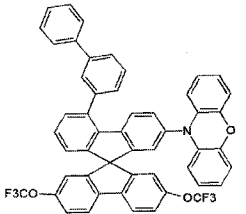
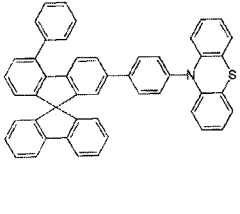
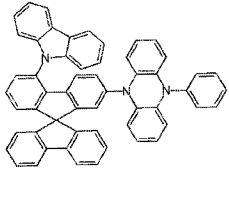
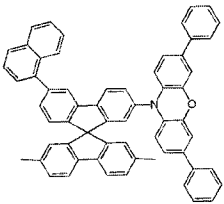
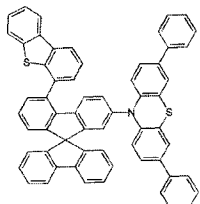
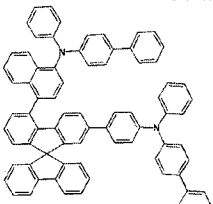
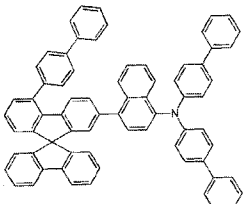
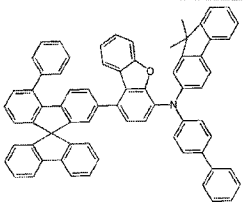
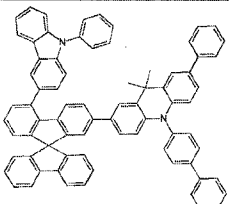
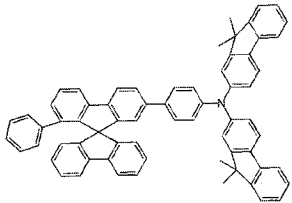
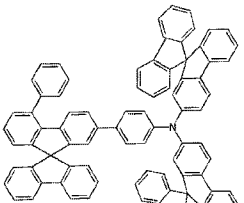
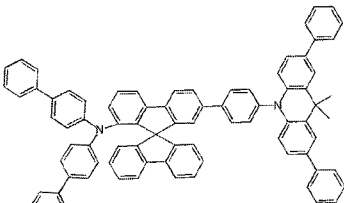
此外較佳的是對應於上述化合物 C-313至 C-1872的化合物，不同之處在於彼等係從下列式衍生

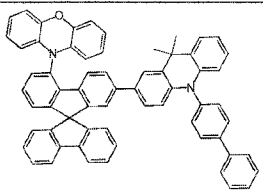
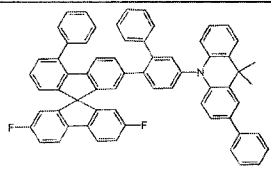
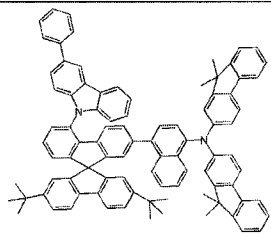
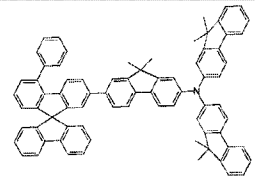
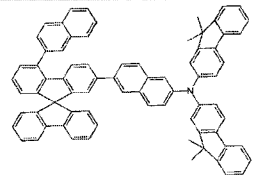
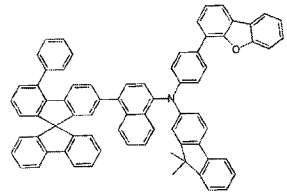
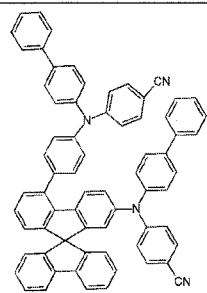
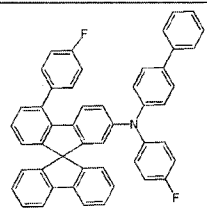
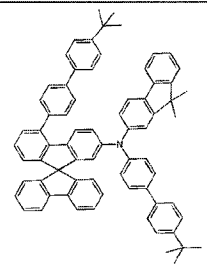
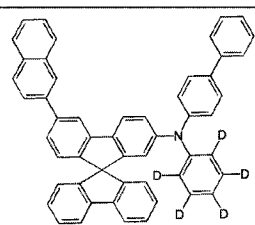
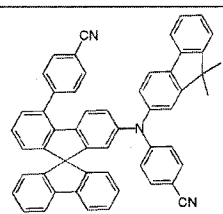
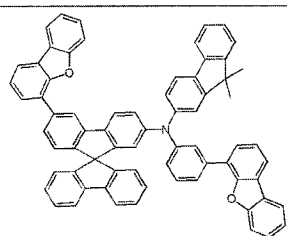
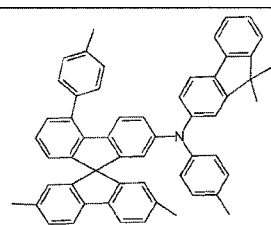
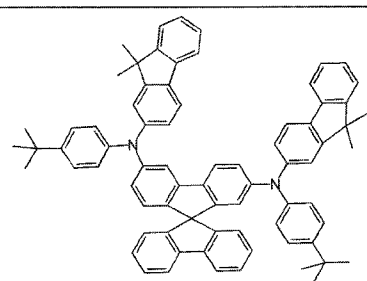
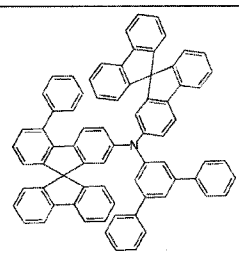


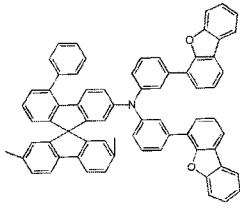
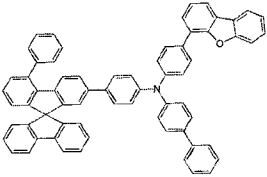
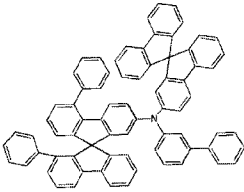
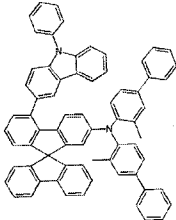
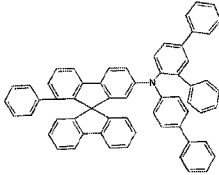
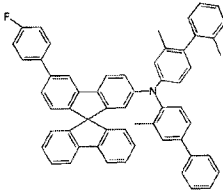
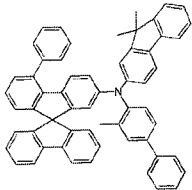
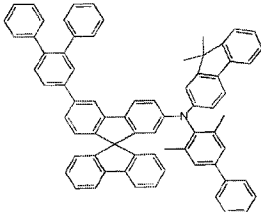
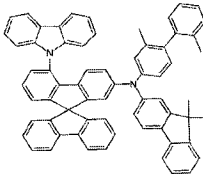
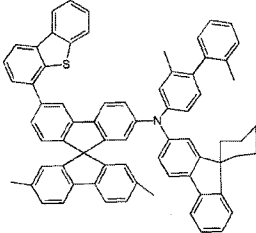
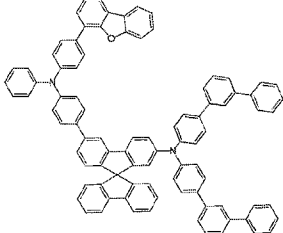
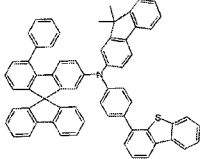
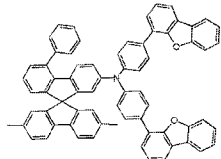
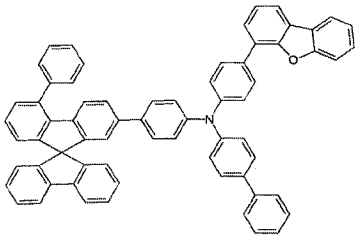
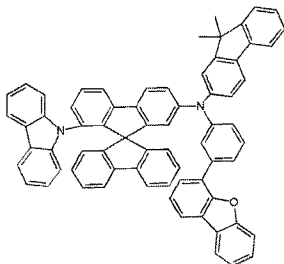
其中 Ar^L為伸苯基，較佳為 1,4-伸苯基，及其中 R¹¹、R³¹、Ar¹⁻¹和 Ar¹⁻²係指定為如對應化合物 C-313至 C-1872所示。

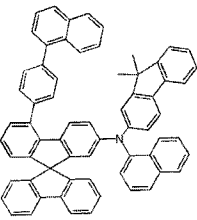
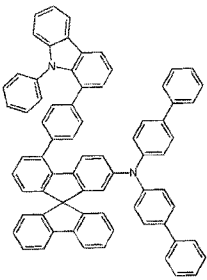
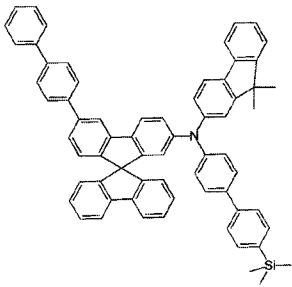
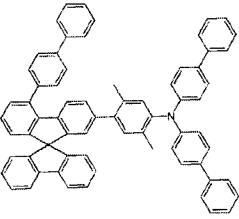
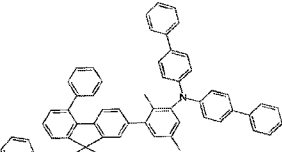
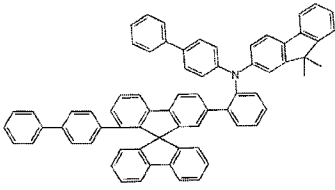
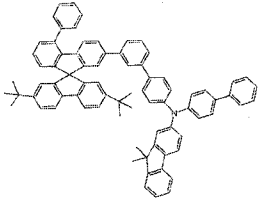
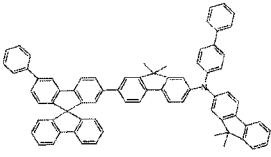
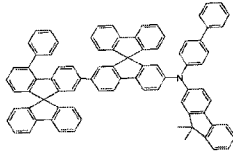
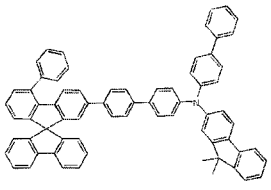
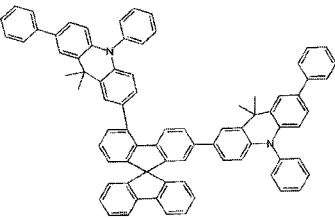
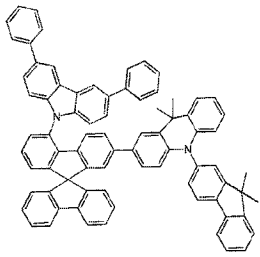
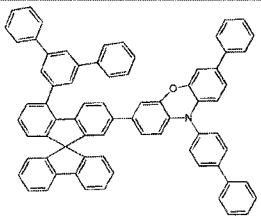
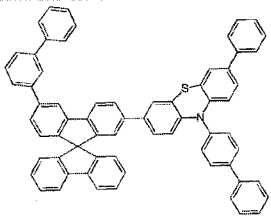
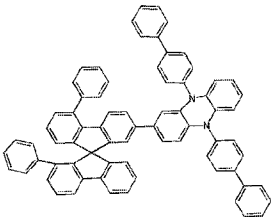
根據式 (I)較佳之化合物係顯示於下列表中：

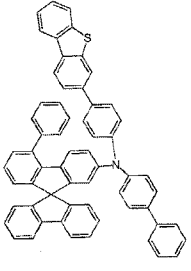
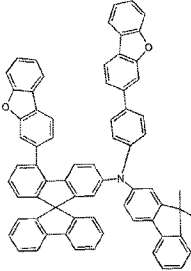
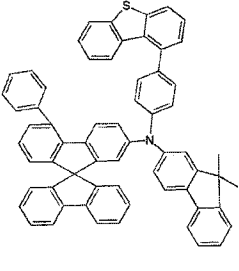
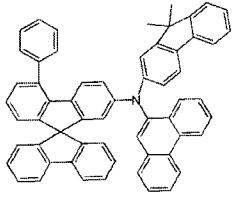
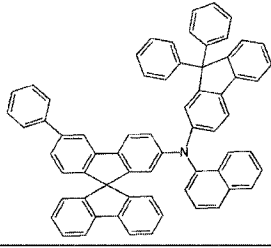
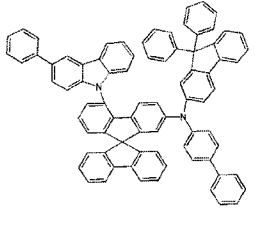
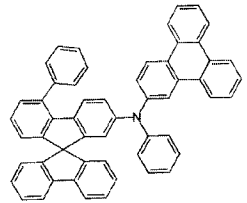
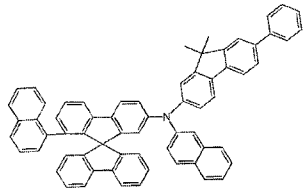
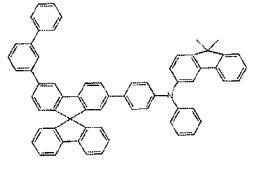
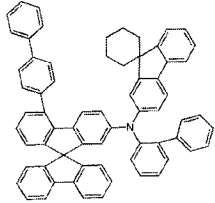
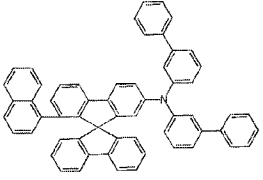
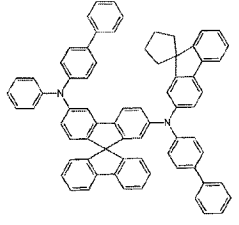
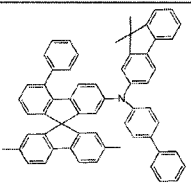
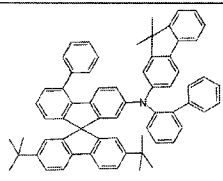
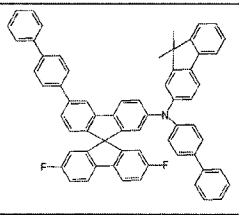
		
(1)	(2)	(3)
		
(4)	(5)	(6)
		
(7)	(8)	(9)
		
(10)	(11)	(12)
		
(13)	(14)	(15)

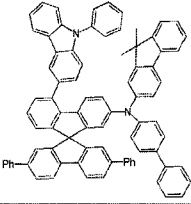
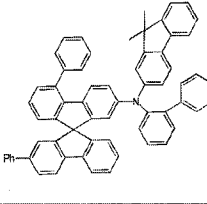
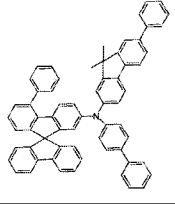
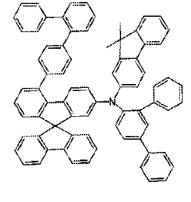
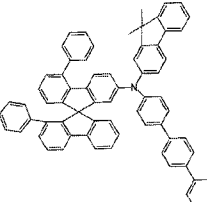
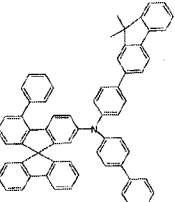
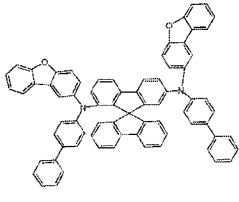
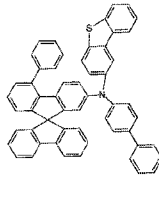
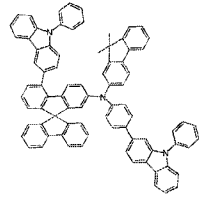
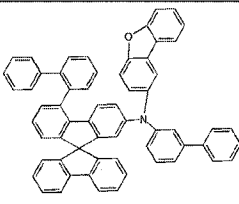
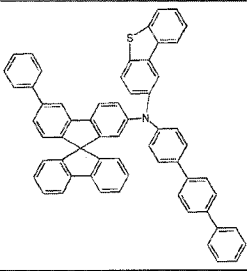
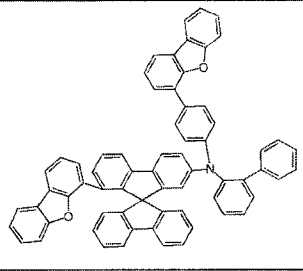
		
(16)	(17)	(18)
		
(19)	(20)	(21)
		
(22)	(23)	(24)
		
(25)	(26)	(27)
		
(28)	(29)	(30)
		

(31)	(32)	(33)
		
(34)	(35)	(36)
		
(37)	(38)	(39)
		
(40)	(41)	(42)
		
(43)	(44)	(45)
		
(46)	(47)	(48)

		
(49)	(50)	(51)
		
(52)	(53)	(54)
		
(55)	(56)	(57)
		
(58)	(59)	(60)
		
(61)	(62)	(63)

		
(64)	(65)	(66)
		
(67)	(68)	(69)
		
(70)	(71)	(72)
		
(73)	(74)	(75)
		
(76)	(77)	(78)

		
(79)	(80)	(81)
		
(82)	(83)	(84)
		
(85)	(86)	(87)
		
(88)	(89)	(90)
		
(91)	(92)	(93)

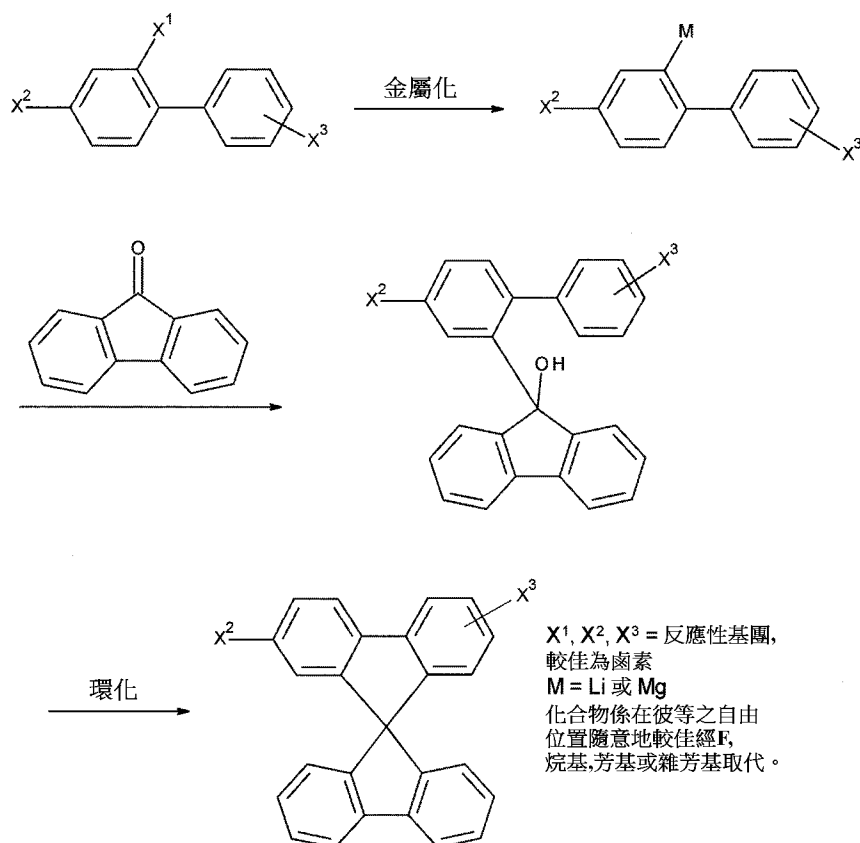
		
(94)	(95)	(96)
		
(97)	(98)	(99)
		
(100)	(101)	(102)
		
(103)	(104)	(105)

根據本申請案之化合物係藉由使用有機合成領域中已知的標準方法製備，諸如金屬催化的偶合反應(特別是 **Suzuki**反應和 **Buchwald**反應)、金屬化之芳基衍生物至羰基的親核加成反應、和酸催化的環化反應。

根據較佳合成方法，經三個反應性基團 X^1 至 X^3 取代之聯苯衍生物(其中 X^1 存在於在苯基-苯基鍵鄰位的位置)係在 X^1 的位置選擇性地金屬化，較佳用 **Li**或 **Mg**。在第二步驟中，在親核加成反應中金屬化之聯苯衍生物與茚酮衍生物

反應。所形成的具有三級羥基的中間物在酸性條件下環化成螺聯萘，其具有兩個反應性基團 X^2 和 X^3 。

流程圖 1



然後使所得化合物在其基團 X^2 和 X^3 的位置進一步反應，使得隨意地橋接之二芳基胺基團(隨意地經由間隔基團連接)係存在於基團 X^2 的位置，及隨意地橋接之二芳基胺基團(隨意地經由間隔基團、或芳基、或雜芳基連接)係存在於基團 X^3 的位置。此使用偶合反應以順序或平行的方式進行達成，該偶合反應係選自與芳基或雜芳基衍生物的 **Suzuki** 反應及與隨意地橋接之二芳基胺衍生物的 **Buchwald** 反應。在平行偶合反應的情況下，二個隨意地橋接之二芳基胺基團可藉由 **Buchwald** 反應在基團 X^2 和 X^3 的位置引入。在其中選自 **Buchwald** 反應和 **Suzuki** 反應之順序偶合反應係

一個接一個地進行，第一反應在具有較高反應性之 X^2 和 X^3 的位置發生，及第二反應在具有較低反應性之基團 X^2 和 X^3 的位置發生。

上述反應的結果，獲得根據本申請案之式(I)化合物。

本發明之另一實施態樣因此為一種製備根據式(I)化合物之方法，其特徵在於其包含下列反應步驟

1) 將在苯基-苯基鍵的鄰位之位置具有一個反應性基團且在其他位置上帶有兩個額外的反應性基團之聯苯衍生物金屬化，其中該金屬化係在苯基-苯基鍵的鄰位之位置進行；

2) 將金屬化之聯苯衍生物加成至茚酮衍生物；

3) 將所得加成產物環化為螺聯茚衍生物，其中該環化係在酸性條件下或用路易士酸進行，及其中該螺聯茚衍生物帶有兩個反應性基團；及

4) 使螺聯茚衍生物與選自芳族環系統、雜芳族環系統和胺基團之基團在二個反應性基團之位置偶合。

步驟1)的金屬化較佳為鋰化或格任亞(Grignard)反應。反應性基團較佳為鹵素基團，更佳為Cl或Br。步驟4)的偶合反應在與胺基偶合的情況下較佳選自Buchwald反應，及在與芳族環系統或雜芳族環系統偶合的情況下較佳選自Suzuki反應。步驟1)至4)較佳以其數字順序進行。此外，較佳地，步驟2)係在步驟1)之後直接地進行，及步驟3)係在步驟2)之後直接進行，及步驟4)係在步驟3)之後直接進行。“直接地”在此方面意指反應步驟之間不進行化學

反應。

上述化合物，尤其是經反應性脫離基(諸如溴、碘、氯、硼酸或硼酸酯)取代之化合物可發現作為製備對應寡聚物、樹枝狀聚合物或聚合物之單體的用途。適當反應性脫離基為(例如)溴、碘、氯、硼酸、硼酸酯、胺、具有終端C-C雙鍵或C-C參鍵之烯基或炔基、環氧乙烷、環氧丙烷、進入環加成(例如1,3-偶極環加成)之基團(例如二烯或疊氮化物)、羧酸衍生物、醇和矽烷。

本發明因此進一步提供含有一或多種式(I)化合物的寡聚物、聚合物或樹枝狀聚合物，其中至聚合物、寡聚物或樹枝狀聚合物之鍵可位於式(I)中經 R^1 、 R^2 、 R^3 或 R^4 取代之任何所欲位置處。根據式(I)化合物的鍵聯，該化合物為寡聚物或聚合物的側鏈之部分或主鏈的部分。寡聚物在本發明的情況下係解理為意指由至少三個單體單元形成之化合物。聚合物在本發明的情況下係解理為意指由至少十個單體單元形成之化合物。本發明之聚合物、寡聚物或樹枝狀聚合物可為共軛、部分共軛或非共軛。本發明之寡聚物或聚合物可為線性、分支或樹枝狀。在具有線性鍵聯之結構中，式(I)之單元可彼此直接連接，或彼等可經由二價基團(例如經由經取代或未經取代之伸烷基、經由雜原子或經由二價芳族或雜芳族基團)彼此連接。在分支及樹枝狀結構中，例如三或多個式(I)之單元可能經由三價或更高價基團(例如經由三價或更高價芳族或雜芳族基團)連接，以產生分支或樹枝狀寡聚物或聚合物。

關於寡聚物、樹枝狀聚合物及聚合物中的式(I)之重複單元，適用與上述關於式(I)化合物相同的較佳選擇。

為了製備寡聚物或聚合物，將本發明之單體進行均聚合或與其他單體進行共聚合。適當且較佳的共聚單體係選自萸(例如根據EP 842208或WO 2000/22026)、螺聯萸(例如根據EP 707020、EP 894107或WO 2006/061181)、對伸苯基(例如根據WO 1992/18552)、咔唑(例如根據WO 2004/070772或WO 2004/113468)、噻吩(例如根據EP 1028136)、二氫萸(例如根據WO 2005/014689或WO 2007/006383)、順-和反-茛並萸(例如根據WO 2004/041901或WO 2004/113412)、酮(例如根據WO 2005/040302)、萸(例如根據WO 2005/104264或WO 2007/017066)亦或複數個此等單元。聚合物、寡聚物及樹枝狀聚合物通常含有更進一步單元，例如發光(螢光或磷光)單元，例如乙烯基三芳基胺(例如根據WO 2007/068325)或磷光金屬錯合物(例如根據WO 2006/003000)、及/或電荷傳輸單元，尤其是彼等以三芳基胺為主者。

本發明之聚合物和寡聚物通常係藉由一或多種單體類型之聚合而製得，其中至少一種單體導致聚合物中式(I)之重複單元。適當的聚合反應為熟習此項技術者已知且描述於文獻中。導致C-C或C-N鍵之形成的特別適當且較佳之聚合反應為Suzuki聚合、Yamamoto聚合、Stille聚合及Hartwig-Buchwald聚合。

為了從液相處理本發明化合物(例如藉由旋轉塗佈或

藉由印刷方法需要本發明化合物的調合物。此等調合物可為例如溶液、分散液或乳液。為此目的，較佳可為使用二或多種溶劑之混合物。適當且較佳的溶劑為(例如)甲苯、苯甲醚、鄰-、間-或對-二甲苯、苯甲酸甲酯、對稱三甲苯、四氫萘、藜蘆醚、THF、甲基-THF、THP、氯苯、二噁烷、苯氧基甲苯(尤其是3-苯氧基甲苯)、(-)-葑酮、1,2,3,5-四甲基苯、1,2,4,5-四甲基苯、1-甲基萘、2-甲基苯並噻唑、2-苯氧基乙醇、2-吡咯啉酮、3-甲基苯甲醚、4-甲基苯甲醚、3,4-二甲基苯甲醚、3,5-二甲基苯甲醚、苯乙酮、 α -萜品醇、苯並噻唑、苯甲酸丁酯、異丙苯、環己醇、環己酮、環己基苯、十氫萘、十二烷基苯、苯甲酸乙酯、茛烷、苯甲酸甲酯、NMP、對-異丙基甲苯、苯基乙基醚、1,4-二異丙基苯、二苄基醚、二乙二醇丁基甲基醚、三乙二醇丁基甲基醚、二乙二醇二丁基醚、三乙二醇二甲基醚、二乙二醇單丁基醚、三丙二醇二甲基醚、四乙二醇二甲基醚、2-異丙基萘、戊基苯、己基苯、庚基苯、辛基苯、1,1-雙(3,4-二甲基苯基)乙烷或此等溶劑之混合物。

本發明因此另外提供一種調合物，尤其是一種溶液、分散液或乳液，其包含至少一種式(I)化合物及至少一種溶劑，較佳有機溶劑。其中可製備該等溶液的方式為熟習此項技術者已知且描述於(例如)WO 2002/072714、WO 2003/019694及其中所引用之文獻中。

本發明化合物適合使用於電子裝置中，尤其是用於有

機電致發光裝置(OLED)中。取決於取代，化合物係使用於不同功能和層中。

本發明因此另外提供式(I)化合物用於電子裝置之用途。此電子裝置較佳係選自由下列所組成之群組：有機積體電路(OIC)、有機場效應電晶體(OFET)、有機薄膜電晶體(OTFT)、有機發光電晶體(OLET)、有機太陽能電池(OSC)、有機光學偵測器、有機感光器(photoreceptor)、有機場淬滅裝置(OFQD)、有機發光電化學電池(OLEC)、有機雷射二極體(O-雷射)及更佳為有機電致發光裝置(OLED)。

如上已述者，本發明另外提供一種包含至少一種式(I)化合物之電子裝置。此電子裝置較佳係選自上述裝置。

更佳的是包含陽極、陰極和至少一個發光層之有機電致發光裝置(OLED)其特徵在於至少一個有機層(其可為發光層、電洞傳輸層或其他層，較佳為發光層或電洞傳輸層，特佳為電洞傳輸層)包含至少一種式(I)化合物。

除了陰極、陽極、和發光層之外，有機電致發光裝置亦可包含其他層。此等在各種情況下係選自例如一或多個電洞注入層、電洞傳輸層、電洞阻擋層、電子傳輸層、電子注入層、電子阻擋層、激子阻擋層、中間層、電荷產生層(IDMC 2003、Taiwan；Session 21 OLED (5)、T. Matsumoto、T. Nakada、J. Endo、K. Mori、N. Kawamura、A. Yokoi、J. Kido、*Multiphoton Organic EL Device Having Charge Generation Layer*)及/或有機或無機

p/n 接面。

包含式(I)化合物之有機電致發光裝置的層之順序較佳如下：

陽極-電洞注入層-電洞傳輸層-隨意其他電洞傳輸層-隨意電子阻擋層-發光層-隨意電洞阻擋層-電子傳輸層-電子注入層-陰極。其他層另外可能存在於 OLED 中。

本發明之有機電致發光裝置可包含二或多個發光層。更佳地，此等發光層在此情況下具有總計幾個在 380 nm 與 750 nm 之間的發光最大值，使得整體結果為發白光；換句話說，將可發螢光或磷光及發藍光、綠光、黃光、橘光或紅光的各種發光化合物使用於發光層中。尤佳的是三層系統，亦即具有三個發光層之系統，其中該三層顯示發藍光、綠光和橘光或紅光(基本結構參見例如 WO 2005/011013)。本發明之化合物較佳地存在於電洞傳輸層、電洞注入層或電子阻擋層中，最佳存在於電子阻擋層中。

根據本發明較佳的是當將式(I)化合物使用於包含一或多種磷光發光化合物的電子裝置時。在此情況下，化合物可存在於不同層中，較佳地存在於電洞傳輸層、電子阻擋層、電洞注入層或發光層中。

術語“磷光發光化合物”通常包含其中發光係透過自旋禁止躍遷(spin-forbidden transition)(例如從激發三重態或具有較高自旋量子數的狀態(例如五重態)躍遷)進行之化合物。

適當磷光發光化合物(=三重態發光體)尤其是在適當

地激發時發光(較佳在可見光區)且亦含有至少一種原子序大於20(較佳為大於38且小於84，更佳為大於56且小於80)的原子之化合物。較佳者為使用包含下列之化合物作為磷光發光化合物：銅、鉬、鎢、銻、釷、鐵、銻、銻、鈹、鉑、銀、金或鎘，尤其是含有銻、鉑或銅的化合物。在本發明的情況下，所有發光銻、鉑或銅錯合物被認為是磷光發光化合物。

上述發光化合物的實例可見於申請案WO 00/70655、WO 01/41512、WO 02/02714、WO 02/15645、EP 1191613、EP 1191612、EP 1191614、WO 05/033244、WO 05/019373和US 2005/0258742。通常，如使用於根據先前技術之磷光OLED及如熟習有機電致發光裝置領域之技術者已知的所有磷光錯合物皆適合。熟習該項技術者也可能在沒有行使發明技術下將其他磷光錯合物與式(I)化合物組合使用於有機電致發光裝置中。其他實例列舉於下列表中。

根據本發明也可能將式(I)化合物使用於包含一或多種螢光發光化合物之電子裝置中。

在本發明之一較佳實施態樣中，式(I)化合物係用作為電洞傳輸材料。在此情況下，化合物較佳存在於電洞傳輸層、電子阻擋層或電洞注入層中。特佳者為使用於電子阻擋層。

根據本申請案之電洞傳輸層為在陽極和發光層之間的具有電洞傳輸功能之層。

電洞注入層和電子阻擋層在本申請案之情況下係理解為電洞傳輸層之特定實施態樣。在多個電洞傳輸層在陽極和發光層之間的情況下，電洞注入層為直接相鄰於陽極或僅以陽極的單一塗層分離之電洞傳輸層。在多個電洞傳輸層在陽極和發光層之間的情況下，電子阻擋層為直接相鄰於陽極側上的發光層之電洞傳輸層。較佳地，本發明之OLED在陽極和發光層之間包含兩個、三個或四個電洞傳輸層，其中至少一個較佳地含有式(I)化合物，且更佳恰好一或兩個含有式(I)化合物。

若式(I)化合物係用作為電洞傳輸層、電洞注入層或電子阻擋層中的電洞傳輸材料，則化合物可以純材料(亦即100%之比例)使用於電洞傳輸層中，或其可與一或多種其他化合物組合使用。在一較佳實施態樣中，包含式(I)化合物之有機層則另外含有一或多種p-摻雜劑。根據本發明所使用的p-摻雜劑較佳為彼等能夠氧化混合物中的其他化合物中之一或多者的有機電子受體化合物。

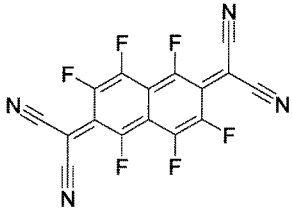
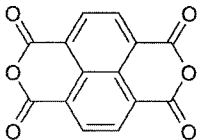
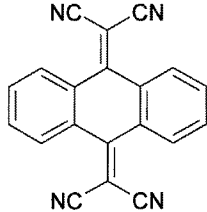
p-摻雜劑之特佳實施態樣為WO 2011/073149、EP 1968131、EP 2276085、EP 2213662、EP 1722602、EP 2045848、DE 102007031220、US 8044390、US 8057712、WO 2009/003455、WO 2010/094378、WO 2011/120709、US 2010/0096600、WO 2012/095143和DE 102012209523中所揭示之化合物。

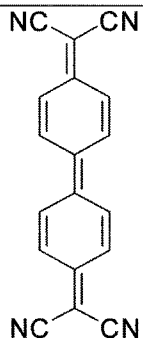
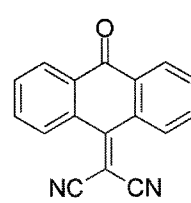
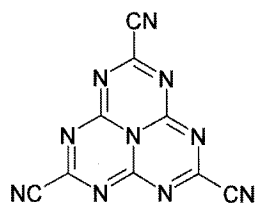
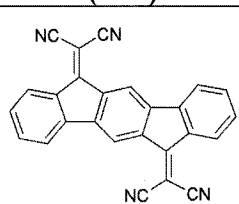
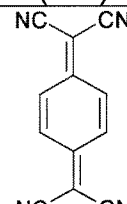
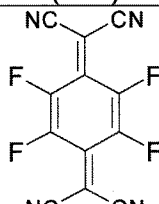
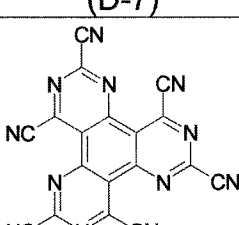
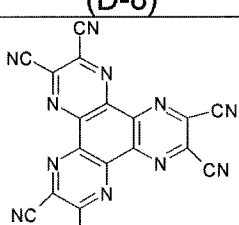
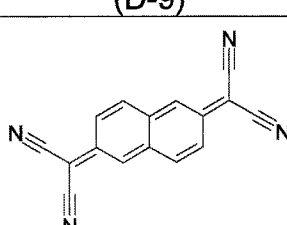
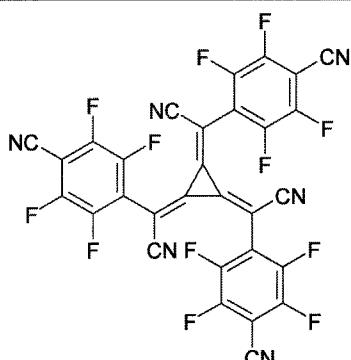
特佳p-摻雜劑為醌二甲烷化合物、氮雜蒽並茚二酮、氮雜蒽、氮雜聯伸三苯、I₂、金屬鹵化物(較佳為過渡金屬

鹵化物)、金屬氧化物(較佳為含有至少一種過渡金屬或第3主族金屬之金屬氧化物)、及過渡金屬錯合物(較佳為Cu、Co、Ni、Pd及Pt與含有至少一個氧原子作為鍵結位置之配位基的錯合物)。此外較佳者為過渡金屬氧化物作為摻雜劑，較佳為銻、鉬及鎢之氧化物，更佳為 Re_2O_7 、 MoO_3 、 WO_3 和 ReO_3 。

p-摻雜劑較佳為實質上均勻分佈在p-摻雜層中。此可例如藉由p-摻雜劑和電洞傳輸材料基質之共蒸發達成。

較佳p-摻雜劑尤其為下列化合物：

		
(D-1)	(D-2)	(D-3)

		
(D-4)	(D-5)	(D-6)
		
(D-7)	(D-8)	(D-9)
		
(D-10)	(D-11)	(D-12)
		
(D-13)		

在本發明之另一較佳實施態樣中，將式(I)化合物與如US 2007/0092755中所述之六氫雜聯伸三苯衍生物一起組合用作為電洞傳輸材料。在此特佳者為將六氫雜聯伸三苯衍生物使用於不同的層中。

在本發明另一實施態樣中，式(I)化合物係與一或多種發光化合物(較佳為磷光發光化合物)組合使用於發光層中

作為基質材料。

發光層中之基質材料的比例在此情況下就螢光發光層而言係介於50.0體積%和99.9體積%之間，較佳係介於80.0體積%和99.5體積%之間，及更佳係介於92.0體積%和99.5體積%之間，及就磷光發光層而言介於85.0體積%和97.0體積%之間。

對應地，發光化合物之比例，就螢光發光層而言係介於0.1體積%與50.0體積%之間、較佳為介於0.5體積%與20.0體積%之間、且更佳為介於0.5體積%與8.0體積%之間，以及就磷光發光層而言係介於3.0體積%與15.0體積%之間。

有機電致發光裝置之發光層亦可包括含有複數種基質材料(混合型基質系統)及/或複數種發光化合物之系統。亦在此情況下，發光化合物通常為彼等在系統中具有較小比例之化合物以及基質材料為彼等在系統中具有較大比例之化合物。然而，在個別情況下，系統中之單一基質材料的比例可小於單一發光化合物的比例。

較佳的是式(I)化合物係用作為混合型基質系統之組分。混合型基質系統較佳地包含二或三種不同的基質材料，更佳為兩種不同的基質材料。較佳地，在此情況下，二種材料中之一者為具有電洞傳輸性質之材料且其他材料為具有電子傳輸性質之材料。式(I)化合物較佳為具有電洞傳輸性質之基質材料。然而，混合基質組分之所欲電子傳輸性質和電洞傳輸性質也可主要或完全合併於單一混合-

基質組分中，在該情況下其他混合基質組分則滿足其他功能。兩種不同的基質材料可以 1：50 至 1：1，較佳為 1：20 至 1：1，更佳為 1：10 至 1：1，且最佳為 1：4 至 1：1 之比率存在。較佳者為將混合型基質系統使用於磷光有機電致發光裝置中。一個關於混合型基質系統的更詳細資訊來源為申請案 WO 2010/108579。

混合型基質系統可包含一或多種發光化合物，較佳為一或多種磷光發光化合物。通常，混合型基質系統較佳地使用於磷光有機電致發光裝置中。

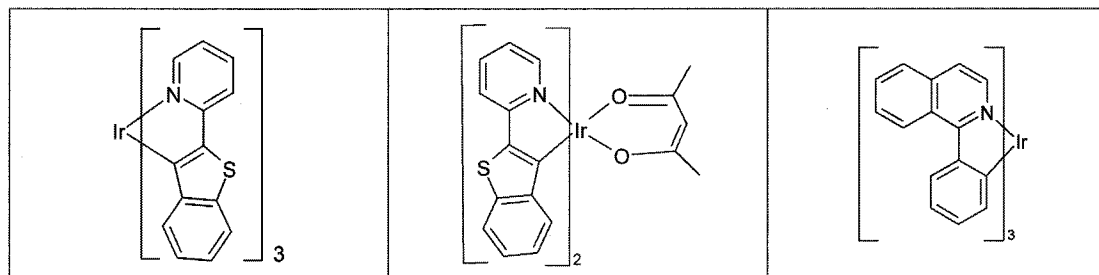
可與本發明化合物組合使用作為混合型基質系統的基質組分之特別適合的基質材料係選自以下指定用於磷光發光化合物之較佳基質材料或用於螢光發光化合物之較佳基質材料，其係根據在混合型基質系統中使用了什麼類型的發光化合物。

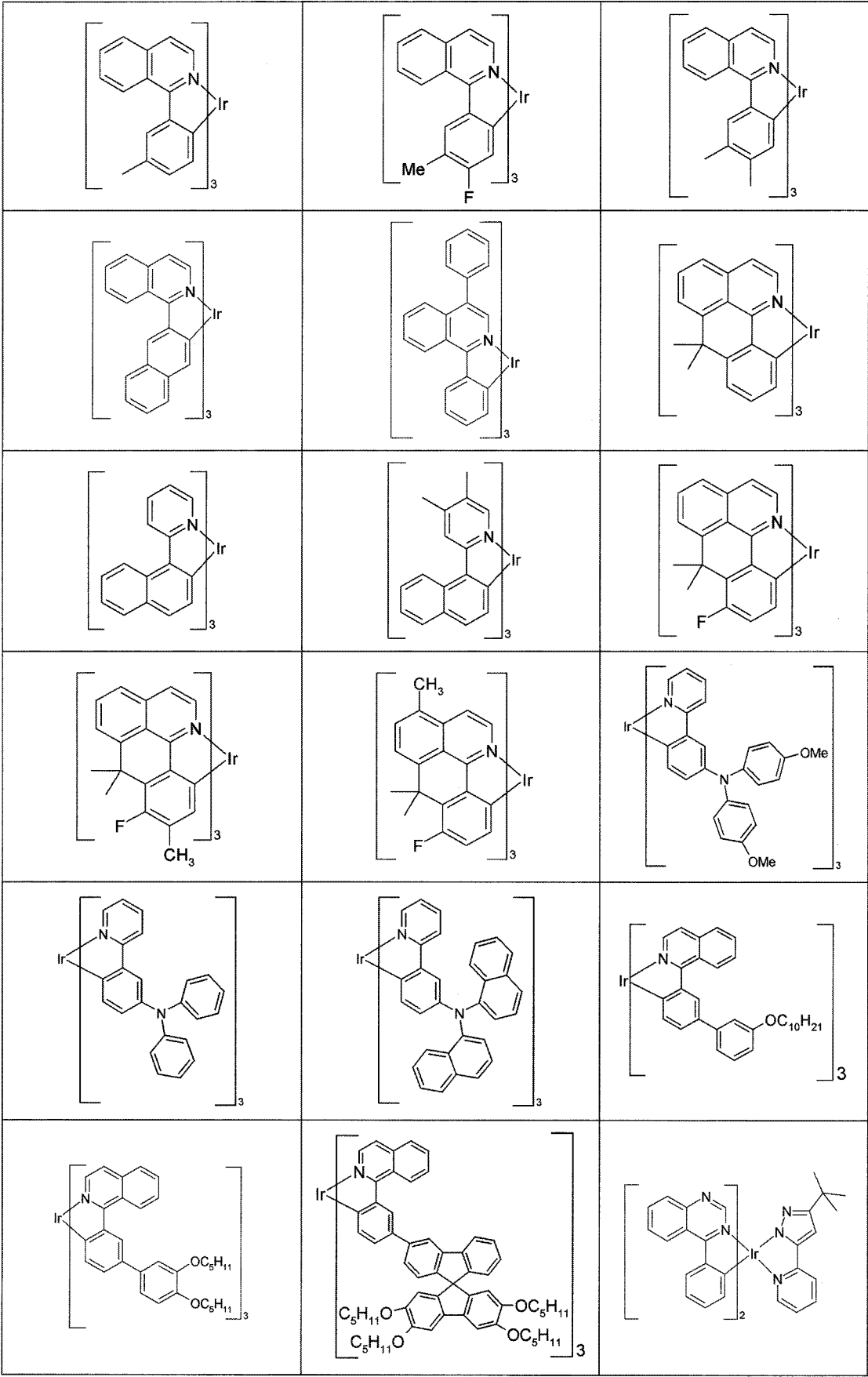
用於混合型基質系統之較佳磷光發光化合物係與進一步詳述之一般較佳磷光發光體材料相同。

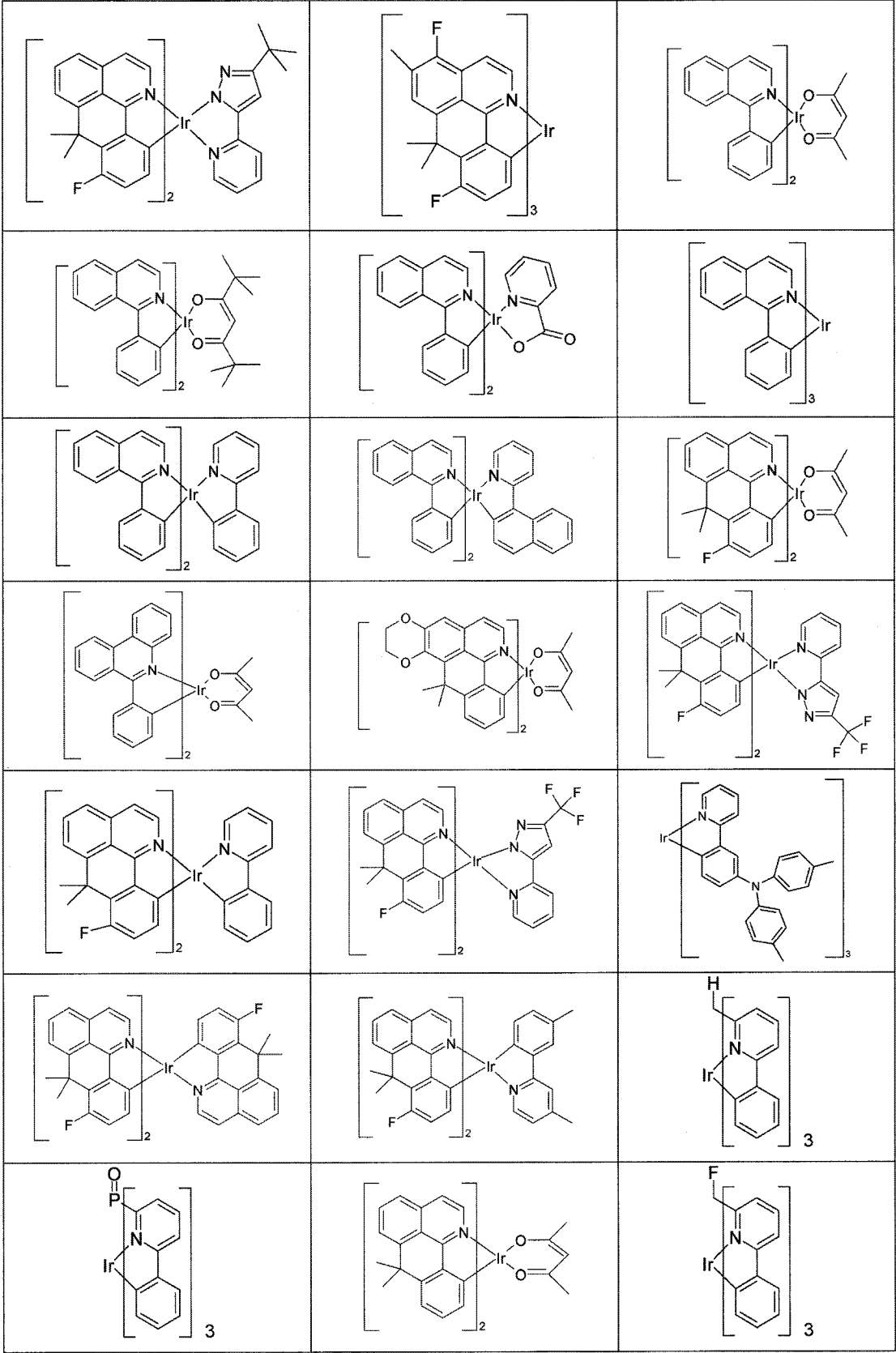
電子裝置中不同功能材料之較佳實施態樣係列於下文

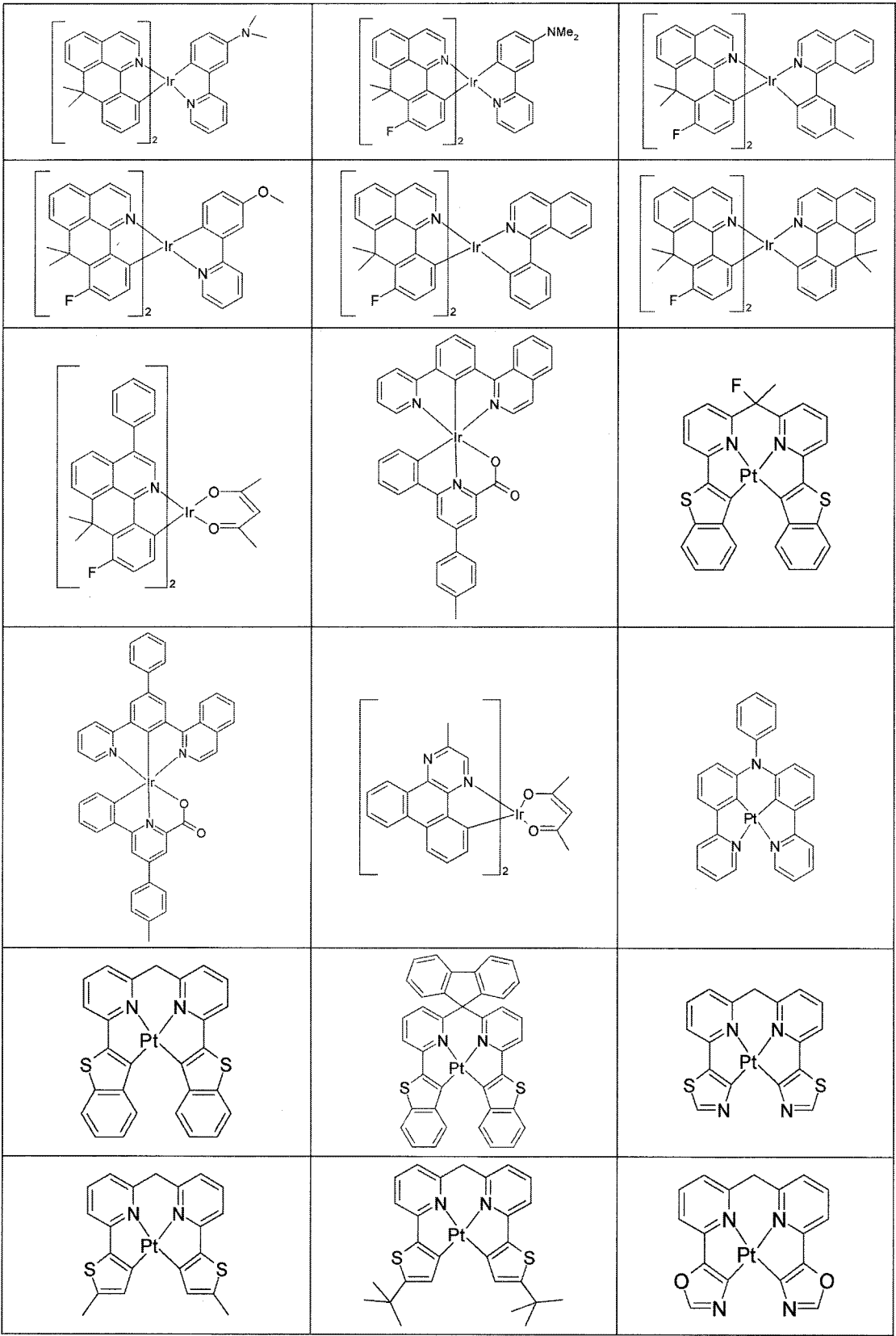
中。

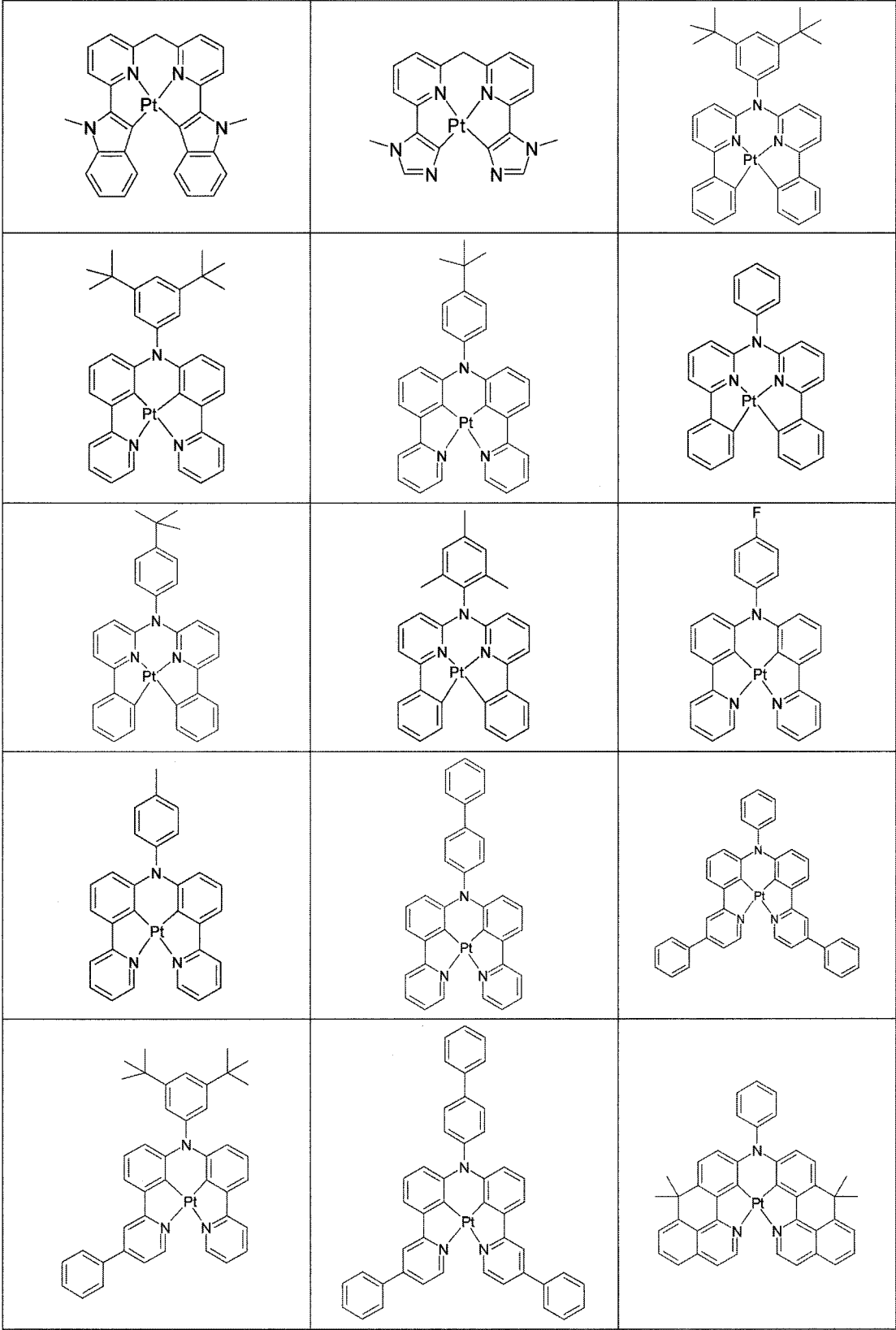
較佳磷光發光化合物為下列磷光發光化合物：

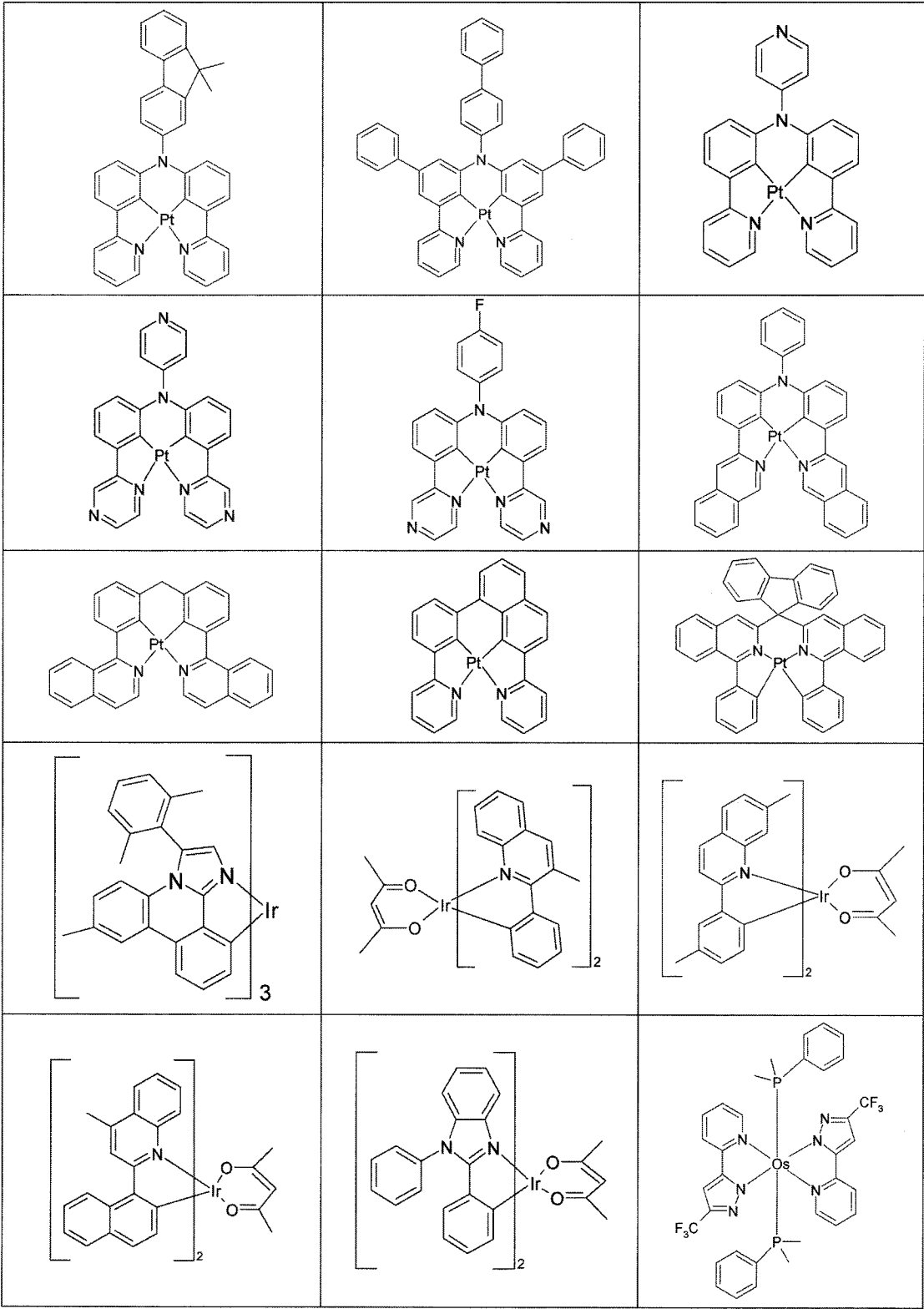


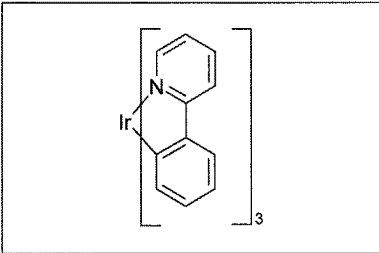
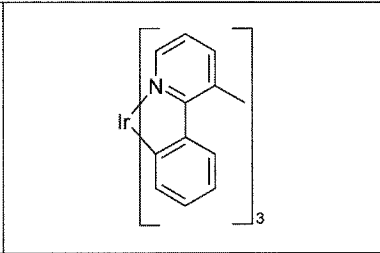
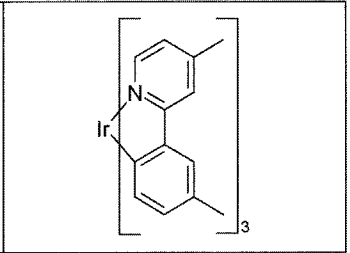
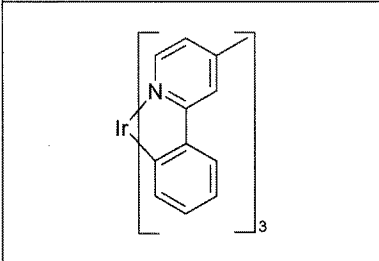
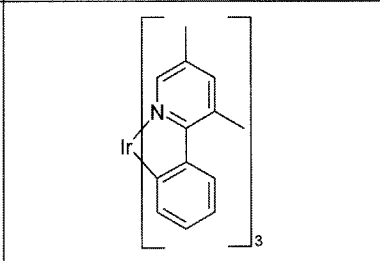
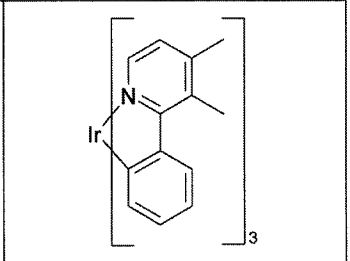
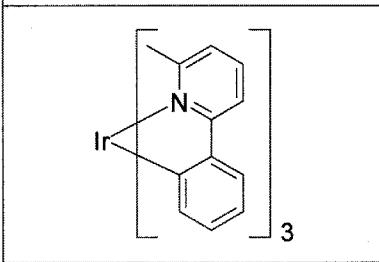
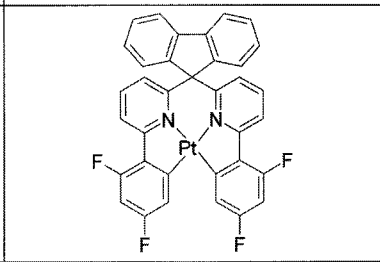
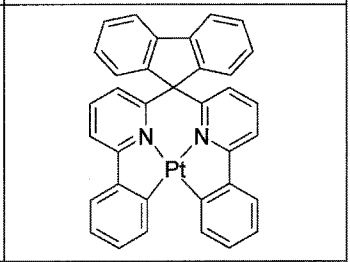
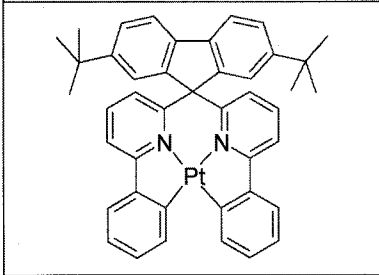
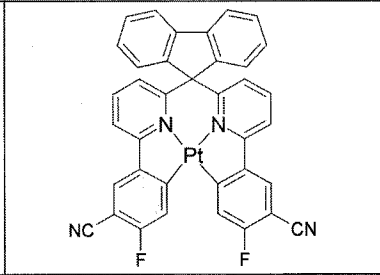
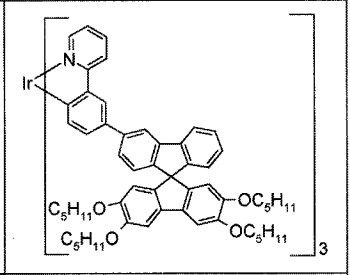
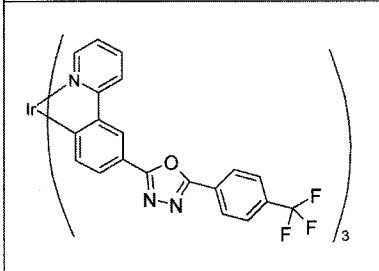
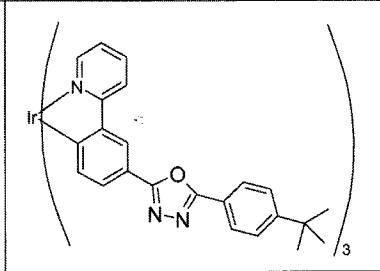
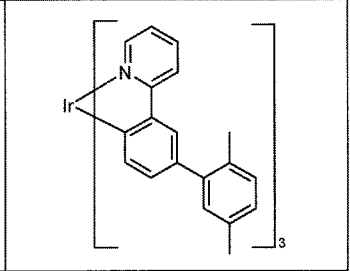
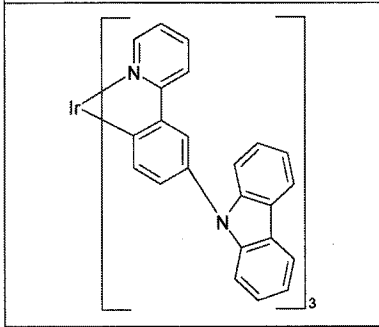
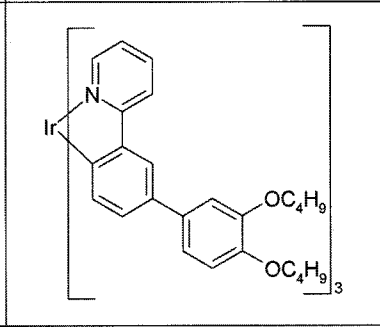
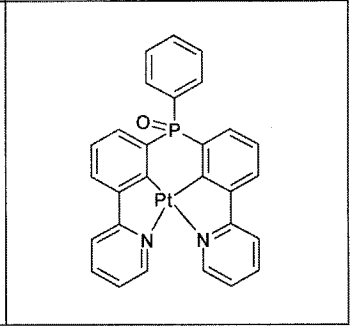


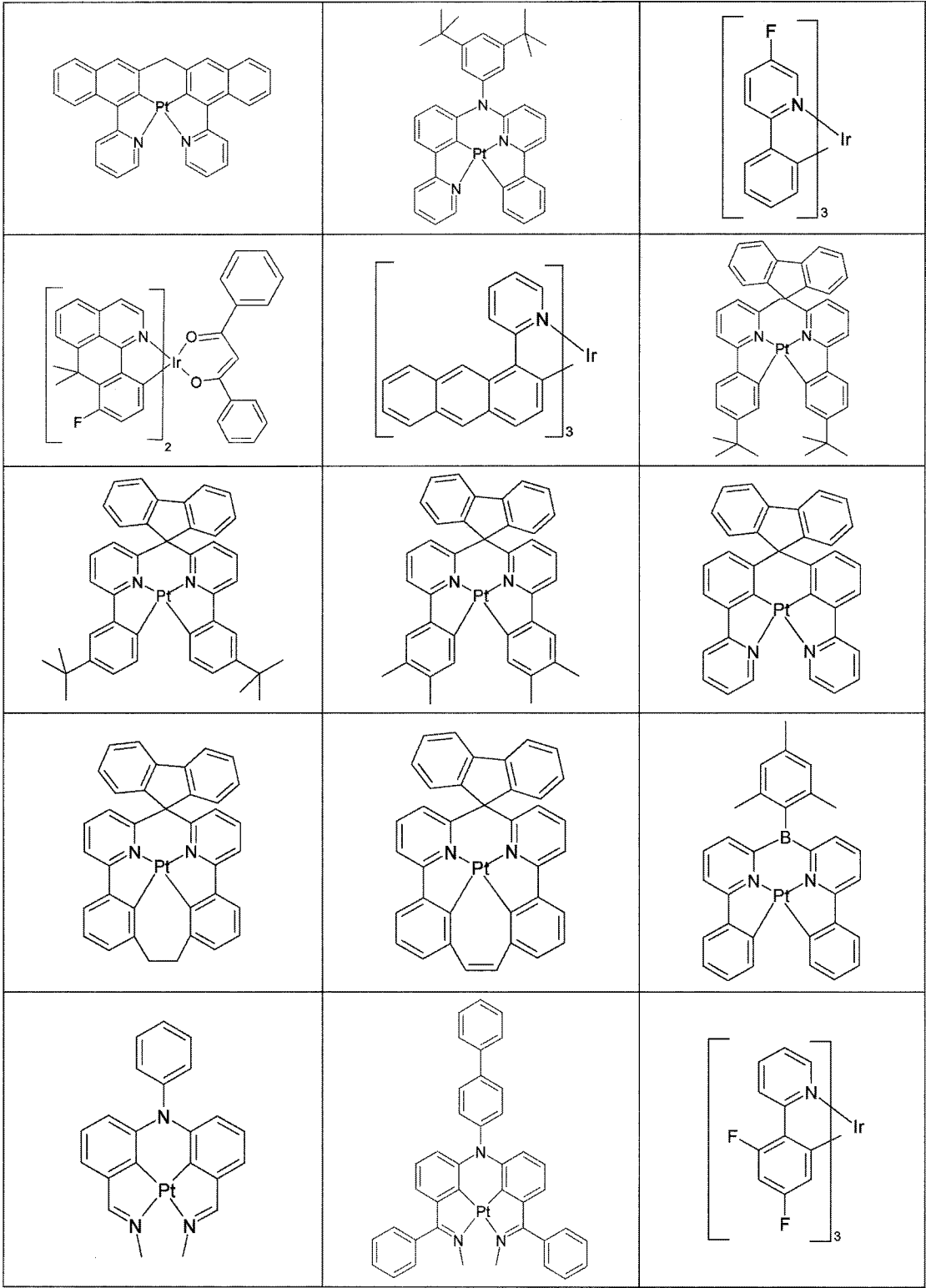


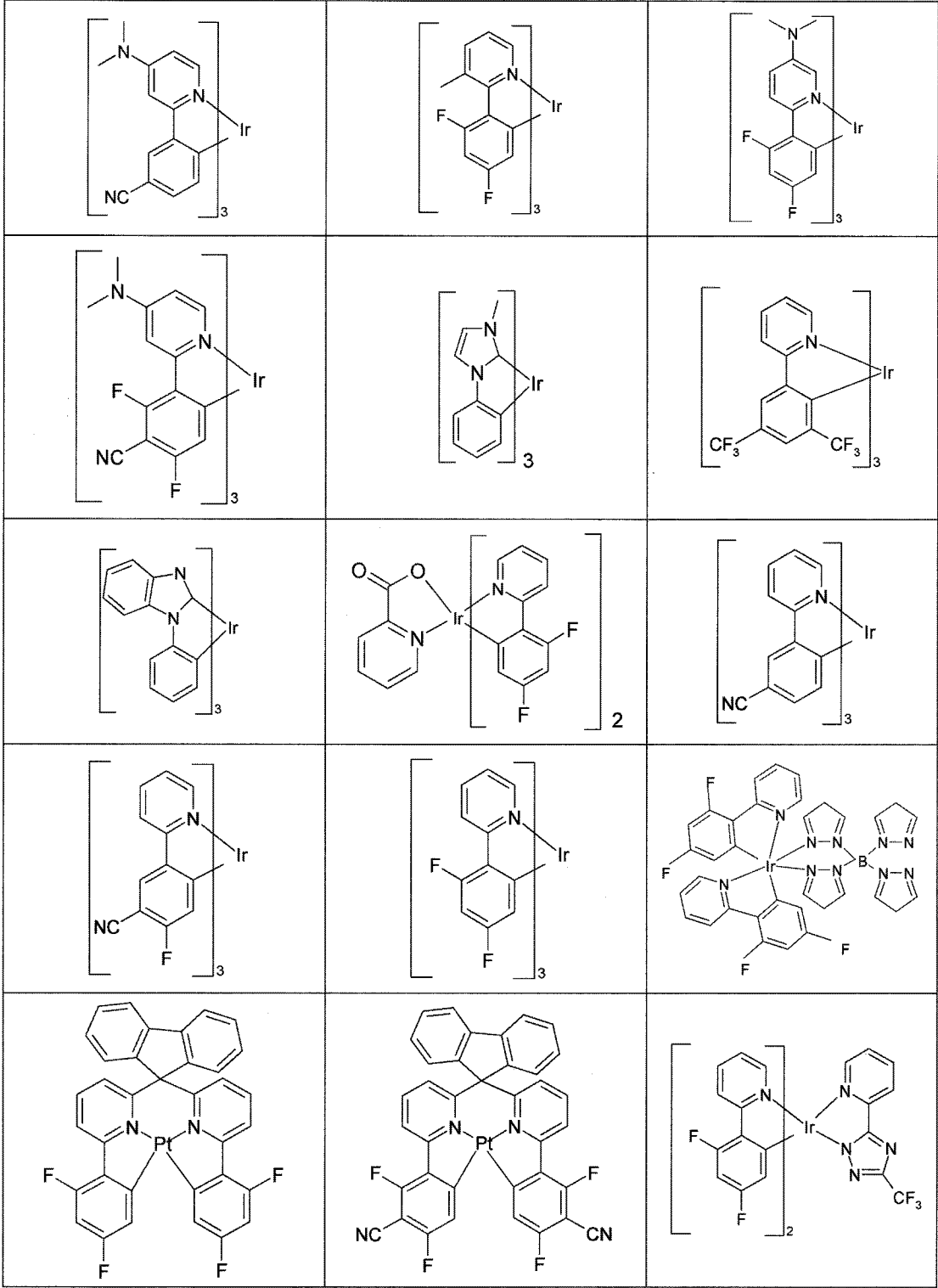


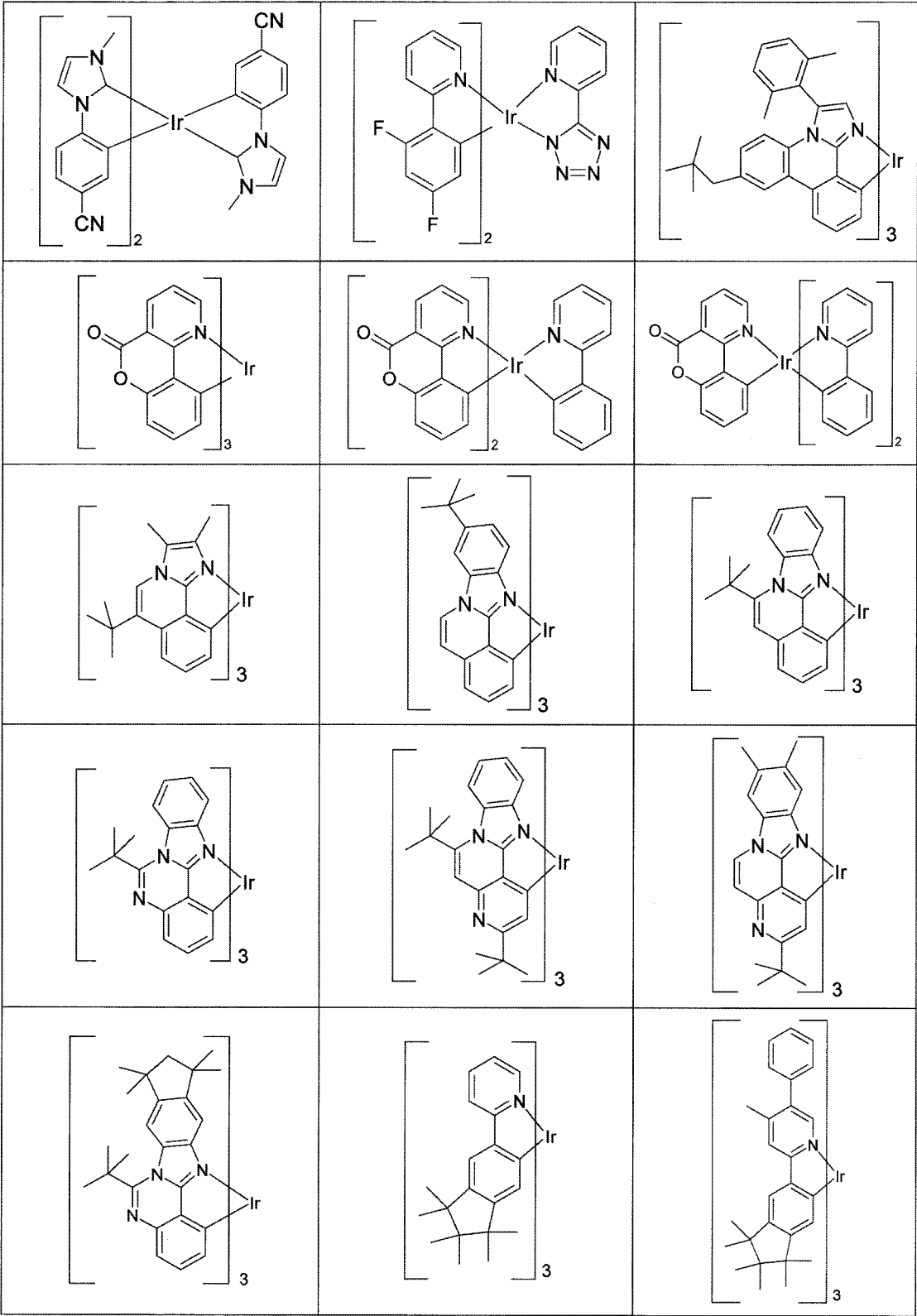


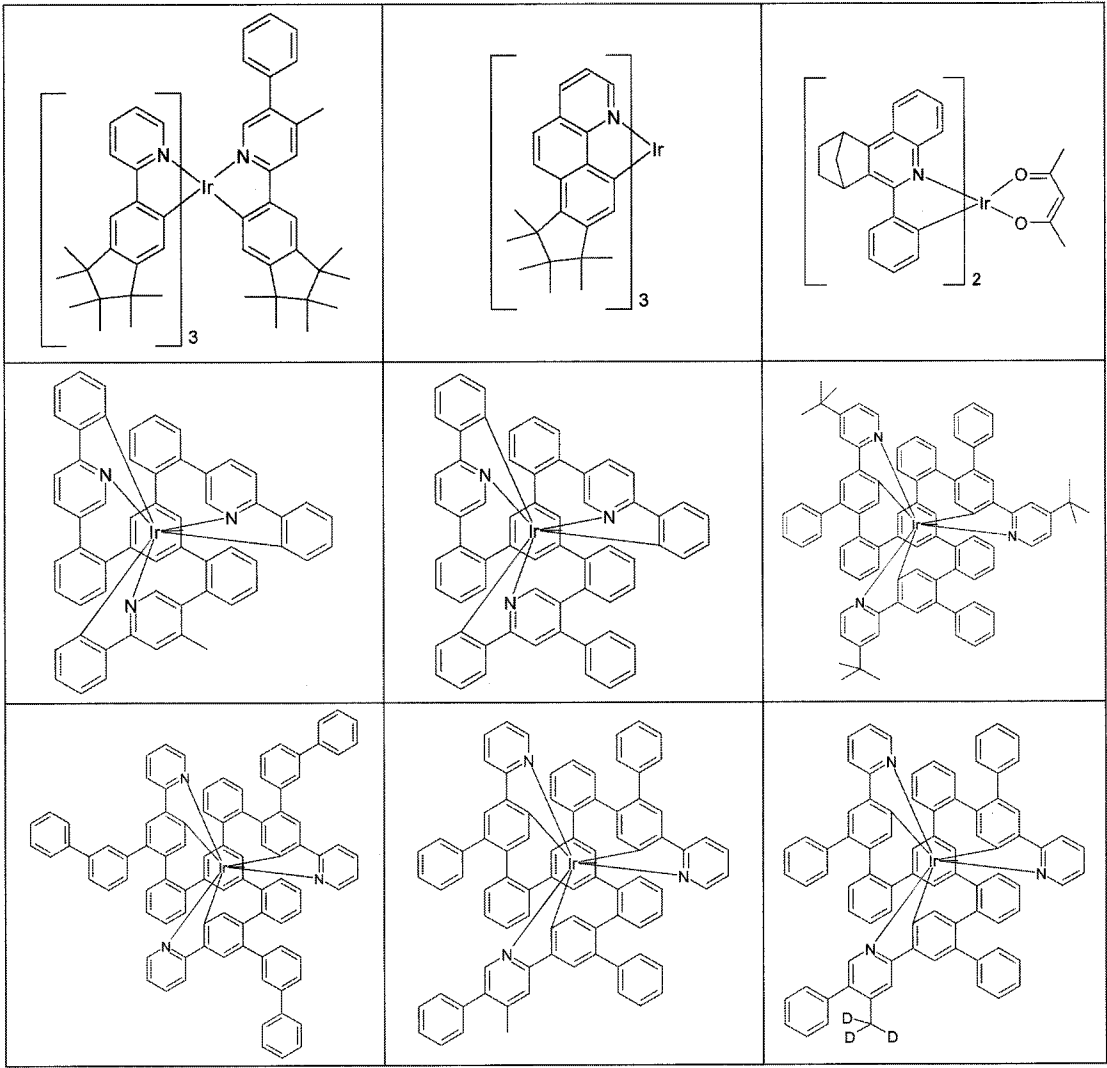










較佳螢光發光化合物係選自芳基胺之類別。芳基胺或芳族胺在本發明的情況下係理解為意指含有三個直接鍵結至氮的經取代或未經取代之芳族或雜芳族環系統的化合物。較佳地，此等芳族或雜芳族環系統中之至少一者為稠合環系統，更佳具有至少14個芳族環原子。此等的較佳實例為芳族蔥胺、芳族蔥二胺、芳族芘胺、芳族芘二胺、芳族茚胺或芳族茚二胺。芳族蔥胺係理解為意指其中一個二芳胺基直接鍵結至蔥基(較佳在9位置)之化合物。芳族蔥二胺係理解為意指其中兩個二芳胺基直接鍵結至蔥基(較佳在9,10位置)之化合物。芳族芘胺、芘二胺、茚胺及茚二

胺係類似地定義，其中二芳胺基較佳地在1位置或1,6位置上與芘鍵結。其他較佳發光化合物為茚並芘胺或茚並芘二胺(例如根據WO 2006/108497或WO 2006/122630)、苯並茚並芘胺或苯並茚並芘二胺(例如根據WO 2008/006449)及二苯並茚並芘胺或二苯並茚並芘二胺(例如根據WO 2007/140847)、及WO 2010/012328中所揭示之具有稠合芳基之茚並芘衍生物。同樣較佳的是WO 2012/048780及WO 2013/185871中所揭示之芘芳基胺。同樣較佳的是WO 2014/037077中所揭示之苯並茚並芘胺、WO 2014/106522中所揭示之苯並芘胺、WO 2014/111269和WO 2017/036574中所揭示之延伸的(extended)苯並茚並芘、WO 2017/028940和WO 2017/028941中所揭示之啡咩、和WO 2016/150544中所揭示之鍵結至呋喃單元或噻吩單元的芘衍生物。

較佳地用於螢光發光化合物之有用基質材料包括各種物質類別的材料。較佳的基質材料係選自下列類別：寡聚伸芳基(oligoarylene)(例如根據EP 676461之2,2',7,7'-四苯基螺聯芘或二萘基蒽)，尤其是含有稠合芳族基團之寡聚伸芳基、寡聚伸芳基伸乙烯基(oligoarylenevinylene)(例如根據EP 676461之DPVBi或螺-DPVBi)、多牙(polypodal)金屬錯合物(例如根據WO 2004/081017)、電洞傳導化合物(例如根據WO 2004/058911)、電子傳導化合物，尤其是酮、磷氧化物、亞砷、等等(例如根據WO 2005/084081和WO 2005/084082)、阻轉異構物(例如根據WO 2006/048268)、硼酸衍生物(例如根據WO 2006/117052)或苯並蒽(例如根據

WO 2008/145239)。特佳基質材料係選自下列類別：包含蔡、蔥、苯並蔥及/或芘之寡聚伸芳基或這些化合物的阻轉異構物、寡聚伸芳基伸乙烯基、酮、磷氧化物和亞碲。非常特佳的基質材料係選自下列類別：包含蔥、苯並蔥、苯並菲及/或芘之寡聚伸芳基或這些化合物的阻轉異構物。寡聚伸芳基在本發明的情況下應理解為意指一種其中至少三個芳基或伸芳基彼此鍵結之化合物。進一步較佳者為 WO 2006/097208、WO 2006/131192、WO 2007/065550、WO 2007/110129、WO 2007/065678、WO 2008/145239、WO 2009/100925、WO 2011/054442和EP 1553154中所揭示之蔥衍生物、EP 1749809、EP 1905754和US 2012/0187826中所揭示之芘化合物、WO 2015/158409中所揭示之苯並蔥基蔥(benzanthracenylantracene)化合物、WO 2017/025165中所揭示之茛並苯並呋喃、及WO 2017/036573中所揭示之菲基蔥(phenanthrylantracene)。

除式(I)化合物之外，用於磷光發光化合物之較佳基質材料為芳族酮、芳族磷氧化物或芳族亞碲或碲(例如根據WO 2004/013080、WO 2004/093207、WO 2006/005627或WO 2010/006680)、三芳基胺、咔唑衍生物(例如CBP(N,N-雙咔唑基聯苯)或WO 2005/039246、US 2005/0069729、JP 2004/288381、EP 1205527或WO 2008/086851中所揭示之咔唑衍生物)、吡啶並咔唑衍生物(例如根據WO 2007/063754或WO 2008/056746)、茛並咔唑衍生物(例如根據WO 2010/136109、WO 2011/000455或WO 2013/041176)、

氮雜呋啉衍生物(例如根據EP 1617710、EP 1617711、EP 1731584、JP 2005/347160)、雙極性基質材料(例如根據WO 2007/137725)、矽烷(例如根據WO 2005/111172)、氮硼雜環戊烯(azaborole)或硼酸酯(例如根據WO 2006/117052)、三吡啶衍生物(例如根據WO 2010/015306、WO 2007/063754或WO 2008/056746)、鋅錯合物(例如根據EP 652273或WO 2009/062578)、二氮雜矽雜環戊二烯(diazasilole)和四氮雜矽雜環戊二烯衍生物(例如根據WO 2010/054729)、二氮磷雜環戊二烯(diazaphosphole)衍生物(例如根據WO 2010/054730)、橋接呋啉衍生物(例如根據US 2009/0136779、WO 2010/050778、WO 2011/042107、WO 2011/088877或WO 2012/143080)、聯伸三苯衍生物(例如根據WO 2012/048781)或內醯胺(例如根據WO 2011/116865或WO 2011/137951)。

除式(I)化合物之外，適當電荷傳輸材料如可用於本發明之電子裝置的電洞注入或電洞傳輸層或電子阻擋層或電子傳輸層中，為(例如)在Y. Shirota等人在Chem. Rev. 2007，107(4)，953-1010中所揭示之化合物或根據先前技術使用於此等層中之其他材料。

較佳地，本發明之OLED包含二或更多個不同電洞傳輸層。式(I)化合物在此可用於一或多個或全部的電洞傳輸層中。在一較佳實施態樣中，式(I)化合物係用於恰好一個或恰好二個電洞傳輸層中，而其他化合物(較佳為芳族胺化合物)係用於所存在的其他電洞傳輸層。與式(I)化合物

一起使用(較佳地於本發明 OLED 之電洞傳輸層中)的其他化合物尤其為茛並萸胺衍生物(例如根據 WO 06/122630 或 WO 06/100896)、EP 1661888 中所揭示之胺衍生物、六氫雜聯伸三苯衍生物(例如根據 WO 01/049806)、具有稠合芳烴之胺衍生物(例如根據 US 5,061,569)、WO 95/09147 中所揭示之胺衍生物、單苯並茛並萸胺(例如根據 WO 08/006449)、二苯並茛並萸胺(例如根據 WO 07/140847)、螺聯萸胺(例如根據 WO 2012/034627 或 WO 2013/120577)、萸胺(例如根據 WO 2014/015937、WO 2014/015938、WO 2014/015935 及 WO 2015/082056)、螺二苯並哌喃胺(例如根據 WO 2013/083216)、二氫吡啶衍生物(例如根據 WO 2012/150001)、螺二苯並呋喃和螺二苯並噻吩(例如根據 WO 2015/022051、WO 2016/102048 及 WO 2016/131521)、菲二芳基胺(例如根據 WO 2015/131976)、螺三苯並草酚酮(spirotribenzotropolone)(例如根據 WO 2016/087017)、具有間苯基二胺基團之螺聯萸(例如根據 WO 2016/078738)、螺雙吡啶(例如根據 WO 2015/158411)、二苯並哌喃二芳基胺(例如根據 WO 2014/072017)、以及根據 WO 2015/086108 之具有二芳基胺基的 9,10-二氫蔥螺化合物。

非常特佳者為使用在 4 位置上經二芳基胺基取代之螺聯萸作為電洞傳輸化合物，尤其是使用彼等在 WO 2013/120577 中所主張且揭示的化合物，及使用在 2 位置上經二芳基胺基取代之螺聯萸作為電洞傳輸化合物，尤其是使用彼等在 WO 2012/034627 中所主張且揭示的化合物。

用於電子傳輸層之材料可為根據先前技術用作為電子傳輸層中的電子傳輸材料之任何材料。尤其適合的是鋁錯合物(例如 Alq_3)、銦錯合物(例如 Zrq_4)、鋰錯合物(例如 LiQ)、苯並咪唑衍生物、三吡啶衍生物、嘧啶衍生物、吡啶衍生物、吡嗪衍生物、喹啉衍生物、喹啶衍生物、喹二唑衍生物、芳族酮、內醯胺、硼烷、二氮磷雜環戊二烯(diazaphosphole)衍生物及磷氧化物衍生物。另外適合的材料為如 JP 2000/053957、WO 2003/060956、WO 2004/028217、WO 2004/080975和WO 2010/072300中所揭示之前述化合物的衍生物。

該電子裝置之較佳陰極為具有低功函數之金屬、金屬合金或由各種金屬(例如鹼土金屬、鹼金屬、主族金屬或鑄系元素(例如Ca、Ba、Mg、Al、In、Mg、Yb、Sm、等等))所組成之多層結構。另外適合的是由鹼金屬或鹼土金屬與銀所組成之合金，例如由鎂與銀所組成之合金。在多層結構之情況下，除了所述金屬之外，亦可能使用其他具有比較高的功函數之金屬，例如Ag或Al，在該情況下，例如通常使用金屬的組合，諸如Ca/Ag、Mg/Ag或Ba/Ag。較佳亦可在金屬陰極和有機半導體之間引入具有高介電常數之材料的薄中間層。為此目的之有用材料的實例為鹼金屬或鹼土金屬氟化物，但亦可用對應氧化物或碳酸鹽(例如LiF、 Li_2O 、 BaF_2 、MgO、NaF、CsF、 Cs_2CO_3 、等等)。為此目的也可能使用喹啶合鋰(lithium quinolate)(LiQ)。此層之層厚度較佳係介於0.5和5 nm之間。

較佳陽極為具有高功函數之材料。較佳地，陽極具有相對於真空大於 4.5eV 之功函數。首先，具有高氧化還原電位之金屬適合於此目的，例如 Ag 、 Pt 或 Au 。其次，金屬/金屬氧化物電極(例如 Al/Ni/NiO_x 、 Al/PtO_x)也可為較佳的。就一些應用而言，電極中至少一者必須是透明或部分透明的，以能夠照射有機材料(有機太陽能電池)或能夠發射光(OLED、O-雷射)。較佳陽極材料在此為導電性混合型金屬氧化物。特佳者為氧化銦錫(ITO)或氧化銦鋅(IZO)。較佳者進一步為導電性摻雜有機材料，尤其是導電性摻雜聚合物。此外，陽極也可由二或多層(例如ITO的內層和金屬氧化物(較佳氧化鎢、氧化鉬或氧化釩)的外層)組成。

將裝置適當地(根據應用)結構化，接觸連接且最後密封，以排除因水及空氣之損壞作用。

在一較佳實施態樣中，根據本發明之電子裝置特徵在於以昇華方法施加一或多層。在此情況下，該等材料係於真空昇華系統中在低於 10^{-5} 毫巴，較佳低於 10^{-6} 毫巴之初壓力下藉由氣相沈積施加。然而，在此情況下，初壓力也可能甚至更低，例如低於 10^{-7} 毫巴。

同樣較佳者為一種電子裝置，其特徵在於藉由 OVPD (有機氣相沈積)方法或輔以載體氣體昇華施加一或多層。在此情況下，該等材料係在介於 10^{-5} 毫巴與 1 巴之間的壓力下施加。此方法的一特殊例子為 OVJP(有機蒸氣噴射印刷)方法，其中該等材料係藉由噴嘴直接施加且因此結構化

(例如，M. S. Arnold等人之Appl. Phys. Lett. 2008，92，053301)。

另外較佳者為一種電子裝置，其特徵在於例如以旋轉塗佈或以任何印刷法(例如網版印刷、快乾印刷、噴嘴印刷或平版印刷，但更佳為LITI(光誘導熱成像、熱轉移印刷)或噴墨印刷)從溶液製造一或多層。為此目的，需要可溶性式(I)化合物。高溶解性可藉由化合物之適當取代而達成。

此外較佳的是本發明之電子裝置係藉由從溶液施加一或多層及藉由昇華方法施加一或多層而製造。

根據本發明，包含一或多種式(I)化合物之電子裝置可使用於顯示器中、作為照明應用中之光源及作為醫學及/或美容應用(例如光療)中之光源。

【實施方式】

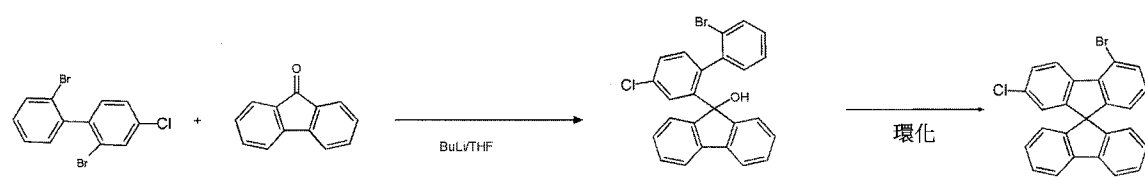
實施例

A) 合成例

除非另有指示，否則在保護性氣體氛圍下進行下列合成。起始材料可自ALDRICH或ABCR購買。在從文獻上得知的起始材料之情況下方括號中的數字係對應於CAS編號。

實施例 1

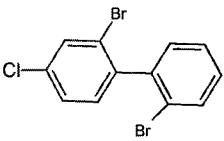
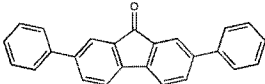
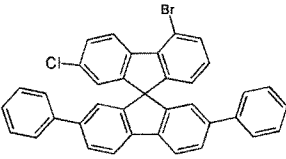
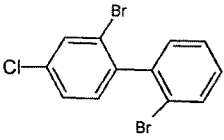
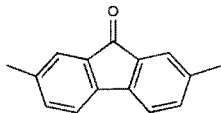
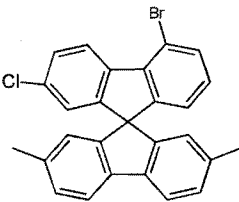
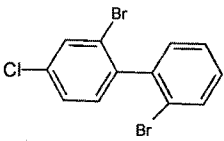
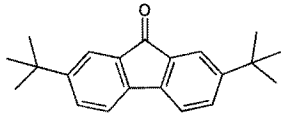
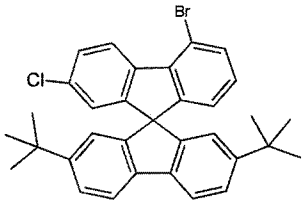
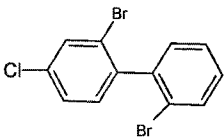
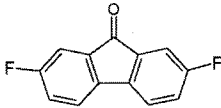
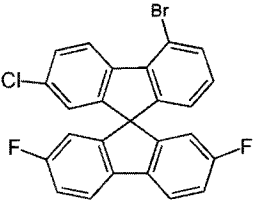
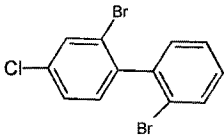
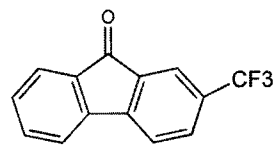
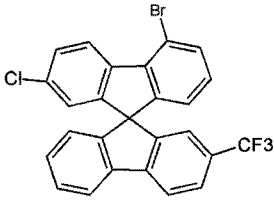
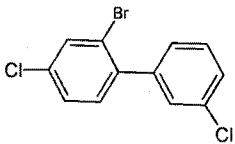
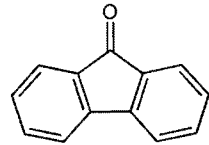
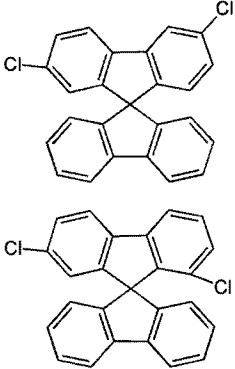
5-溴-2-氯-9,9'-螺聯萘 1a的合成

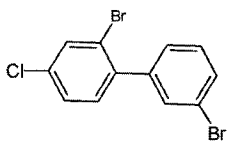
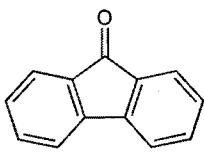
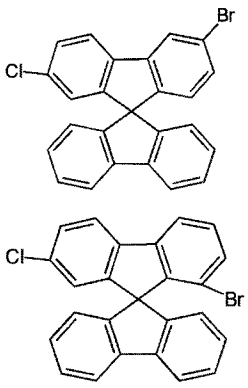


在氬氣下於 -78°C 以 109 mL 的 $n\text{-BuLi}$ (在己烷中之 2,2 M, 239 mmol) 處理 2,2'-二溴-4-氯-聯苯 (84 g, 239 mmol) 在 THF (200 ml) 中的溶液。將混合物攪拌 30 分鐘。滴加茚-9-酮 (44 g, 239 mmol) 在 150 mL THF 中的溶液。反應在 -78°C 下進行 30 分鐘，及接著在室溫下攪拌過夜。將反應用水淬滅並過濾固體。不經進一步純化，將在 966 mL 甲苯中的醇和 2.9 g 對甲苯磺酸的溶液回流過夜。冷卻後，用水洗滌有機相並在真空中移除溶劑。將產物分離為白色固體的形式 (60 g, 理論的 91%)。

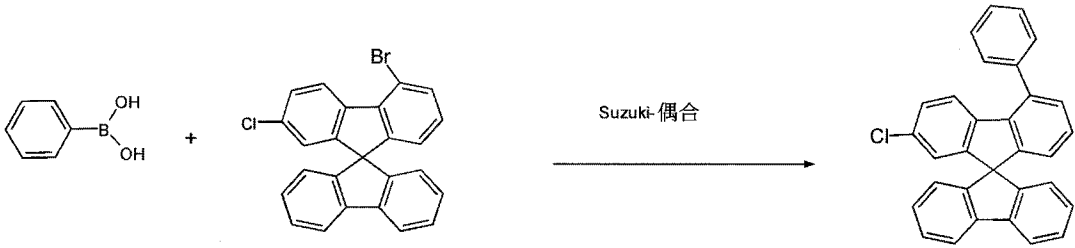
類似地進行其他鹵化螺聯茚衍生物的合成：

	溴-聯苯	芳基-茚酮	產物	產率
1b	 [1801701-07-4]	 [3096-49-9]		86%
1c	 [1801752-89-5]			84%
1d	 [1801701-07-4]	 [486-25-9]		90%

1f	 [1801701-07-4]	 [115033-91-5]		90%
1g	 [1801701-07-4]	 [2840-49-5]		66%
1h	 [1801701-07-4]	 [58775-13-6]		81%
1i	 [1801701-07-4]	 [24313-53-9]		77%
1j	 [1801701-07-4]	 [22052-25-1]		85%
1k	 [1801752-88-4]		 兩種異構物 中的各者將 被分離	81%

11			 兩種異構物 中的各者將 被分離	80%
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2-氯-5-苯基-9,9'-螺聯萘2a的合成



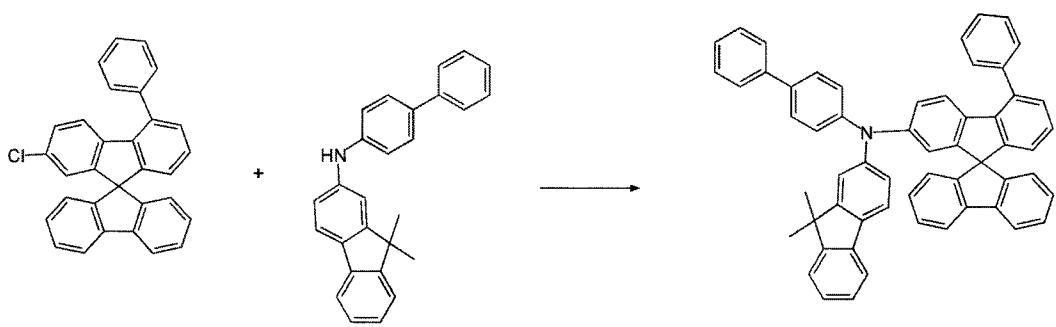
將 31,5 g (251 mmol) 的苯基-硼酸、110 g (251 mmol) 的 5-溴-2-氯-9,9'-螺聯萘、9,9 g (8,5 mmol) 的 $\text{Pd}(\text{P}(\text{Ph}_3))_4$ 、和 66,8 g (627 mmol) 的 Na_2CO_3 溶解在 903 mL 的水、278 mL 的乙醇和 1,9 L 的甲苯中。將反應混合物在氬氣氛下回流並攪拌 12 小時，且冷卻至室溫後，將混合物通過 Celite 過濾。將濾液在真空中蒸發、並將殘餘物從庚烷中結晶。將產物分離為灰白色固體的形式 (100 g，理論的 94%)。

類似地合成下列化合物：

實施例	鹵化螺	硼酸	產物	產率
2b				86%
2c				82%
2d				43%
2e				92%
2f				90%
2g				85%

2h				55%
2i				54%
2j				40%
2k				50%
2l				80%
2m				85%
2n				60%

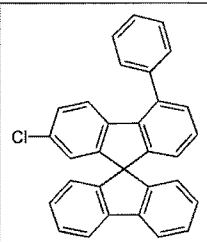
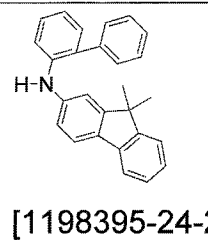
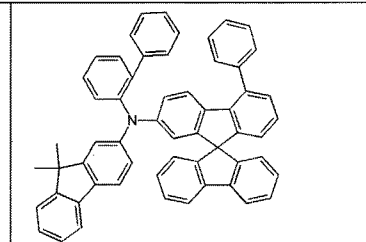
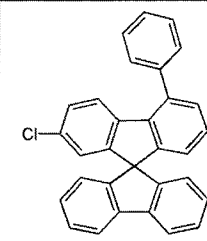
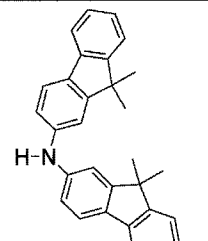
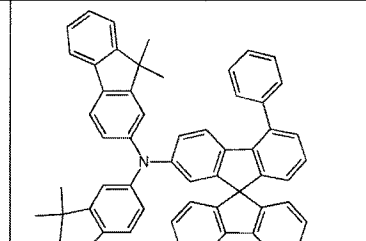
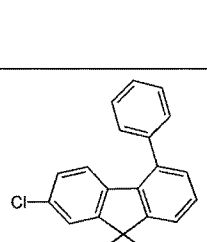
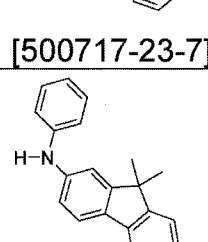
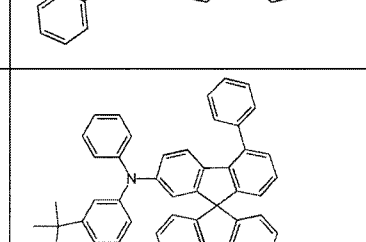
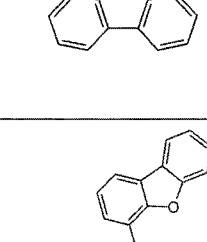
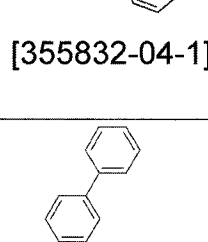
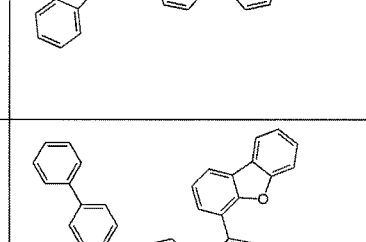
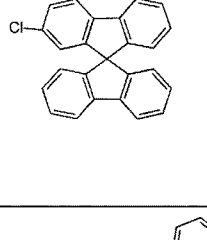
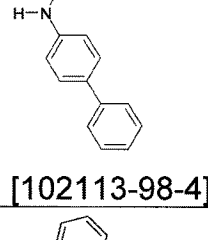
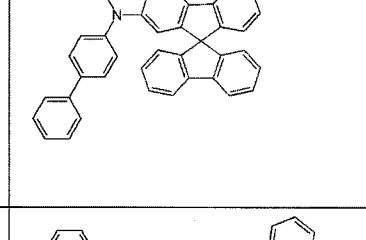
N-{{[1,1'-聯 苯]-4-基 }-N-(9,9-二 甲基 -9H-蒾 -2-基)-5-苯
基 -9,9'-螺 聯 [蒾]-2-胺 3a的 合成

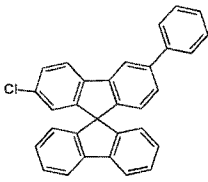
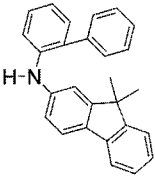
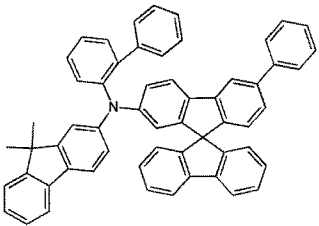
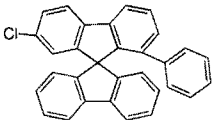
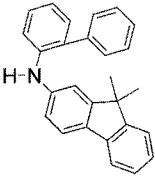
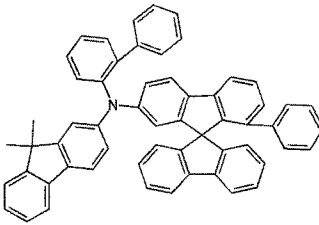
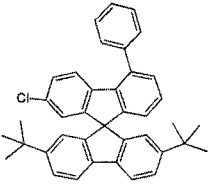
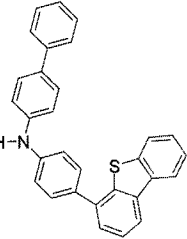
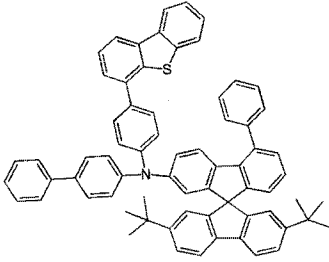
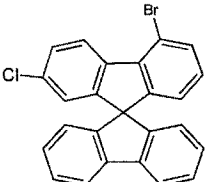
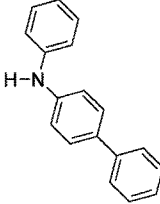
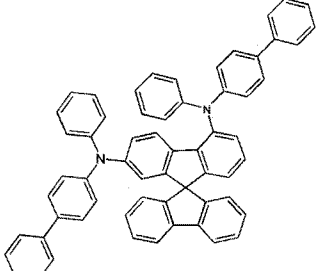
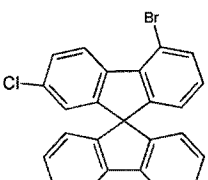
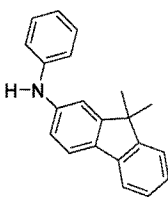
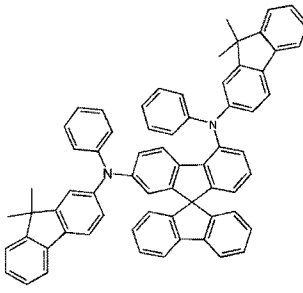


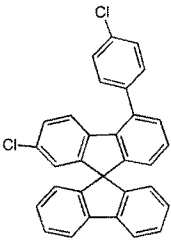
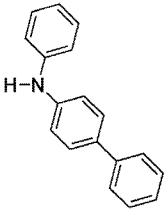
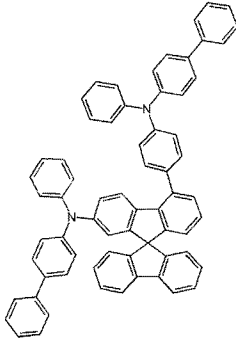
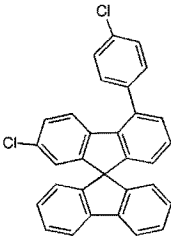
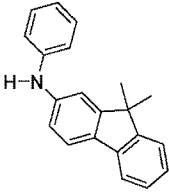
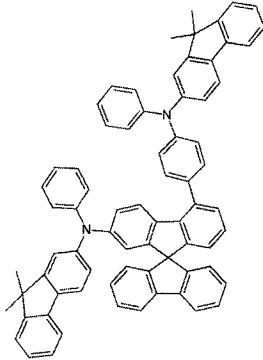
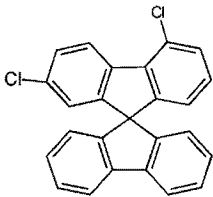
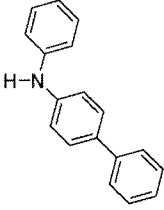
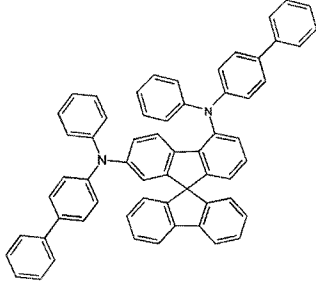
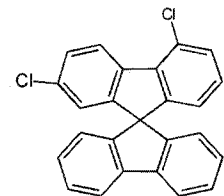
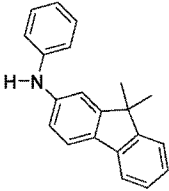
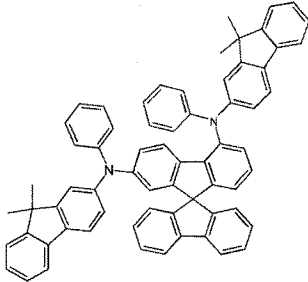
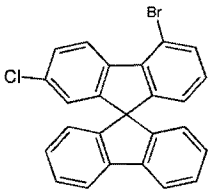
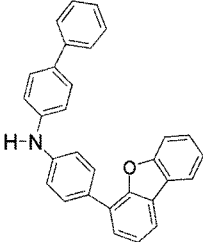
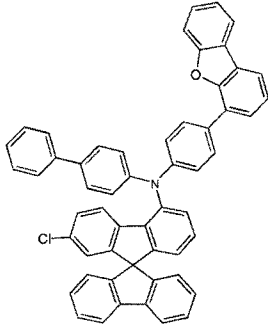
將三-三級丁基膦 (1,32 mL 的在甲苯中之 1.0 M 溶液、1,32 mmol)、Pd₂(dba)₃ (607 mg、0,66 mmol) 和三級丁醇鈉 (4,8 g、49,7 mmol) 加至聯苯-4-基-(9,9-二甲基-9H-芴-2-基)-胺 (11,9 g、33,1 mmol) 和 2'-氯-5'-苯基-9,9'-螺聯芴 (14,7 g、33,1 mmol) 在脫氣甲苯 (500 ml) 中的溶液，並將該混合物在回流下加熱 6h。將反應混合物冷卻至室溫，用甲苯擴大並通過 Celite 過濾。將濾液在真空中蒸發，並將殘餘物從甲苯/庚烷中結晶。在 Soxhlet 萃取器 (甲苯) 中萃取粗製產物，並藉由區域昇華在真空中純化兩次。將產物分離為灰白色固體的形式 (9,5 g，理論的 38%)。

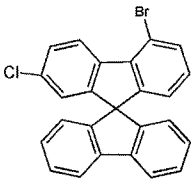
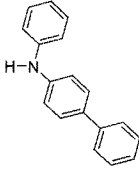
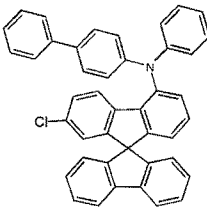
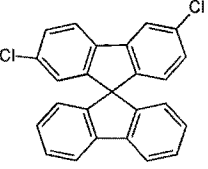
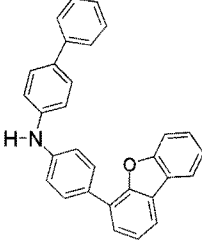
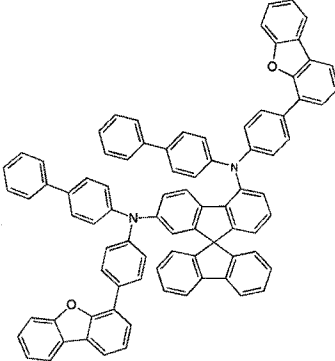
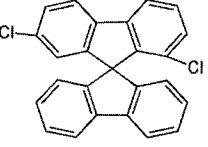
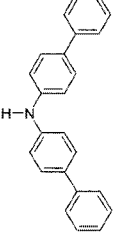
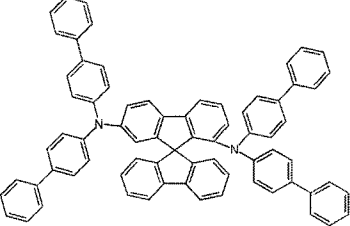
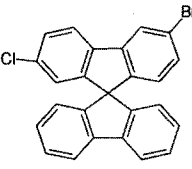
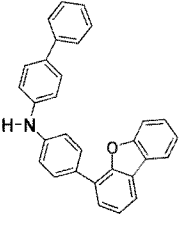
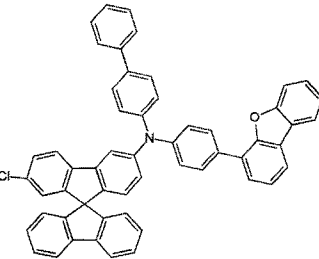
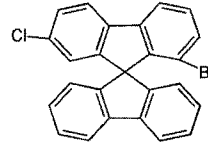
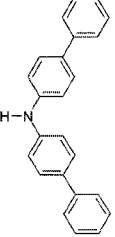
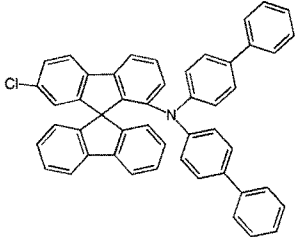
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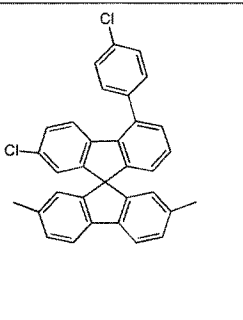
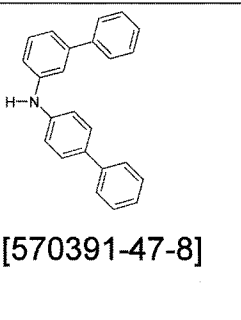
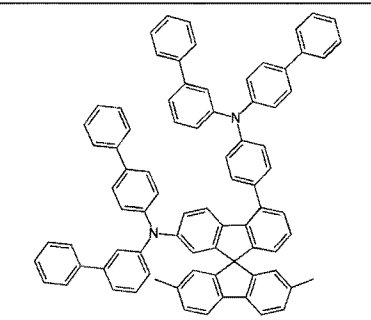
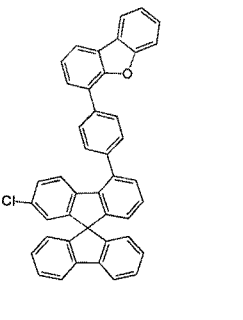
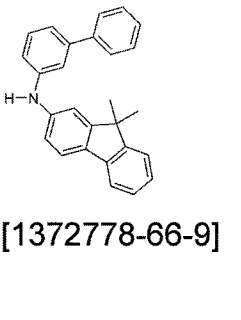
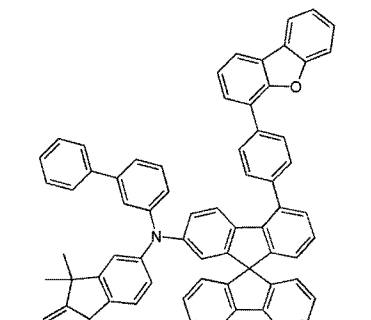
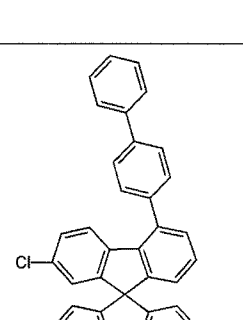
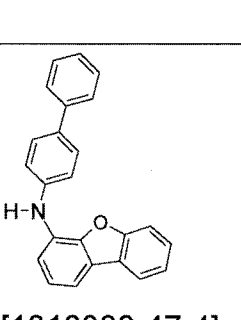
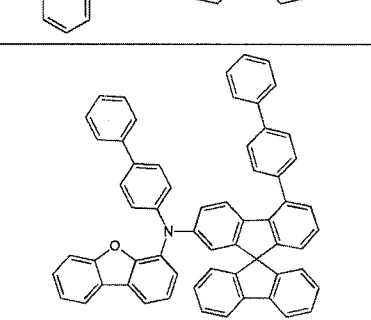
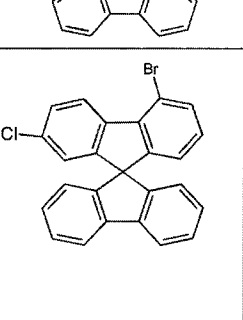
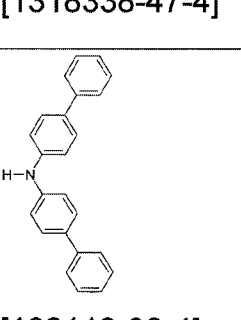
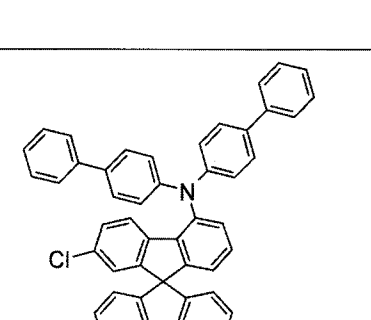
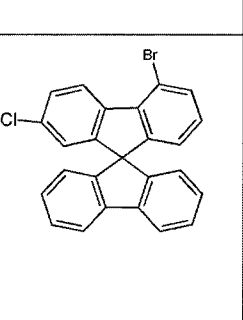
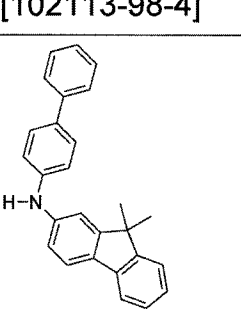
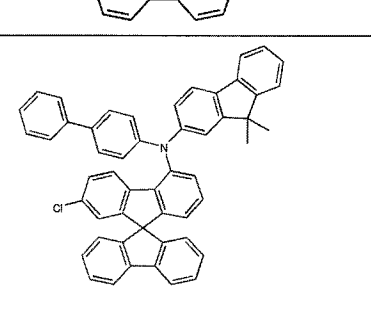
實施例	鹵化螺	胺	產物	產率
3b		 [102113-98-4]		43%

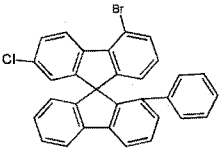
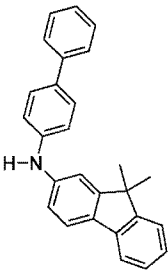
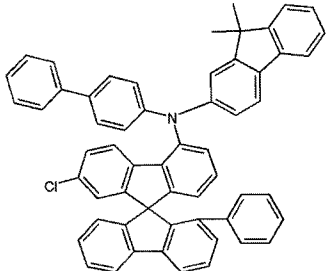
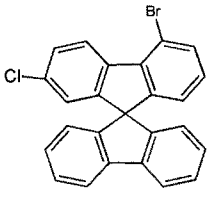
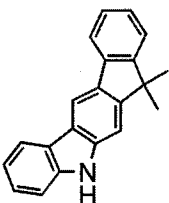
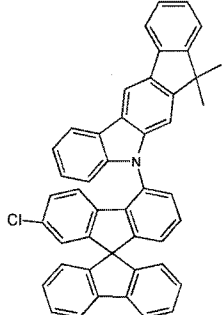
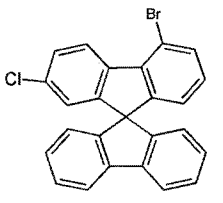
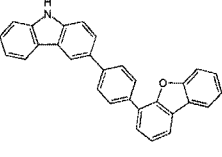
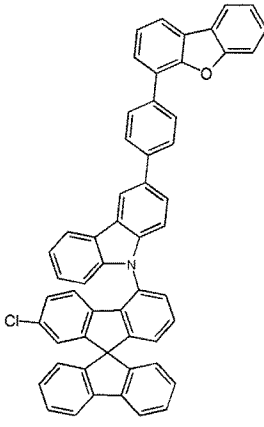
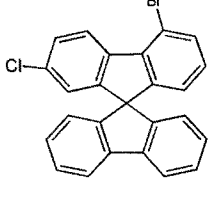
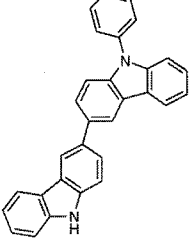
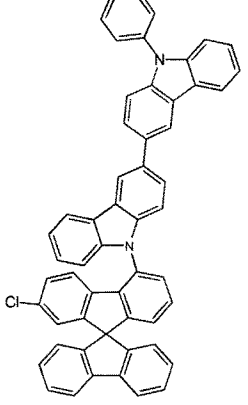
3c		 [1198395-24-2]		85%
3d		 [500717-23-7]		55%
3e		 [355832-04-1]		64%
3f		 [102113-98-4]		56%
3g		 [897671-69-1]		73%

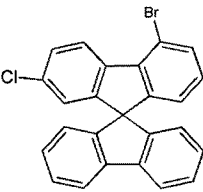
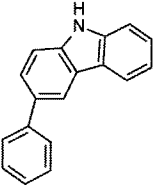
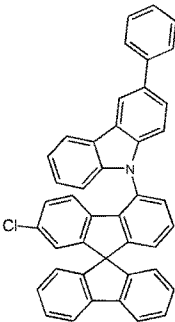
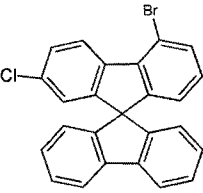
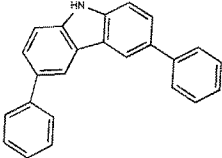
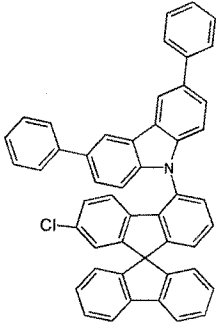
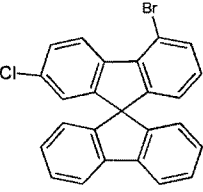
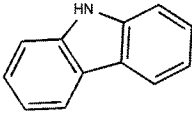
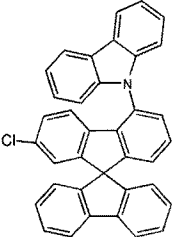
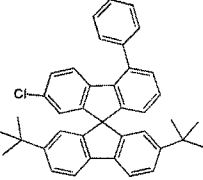
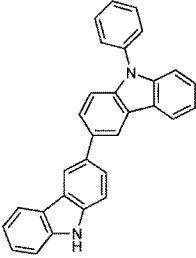
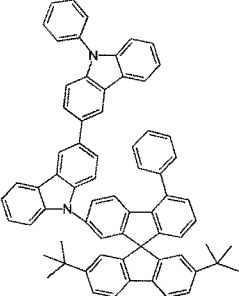
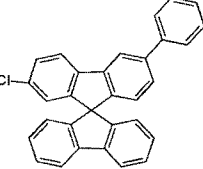
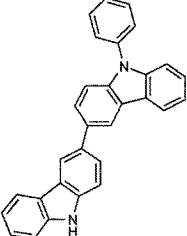
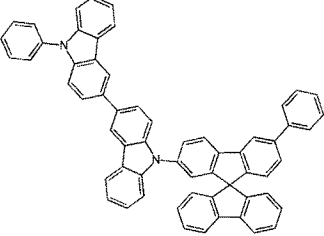
3h		 [1198395-24-2]		65%
3i		 [1198395-24-2]		67%
3j		 [1431879-08-1]		66%
3k		 [32228-99-2]		50%
3l		 [355832-04-1]		62%

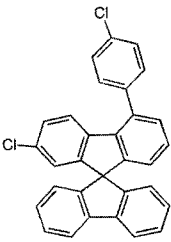
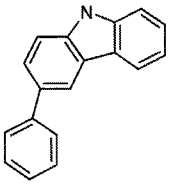
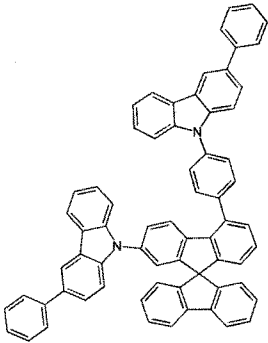
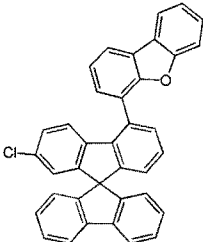
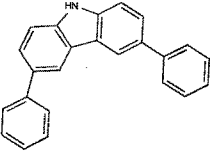
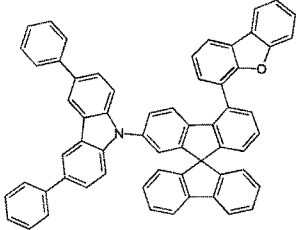
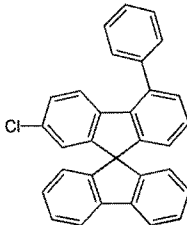
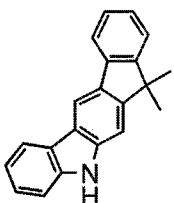
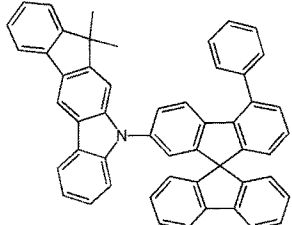
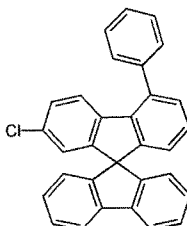
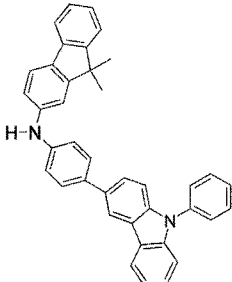
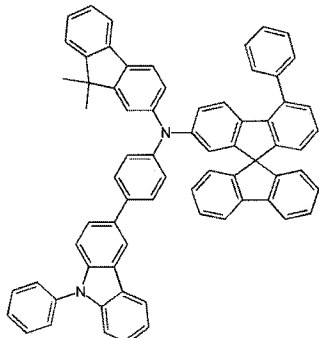
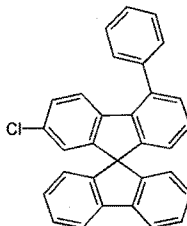
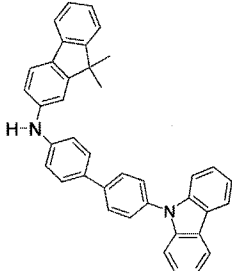
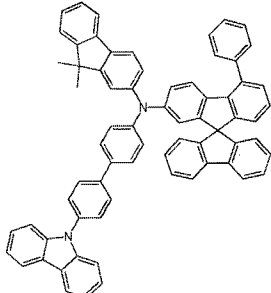
3m		 [32228-99-2]		73%
3n		 [355832-04-1]		69%
3o		 [32228-99-2]		57%
3p		 [355832-04-1]		65%
3q		 [955959-89-4]		71%

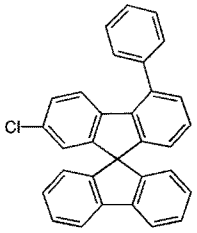
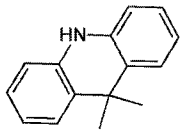
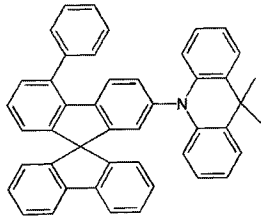
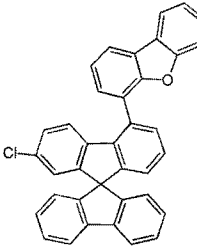
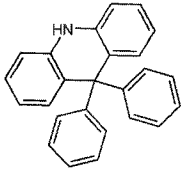
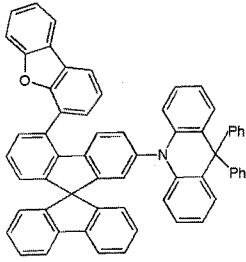
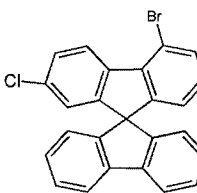
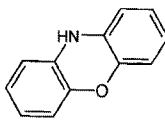
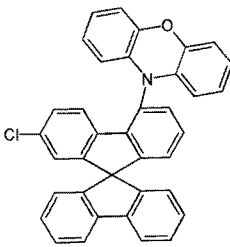
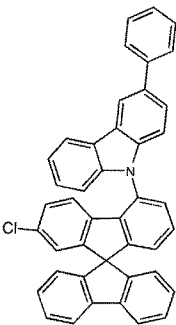
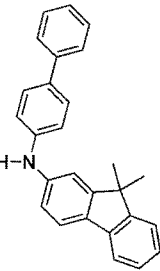
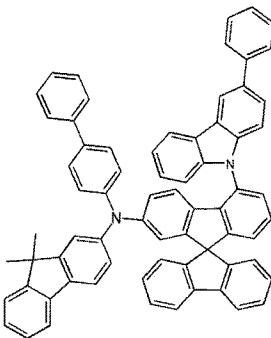
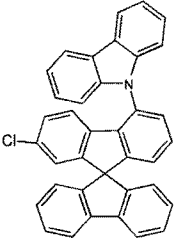
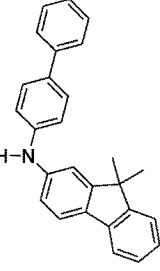
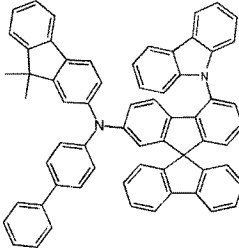
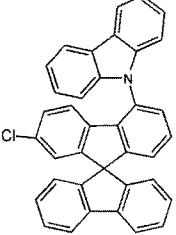
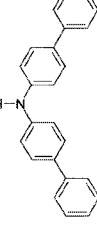
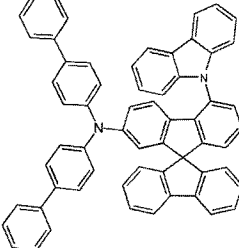
3r				71%
3s		 [955959-89-4]		72%
3t		 [102113-98-4]		62%
3u		 [955959-89-4]		45%
3v		 [102113-98-4]		66%

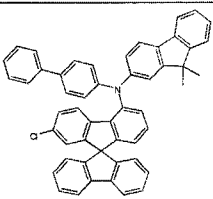
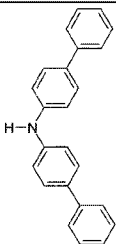
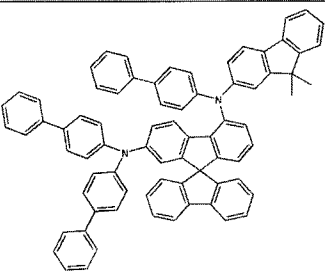
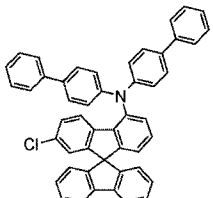
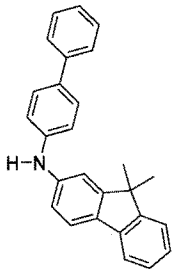
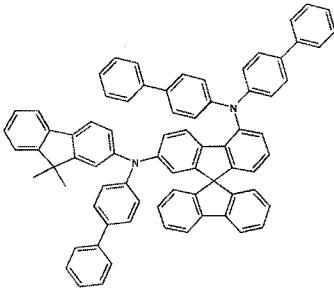
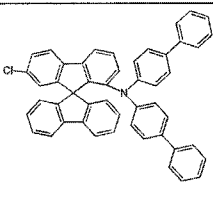
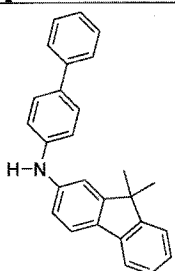
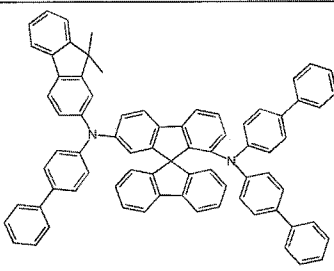
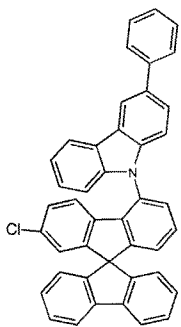
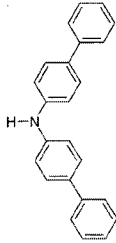
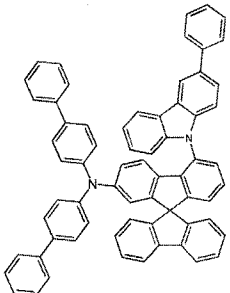
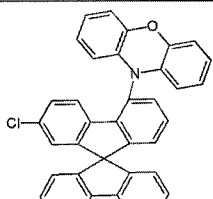
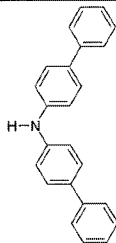
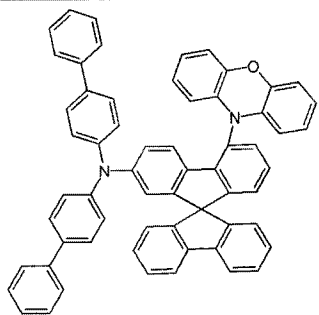
3w		 [570391-47-8]		66%
3x		 [1372778-66-9]		71%
3y		 [1318338-47-4]		49%
3z		 [102113-98-4]		65%
3aa		 [897671-69-1]		73%

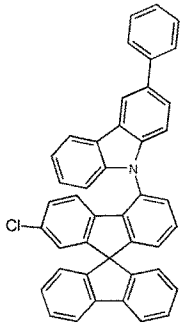
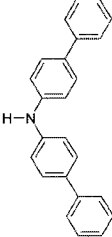
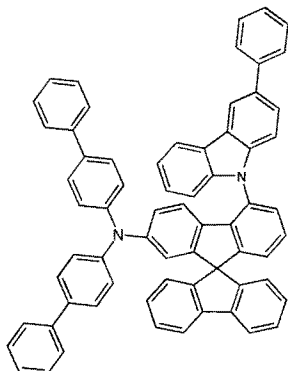
3ab		 [897671-69-1]		70%
3ac		 1257220-47-5		80%
3ad				75%
3ae		 1060735-14-9		60%

3af		 103012-26-6		85%
3ag				80%
3ah				76%
3ai				67%
3aj				50%

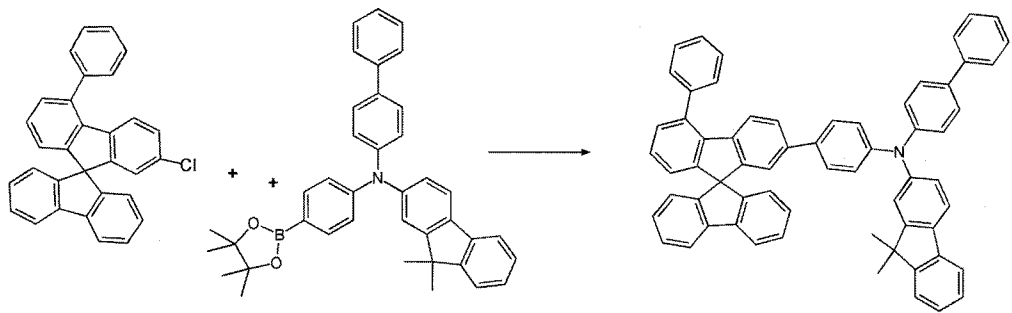
3ak				40%
3al				50%
3am				38%
3an		 [1354653-33-0]		35%
3ao		 [1267248-54-3]		45%

3ap				50%
3aq				55%
3ar				60%
3as		 [897671-69-1]		55%
3at		 [897671-69-1]		45%
3au		 [102113-98-4]		52%

3av		 [102113-98-4]		47%
3aw		 [897671-69-1]		51%
3ax		 [897671-69-1]		48%
3ay		 [102113-98-4]		46%
3az		 [102113-98-4]		38%

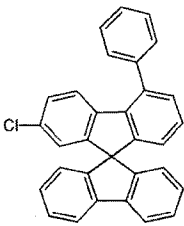
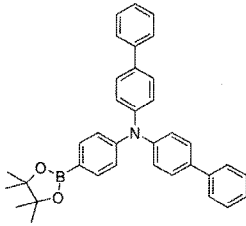
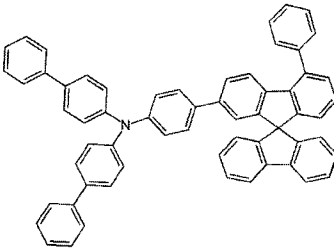
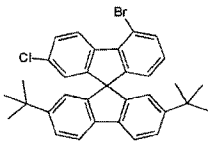
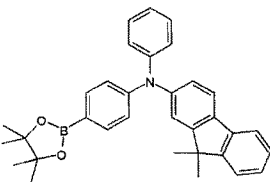
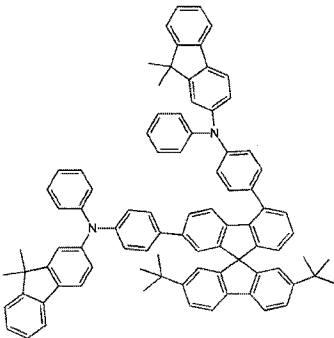
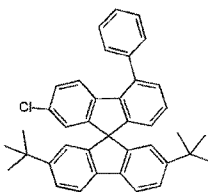
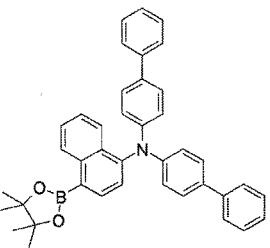
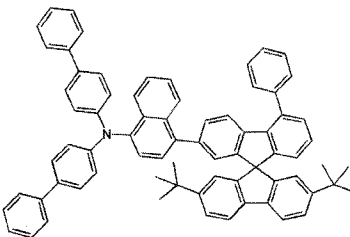
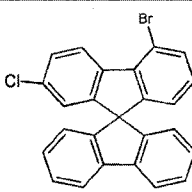
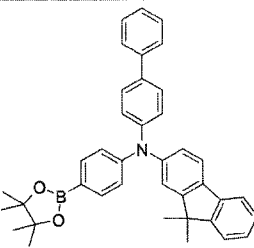
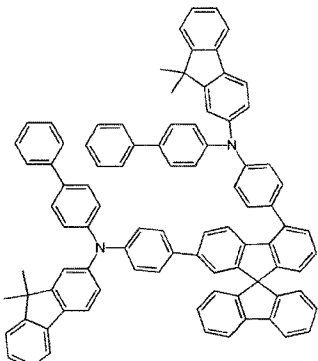
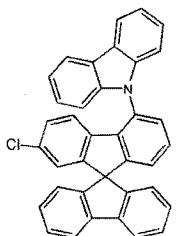
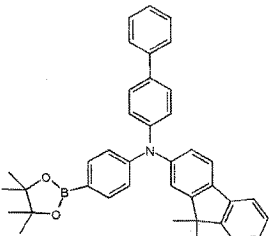
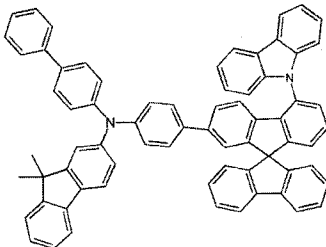
3ba		 [102113-98-4]		55%
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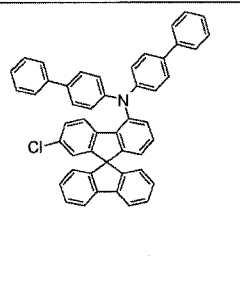
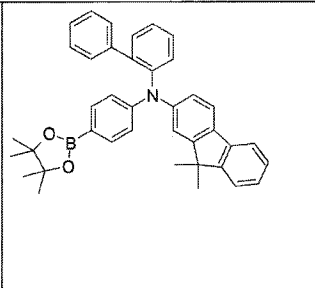
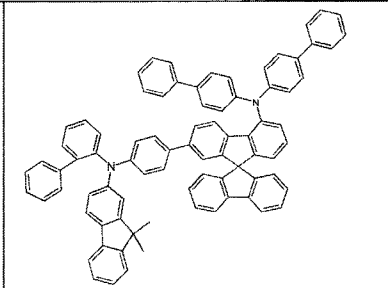
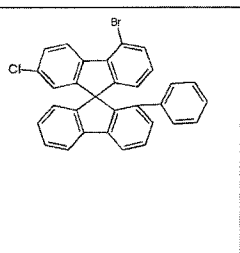
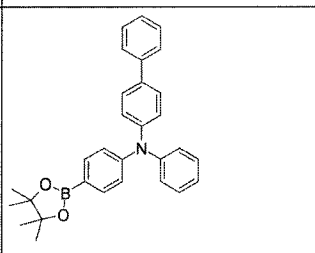
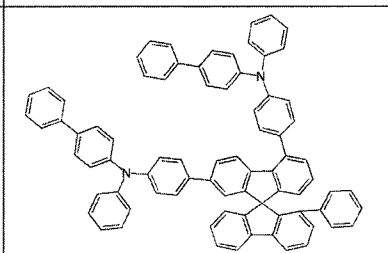
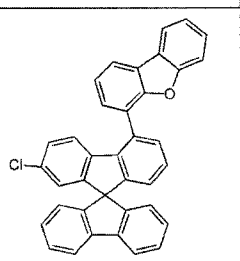
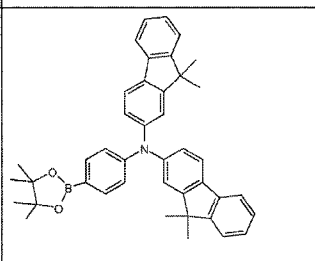
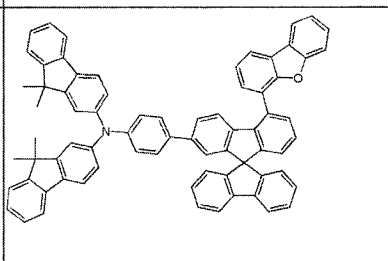
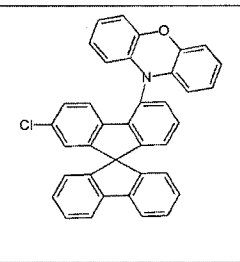
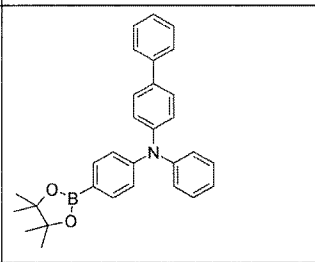
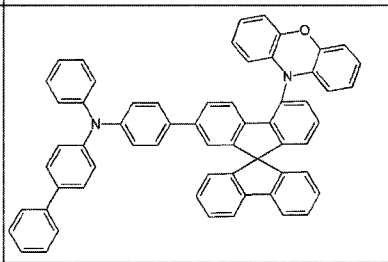
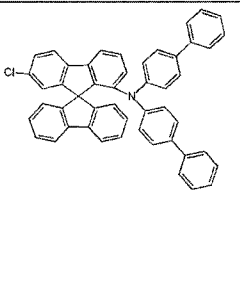
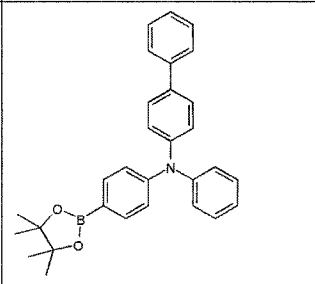
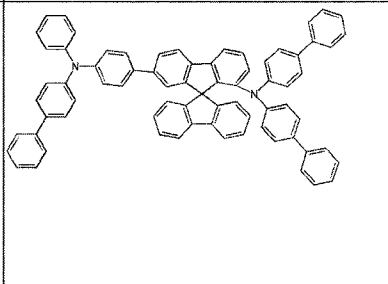
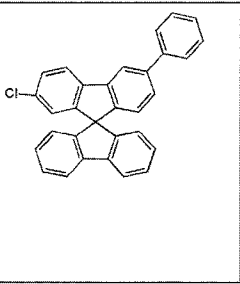
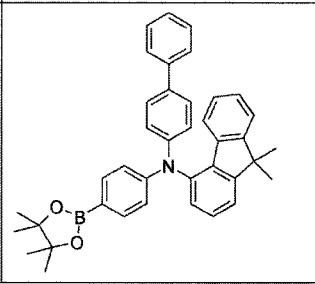
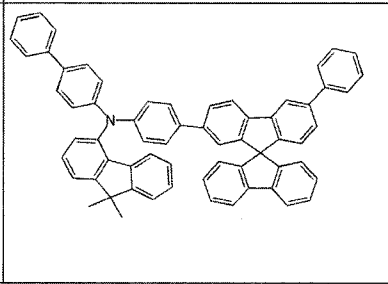
N-{[1,1'-聯苯]-4-基}-9,9-二甲基-N-(4-{4-苯基-9,9'-螺聯[芴]-7-基}苯基)-9H-芴-2-胺 4a 的合成

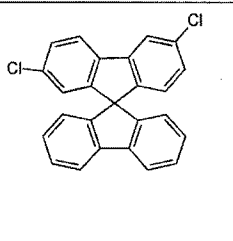
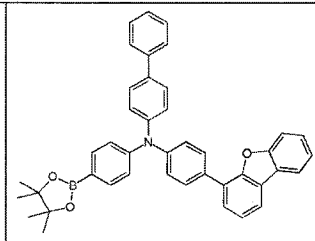
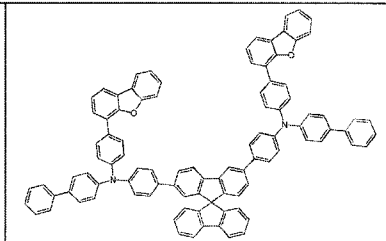
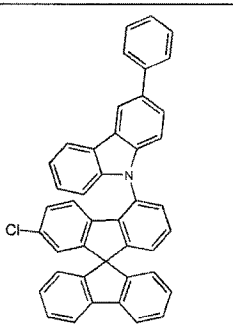
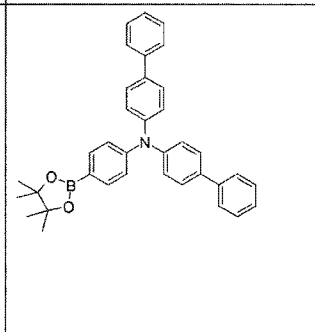
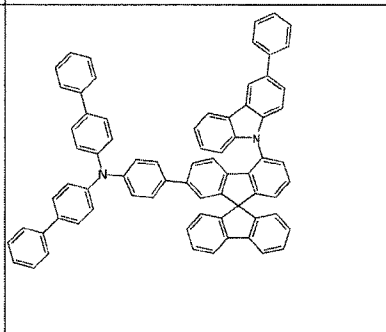
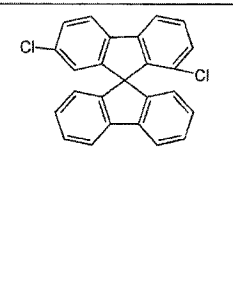
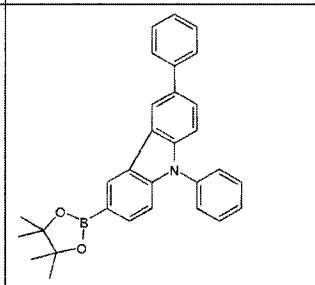
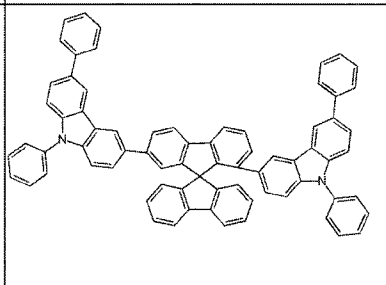
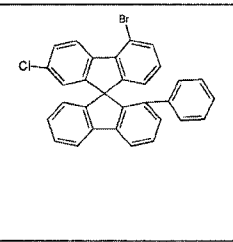
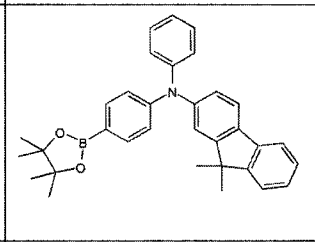
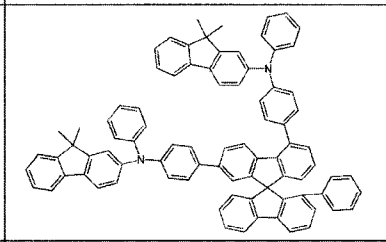
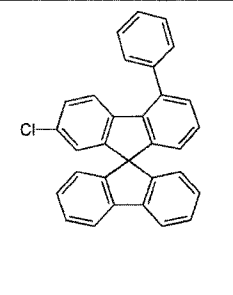
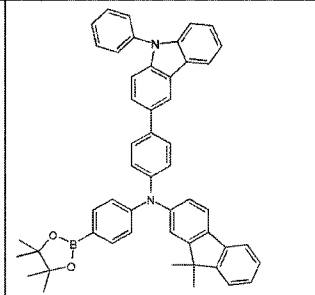
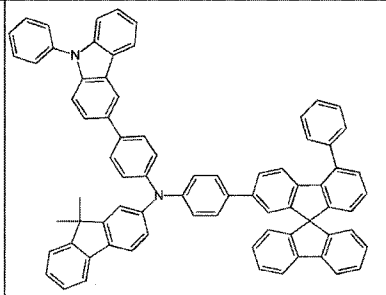
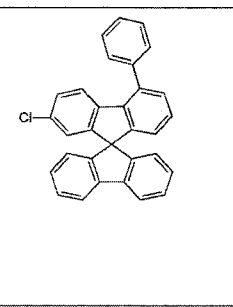
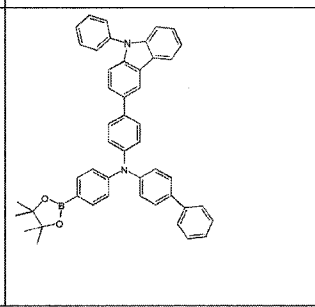
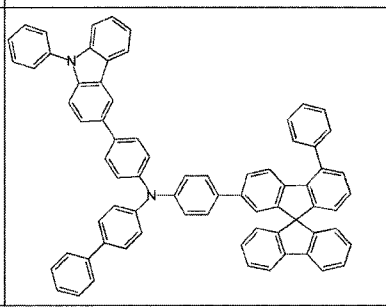


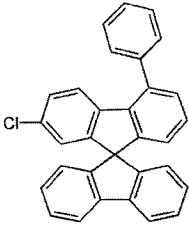
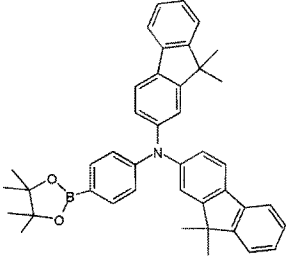
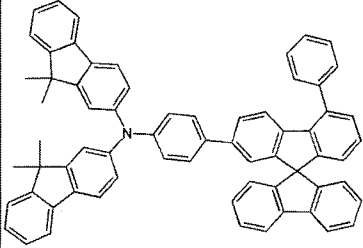
將 59.1 g (101.8 mmol) 的聯苯-4-基-(9,9-二甲基-9H-芴-2-基(4,4,5,5-四甲基-[1,3,2]二氧雜環戊硼烷-2-基)-苯基)-胺、43.5 g (101.8 mmol) 的 2-氯-5-苯基-9,9'-螺聯芴、3.88 g (5.14 mmol) 的 $\text{PdCl}_2(\text{Cy})_3$ 、31.2 g (205.6 mmol) 的氟化銫溶解在 800 mL 的甲苯中。將反應混合物在氬氣氛下回流並攪拌 12 小時，然後冷卻至室溫，將混合物通過 Celite 過濾。將濾液在真空中蒸發、並將殘餘物從庚烷中結晶。在 Soxhlet 萃取器(甲苯)中萃取粗製產物並藉由區域昇華在真空中純化兩次。將產物分離為白色固體的形式(42 g，理論的 51%)。

類似地合成下列化合物：

實施例	鹵化螺	胺	產物	產率
4b				50%
4c				55%
4d				60%
4e				63%
4f				70%

4g				75%
4h				55%
4i				64%
4j				60%
4k				59%
4l				75%

4m				81%
4n				85%
4o				77%
4p				62%
4q				60%
4r				72%

4s				45%
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B) 裝置例

1) 一般程序

藉由下列一般方法製備包含根據本申請案之化合物的 OLED 和包含考參化合物之 OLED：所使用之基板為以 50nm 厚度的結構化 ITO(氧化銦錫)塗佈之玻璃板。OLED 基本上具有下列層結構：基板/電洞注入層(HIL)/電洞傳輸層(HTL)/電子阻擋層(EBL)/發光層(EML)/電子傳輸層(ETL)/電子注入層(EIL)和最後陰極。陰極係由具有 100nm 厚度的鋁層所形成。OLED 的特定裝置配置係顯示於表 1 中，及製造 OLED 所需之材料係顯示於表 3 中。

所有材料在真空室內藉由熱氣相沈積施加。發光層在此經常是由至少一種基質材料(主體材料)及發光摻雜劑(發光體)所組成，該發光摻雜劑係藉由共同蒸發以某體積比例與基質材料或基質材料等摻混。詞句諸如 H1：SEB(5%) 在此意指材料 H1 係以 95% 之體積比例存在於層中，且 SEB 係以 5% 之體積比例存在於層中。類似地，其他層亦可由二或多種材料之混合物所組成。

OLED 係以標準方法示性。為此目的，測定電致發光光譜及假設 Lambert 發光特性，從電流/電壓/發光密度特徵

線 (IUL 特徵線) 計算以發光密度為函數之外部量子效率 (EQE, 以百分比測量), 及壽命。詞句 EQE @ $10\text{mA}/\text{cm}^2$ 表示在 $10\text{mA}/\text{cm}^2$ 之操作電流密度下的外部量子效率。LT80 @ $60\text{mA}/\text{cm}^2$ 為 OLED 已從其之初發光強度 (即 $5000\text{cd}/\text{m}^2$) 降至初發光強度之 80% (即至 $4000\text{cd}/\text{m}^2$) 的壽命, 不使用任何加速因子。含有本發明和比較材料之各種 OLED 的數據係總結於表 2 中。

特別地, 根據本發明之化合物適合作為 HIL、HTL 或 EBL 材料, 或適合作為 OLED 中 EML 的基質材料。彼等適合用作為層中的單一材料, 但也可用作 HIL、HTL、EBL 中或 EML 內的混合組分。

2) 根據本申請案之化合物應用於 OLED 的 HIL、HTL 和 EBL 之用途的實施例

表 2 顯示用表 1 中所示的特定 OLED 實施例獲得之性能數據。OLED C1 和 C2 為參考例, 其包含先前技術化合物 HTM-b 和 EBM。OLED E1、E2 和 E3 為本申請案之 OLED, 其包含本發明化合物 HTM-1、HTM-2 和 HTM-3。相較於根據先前技術的 OLED (C1 至 C2), 包含根據本發明化合物之樣品 (E1 至 E3) 在單重態藍色裝置 (C1 與 E1 和 E3 相比) 和三重態綠色裝置 (C2 與 E2 相比) 中均表現出更好的性能。

可以看出, 裝置 E1 的壽命優於參考例 C1。相較於參考材料 HTM-b, 此顯示化合物 HTM-1 的改良性能。類似地, 裝置 E3 的壽命優於裝置 C1 的壽命。相較於參考材料

HTM-b，此顯示化合物 HTM-3 的改良性能。

最後，裝置 E2 顯示比參考例 C2 更好的壽命。相較於參考化合物 EBM，此顯示化合物 HTM-2 的改良性能。

表 1：裝置配置						
實施例	HIL	HTL	EBL	EML	ETL	EIL
	厚度 / nm	厚度 / nm	厚度 / nm	厚度 / nm	厚度 / nm	厚度 / nm
C1	HTM-b: p- 摻雜(5%) 20 nm	HTM-b 180 nm	EBM 10 nm	H:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
C2	HTM-a: p- 摻雜(5%) 20 nm	HTM-a 220 nm	EBM 10 nm	TMM-1: TMM- 2(28%):TEG(12%) 30 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E1	HTM-1: p- 摻雜(5%) 20 nm	HTM-1 180 nm	EBM 10 nm	H:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E2	HTM-a: p- 摻雜(5%) 20 nm	HTM-a 220 nm	HTM-2 10 nm	TMM-1: TMM- 2(28%):TEG(12%) 30 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E3	HTM-3: p- 摻雜(5%) 20 nm	HTM-3 180 nm	EBM 10 nm	H:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm

表 2：OLED 之數據			
	U	EQE	LT80 @ 60/40* mA/cm ²
	[V]	[%]	[h]
C1	4.3	8.5	130
C2	3.8	17.7	270*
E1	3.9	8.6	180
E2	3.8	16.0	320*
E3	4.1	9.0	170

3) 比較在單重態藍色裝置的 HIL 和 HTL 中包含根據本發明化合物 HTM-1 之 OLED 和包含化合物 HTM-c 之 OLED

根據上述 1) 中所述的一般方法製備兩種 OLED。

堆疊結構係顯示於下述表 1b 中：

表 1b：裝置配置						
實施例	<i>HIL</i>	<i>HTL</i>	<i>EBL</i>	<i>EML</i>	<i>ETL</i>	<i>EIL</i>
	厚度 / nm	厚度 / nm	厚度 / nm	厚度 / nm	厚度 / nm	厚度 / nm
C3	HTM-c: p-摻雜(5%) 20 nm	HTM-c 180 nm	EBM 10 nm	H:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E4	HTM-1: p-摻雜(5%) 20 nm	HTM-1 180 nm	EBM 10 nm	H:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm

雖然操作電壓和壽命保持相似，但相較於包含比較化合物 HTM-c 之 OLED C3，發現包含根據本發明化合物 HTM-1 之 OLED E4 的 EQE 強烈增加。OLED E4 具有 9.1% 的 EQE，而 OLED C3 具有 7.9 % 的 EQE。

4) 比較在三重態綠色裝置的 EBL 中包含根據本發明化合物 HTM-1 之 OLED 和包含化合物 HTM-c 之 OLED

根據上述 1) 中所述的一般方法製備兩種 OLED。

堆疊結構係顯示於下述表 1c 中：

表 1c：裝置配置							
實施例	<i>HIL</i>	<i>HTL</i>	<i>EBL</i>	<i>EML</i>	<i>ETL1</i>	<i>ETL2</i>	<i>EIL</i>
	厚度 / nm	厚度 / nm	厚度 / nm	厚度 / nm	厚度 / nm	厚度 / nm	厚度 / nm
C4	HTM-a: p-摻雜(5%) 20 nm	HTM-a 220 nm	HTM-c 10 nm	TMM-1: TMM-2(29%):TEG(12%) 30 nm	ETM 10 nm	ETM: LiQ(50%) 30 nm	LiQ 1 nm
E5	HTM-a: p-摻雜(5%) 20 nm	HTM-a 220 nm	HTM-1 10 nm	TMM-1: TMM-2(29%):TEG(12%) 30 nm	ETM 10 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm

雖然操作電壓和壽命保持相似，但相較於包含比較化合物 HTM-c 之 OLED C4，發現包含根據本發明化合物 HTM-1 之 OLED E5 的 EQE 強烈增加。OLED E5 顯示 15.9% 的 EQE，而 OLED C4 顯示 14.9% 的 EQE。

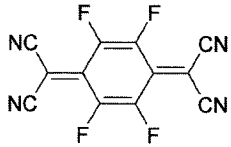
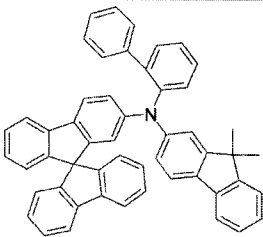
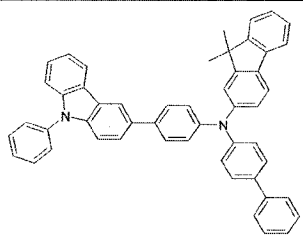
5) 具有化合物HTM-4至HTM-7之其他裝置例

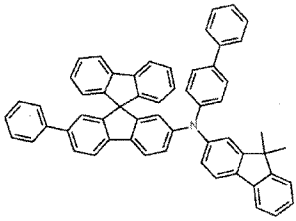
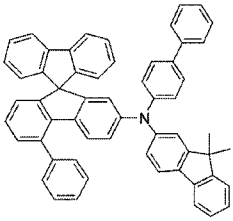
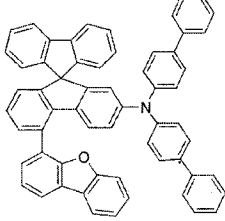
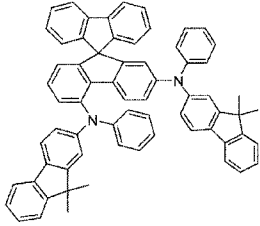
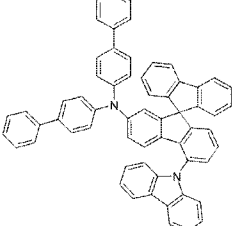
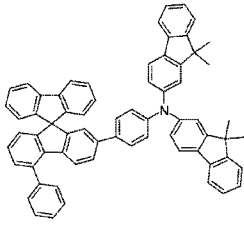
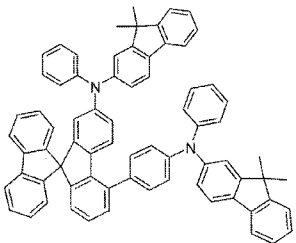
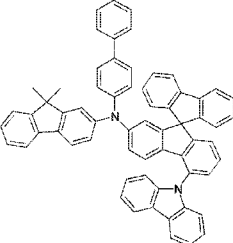
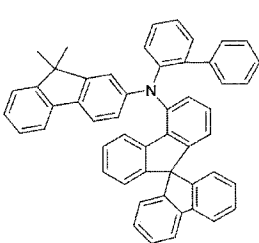
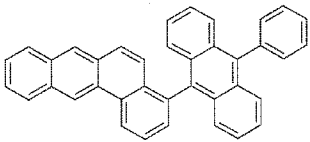
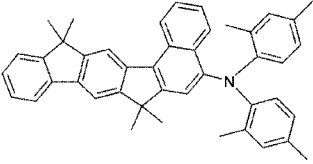
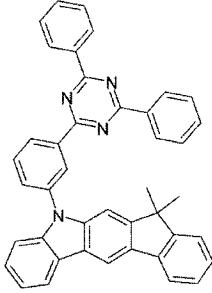
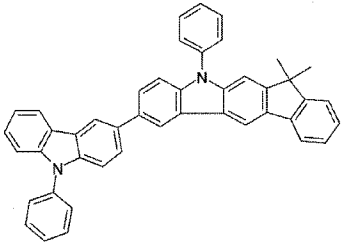
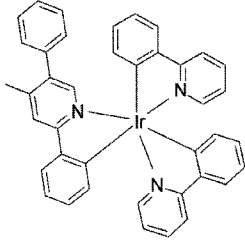
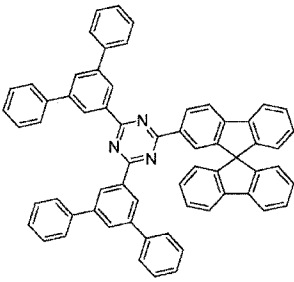
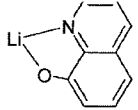
OLED E6、E7、E8和E9為根據本申請案之OLED，其包含本發明化合物HTM-4、HTM-5、HTM-6和HTM-7。

E6顯示本發明化合物HTM-4作為單重態藍色裝置中之HIL和HTL材料的性能(詳細堆疊層見下)。在此，發現290 h之壽命LT80@60 mA/cm²，以及良好的效率和電壓。

E7、E8和E9顯示本發明化合物HTM-5、HTM-6和HTM-7作為三重態綠色裝置中之EBL材料的性能(詳細堆疊層見下)。在此，發現390 h (E7)、280 h (E8)、和310 h (E9)之壽命LT80@40 mA/cm²，以及良好的效率和電壓。

表 1d：裝置配置						
實施例	HIL	HTL	EBL	EML	ETL	EIL
	厚度 / nm	厚度 / nm	厚度 / nm	厚度 / nm	厚度 / nm	厚度 / nm
E6	HTM-4: p-摻雜(5%) 20 nm	HTM-4 180 nm	EBM 10 nm	H:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E7	HTM-a: p-摻雜(5%) 20 nm	HTM-a 220 nm	HTM-5 10 nm	TMM-1: TMM-2(28%):TEG(12%) 30 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E8	HTM-a: p-摻雜(5%) 20 nm	HTM-a 220 nm	HTM-6 10 nm	TMM-1: TMM-2(28%):TEG(12%) 30 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E9	HTM-a: p-摻雜(5%) 20 nm	HTM-a 220 nm	HTM-7 10 nm	TMM-1: TMM-2(28%):TEG(12%) 30 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm

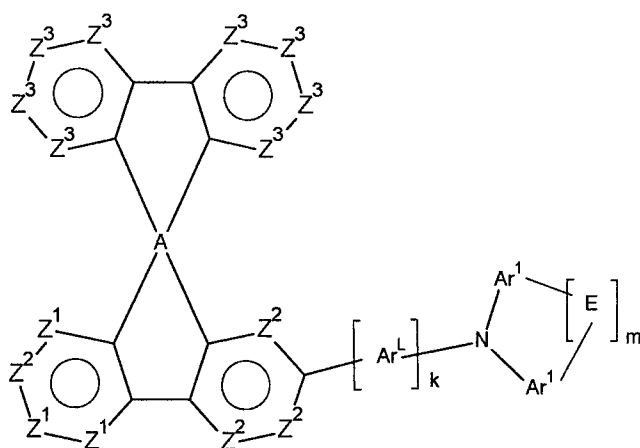
表 3：所使用之材料		
		
p-摻雜劑 F4TCNQ	HTM-a	HTM-b

		
HTM-c	HTM-1	HTM-2
		
HTM-3	HTM-4	HTM-5
		
HTM-6	HTM-7	EBM
		
H	SEB	TMM-1
		
TMM-2	TEG	ETM
		
LiQ		

【發明申請專利範圍】

【第1項】

一種式(I)化合物，



式 (I)

其中變數係定義如下：

A 為 C 或 Si；

Z¹ 在每次出現時係相同或不同地選自 CR¹和 CR²；

Z² 為 CR²；

Z³ 為 CR³；

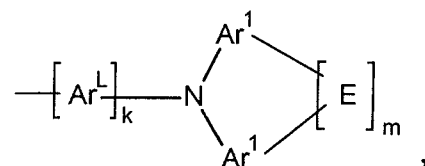
Ar^L 在每次出現時係相同或不同地選自可經一或多個基團 R⁴取代的具有 6 至 40 個芳族環原子之芳族環系統和可經一或多個基團 R⁴取代的具有 5 至 40 個芳族環原子之雜芳族環系統；

Ar¹ 係相同或不同地選自可經一或多個基團 R⁴取代的具有 6 至 40 個芳族環原子之芳族環系統和可經一或多個基團 R⁴取代的具有 5 至 40 個芳族環原子之雜芳族環系統；

E 為單鍵或為選自 C(R⁴)₂、N(R⁴)、O、和 S 的二價

基；

R^1 在每次出現時係相同或不同地選自



$\text{Si}(\text{R}^5)_3$ 、具有 1 至 20 個 C 原子之直鏈烷基、烷氧基或烷硫基 (thioalkyl)、具有 3 至 20 個 C 原子之支鏈或環狀烷基、烷氧基、或烷硫基、具有 6 至 40 個芳族環原子之芳族環系統、和具有 5 至 40 個芳族環原子之雜芳族環系統，其中該等烷基、烷氧基和烷硫基及該等芳族和雜芳族環系統在各情況下可經一或多個基團 R^5 取代；

R^2 、 R^3 在每次出現時係相同或不同地選自 H、F、具有 1 至 20 個 C 原子之直鏈烷基、具有 3 至 20 個 C 原子之支鏈或環狀烷基、具有 6 至 30 個芳族環原子之芳族環系統、和具有 5 至 30 個芳族環原子之雜芳族環系統；其中該等烷基、芳族環系統和雜芳族環系統在各情況下可經一或多個基團 R^5 取代；

R^4 在每次出現時係相同或不同地選自 H、D、F、 $\text{C}(=\text{O})\text{R}^5$ 、CN、 $\text{Si}(\text{R}^5)_3$ 、 $\text{N}(\text{R}^5)_2$ 、 $\text{P}(=\text{O})(\text{R}^5)_2$ 、 OR^5 、 $\text{S}(=\text{O})\text{R}^5$ 、 $\text{S}(=\text{O})_2\text{R}^5$ 、具有 1 至 20 個 C 原子之直鏈烷基或烷氧基、具有 3 至 20 個 C 原子之支鏈或環狀烷基或烷氧基、具有 2 至 20 個 C 原子之烯基或炔基、具有 6 至 40 個芳族環原子之芳族環系統、

和具有5至40個芳族環原子之雜芳族環系統；其中二或多個基團 R^4 可彼此連接以形成環；其中該等烷基、烷氧基、烯基和炔基及該等芳族和雜芳族環系統在各情況下可經一或多個基團 R^5 取代，及其中該等烷基、烷氧基、烯基和炔基中之一或多個 CH_2 基團在各情況下可經 $-R^5C=CR^5-$ 、

$-C\equiv C-$ 、 $Si(R^5)_2$ 、 $C=O$ 、 $C=NR^5$ 、 $-C(=O)O-$ 、

$-C(=O)NR^5-$ 、 NR^5 、 $P(=O)(R^5)$ 、 $-O-$ 、 $-S-$ 、 SO 或 SO_2 置換；

R^5 在每次出現時係相同或不同地選自 H 、 D 、 F 、 $C(=O)R^6$ 、 CN 、 $Si(R^6)_3$ 、 $N(R^6)_2$ 、 $P(=O)(R^6)_2$ 、 OR^6 、 $S(=O)R^6$ 、 $S(=O)_2R^6$ 、具有1至20個 C 原子之直鏈烷基或烷氧基、具有3至20個 C 原子之支鏈或環狀烷基或烷氧基、具有2至20個 C 原子之烯基或炔基、具有6至40個芳族環原子之芳族環系統、和具有5至40個芳族環原子之雜芳族環系統；其中該等烷基、烷氧基、烯基和炔基及該等芳族和雜芳族環系統在各情況下可經一或多個基團 R^6 取代，及其中該等烷基、烷氧基、烯基和炔基中之一或多個 CH_2 基團在各情況下可經 $-R^6C=CR^6-$ 、 $-C\equiv C-$ 、 $Si(R^6)_2$ 、 $C=O$ 、 $C=NR^6$ 、 $-C(=O)O-$ 、 $-C(=O)NR^6-$ 、 NR^6 、 $P(=O)(R^6)$ 、 $-O-$ 、 $-S-$ 、 SO 或 SO_2 置換；

R^6 在每次出現時係相同或不同地選自 H 、 D 、 F 、

CN、具有 1 至 20 個 C 原子之烷基、具有 6 至 40 個 C 原子之芳族環系統、和具有 5 至 40 個芳族環原子之雜芳族環系統；及其中該等烷基、芳族環系統和雜芳族環系統可經 F 和 CN 取代；

k 在每次出現時係相同或不同地為 0 或 1；其中在 $k=0$ 的情況下，基團 Ar^L 不存在且該氮原子和該螺聯萘基團係直接連接；

m 在每次出現時係相同或不同地為 0 或 1，其中在 $m=0$ 的情況下，基團 E 不存在且基團 Ar^1 不連接；

其特徵在於基團 Z^1 中至少一者為 CR^1 。

【第 2 項】

根據申請專利範圍第 1 項之化合物，其中 Ar^L 係選自衍生自下列之二價基：苯、聯苯基、聯三苯基、萘基、萘基、茛並萘基、螺聯萘基、二苯並呋喃基、二苯並噻吩基、和呋唑基，彼等可各自經一或多個基團 R^4 取代。

【第 3 項】

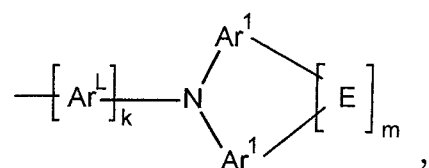
根據申請專利範圍第 1 或 2 項之化合物，其中基團 Ar^1 係相同或不同地選自衍生自下列基團之基團：苯基、聯苯基、聯三苯基、聯四苯基、萘基、萘基、苯並萘基、螺聯萘基、茛並萘基、二苯並呋喃基、二苯並噻吩基、呋唑基、苯並呋喃基、苯並噻吩基、吡啶基、喹啉基、吡啶基、嘧啶基、吡嗪基、噁嗪基和三吡嗪基，彼等各自隨意地經一或多個基團 R^4 取代，或選自衍生自此等基團的 2 或 3 個基團之組合，彼等各自隨意地經一或多個基團 R^4 取代。

【第4項】

根據申請專利範圍第1或2項之化合物，其中標號 m 為 0。

【第5項】

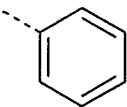
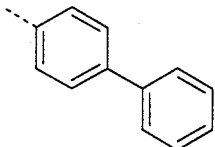
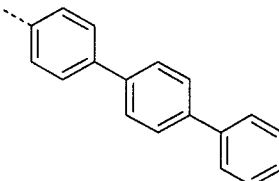
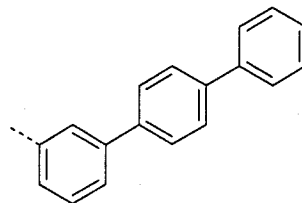
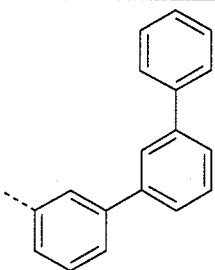
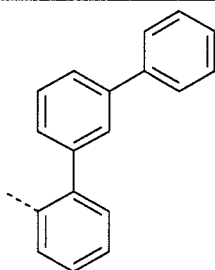
根據申請專利範圍第1或2項之化合物，其中基團 R^1 係相同或不同地選自

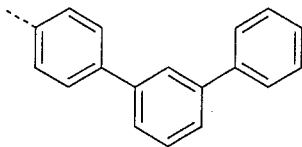
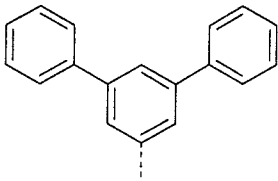
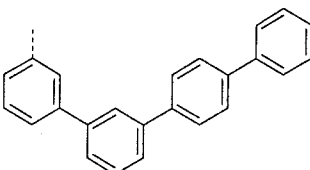
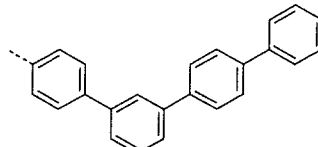
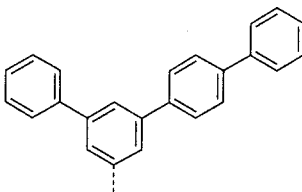
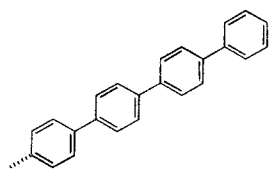
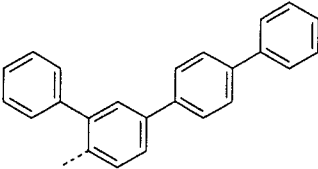
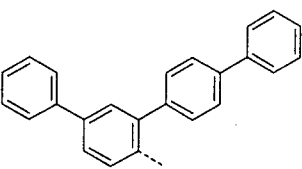
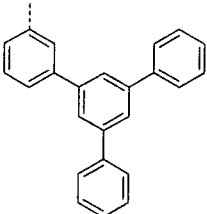
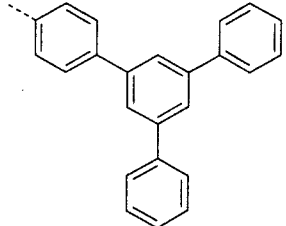
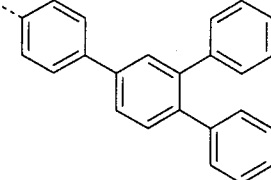
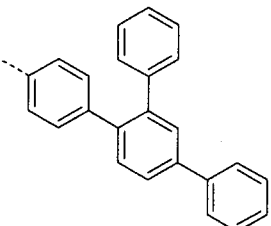
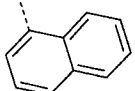
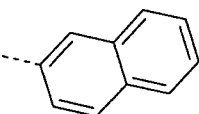
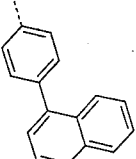
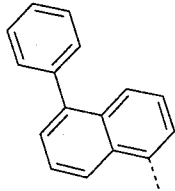
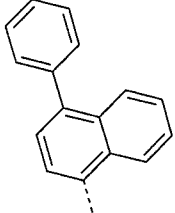
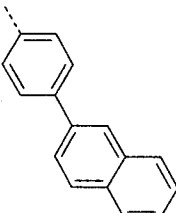


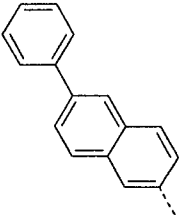
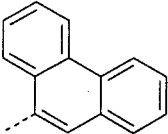
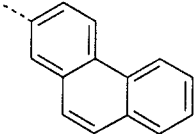
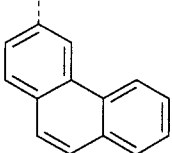
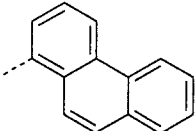
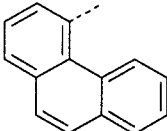
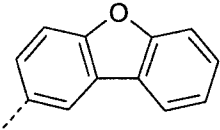
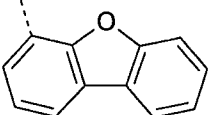
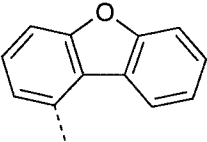
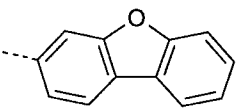
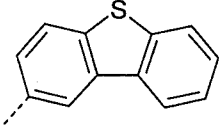
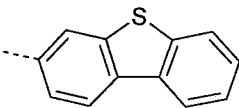
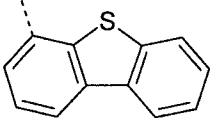
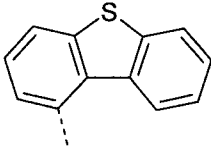
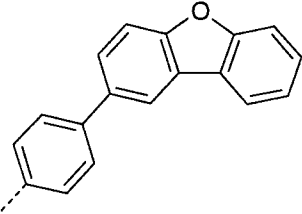
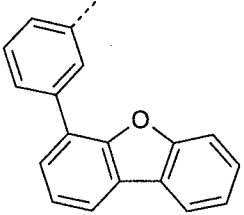
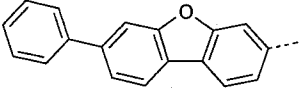
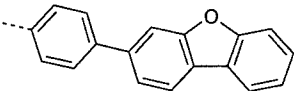
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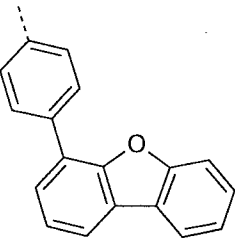
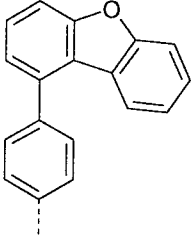
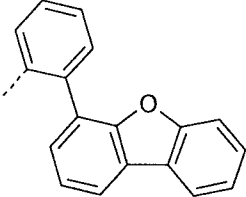
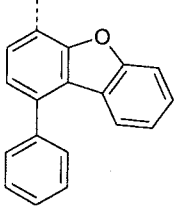
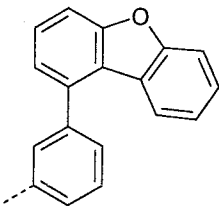
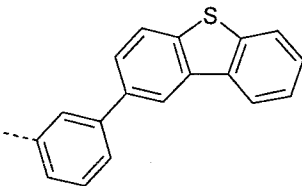
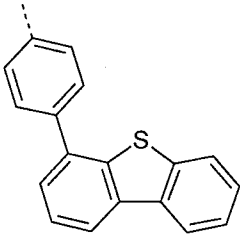
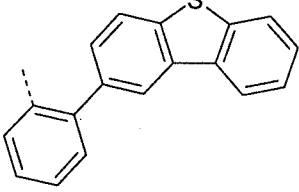
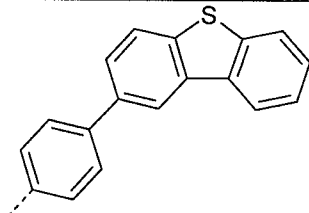
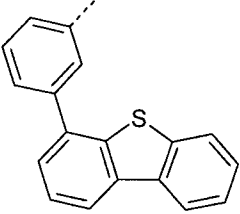
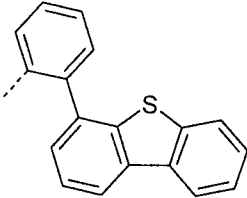
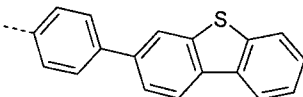
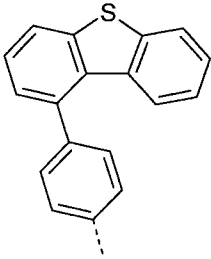
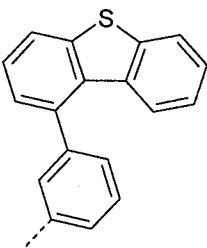
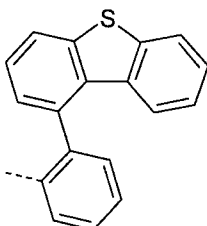
【第6項】

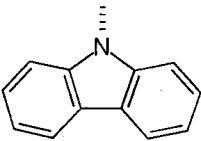
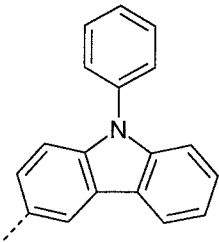
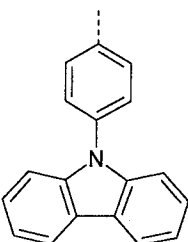
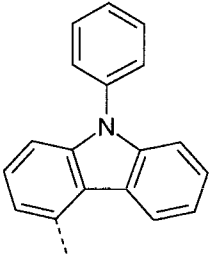
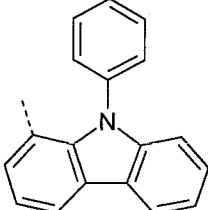
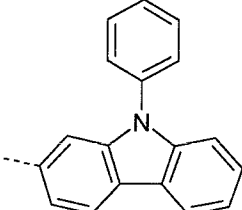
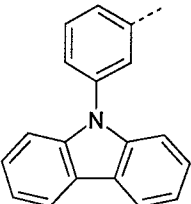
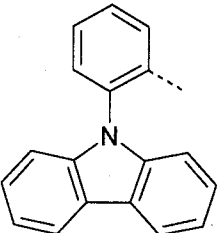
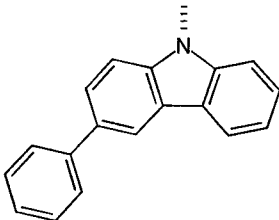
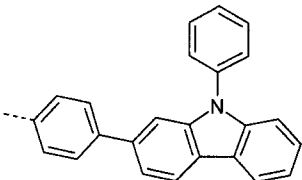
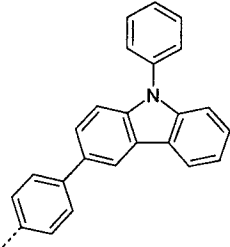
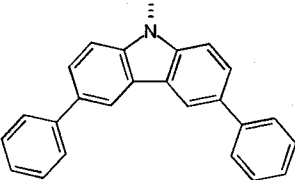
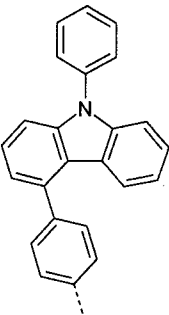
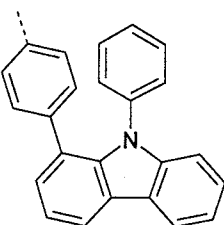
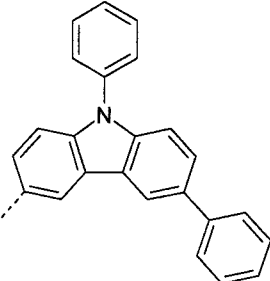
根據申請專利範圍第1或2項之化合物，其中基團 R^1 為符合下列基團之基團

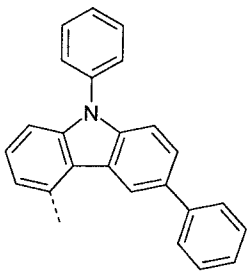
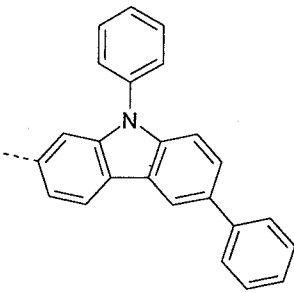
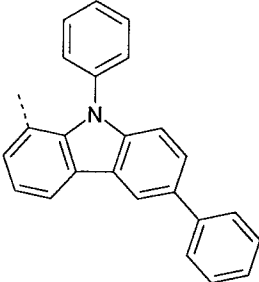
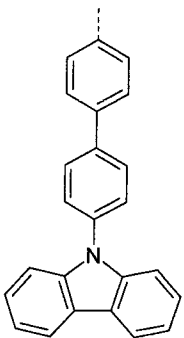
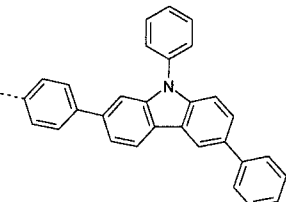
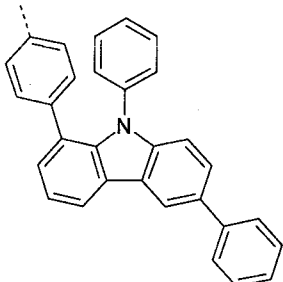
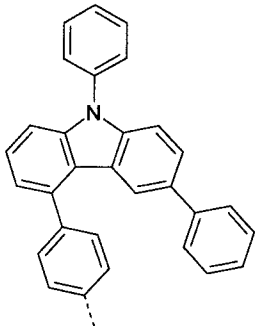
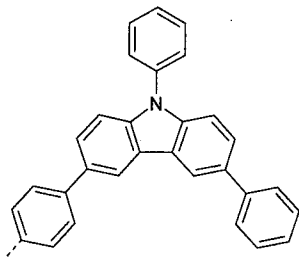
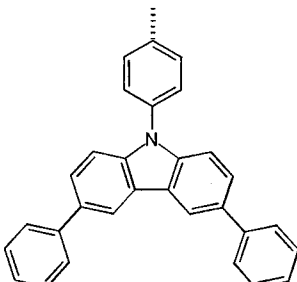
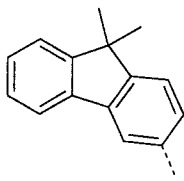
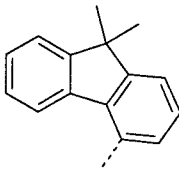
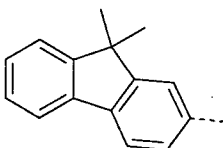
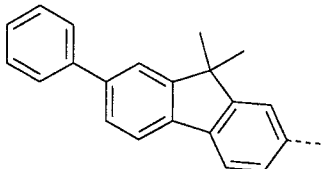
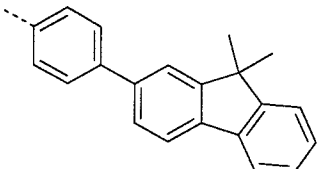
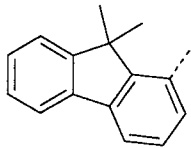
		
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R-4	R-5	R-6

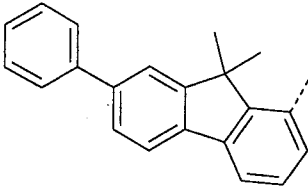
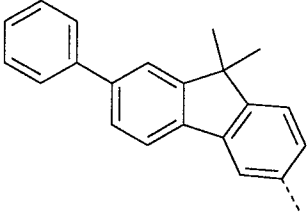
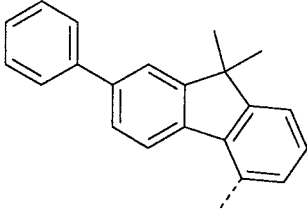
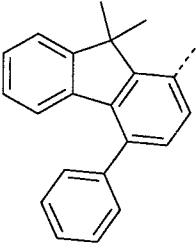
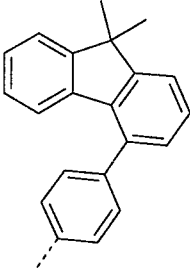
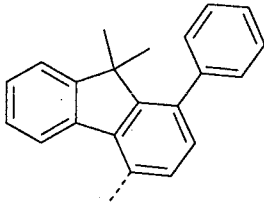
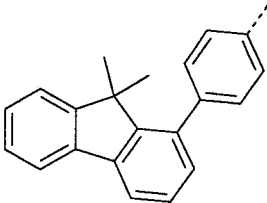
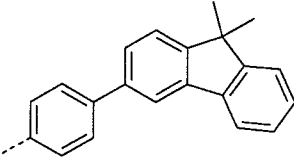
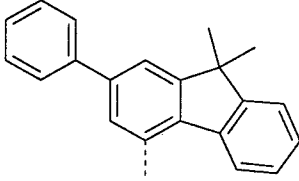
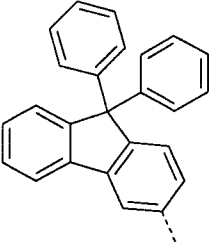
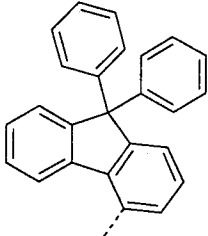
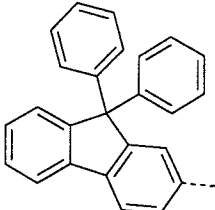
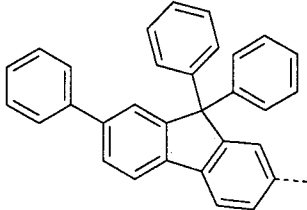
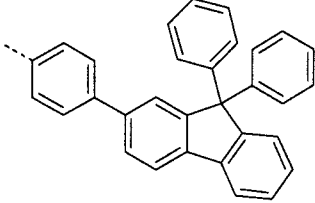
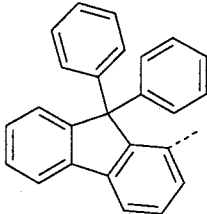
		
R-7	R-8	R-9
		
R-10	R-11	R-12
		
R-13	R-14	R-15
		
R-16	R-17	R-18
		
R-19	R-20	R-21
		
R-22	R-23	R-24

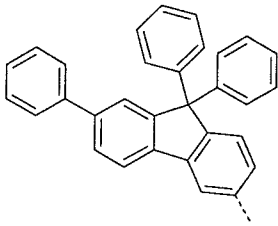
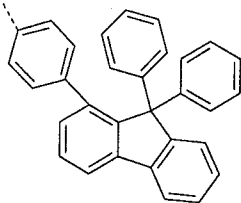
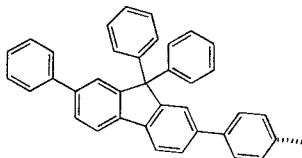
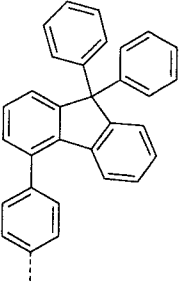
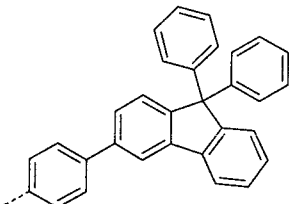
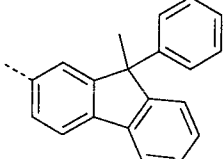
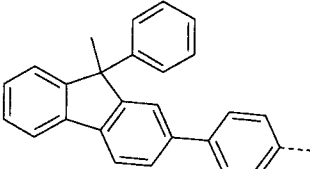
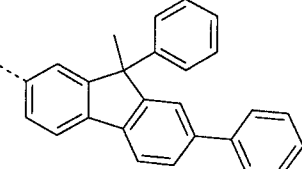
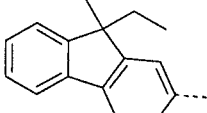
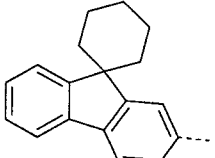
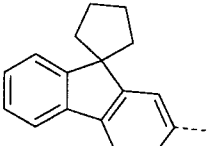
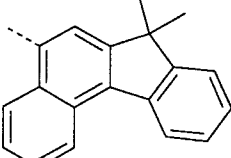
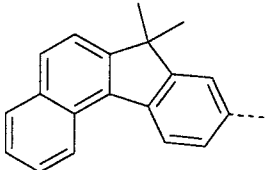
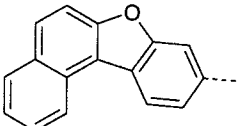
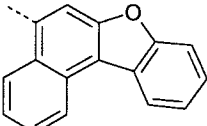
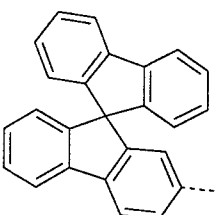
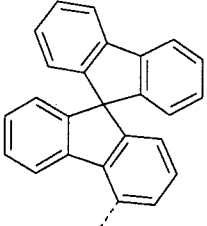
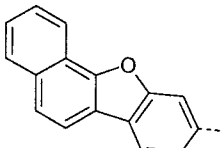
		
R-25	R-26	R-27
		
R-28	R-29	R-30
		
R-31	R-32	R-33
		
R-34	R-35	R-36
		
R-37	R-38	R-39
		
R-40	R-41	R-42

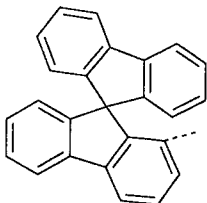
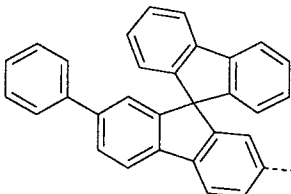
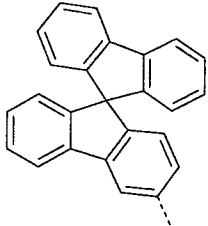
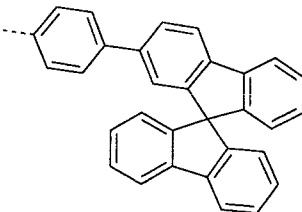
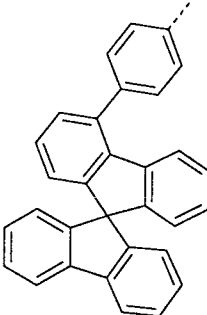
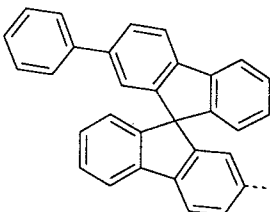
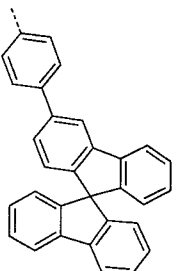
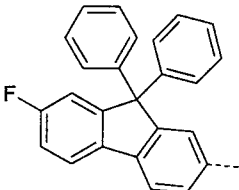
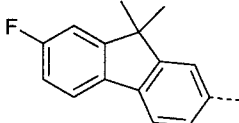
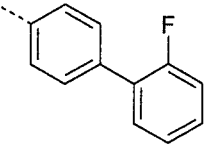
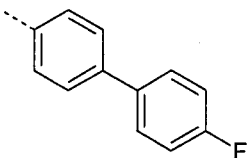
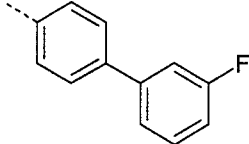
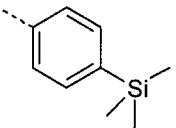
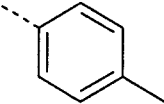
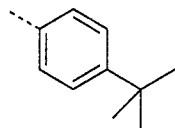
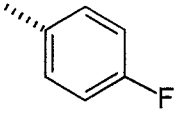
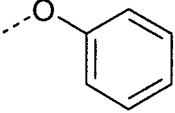
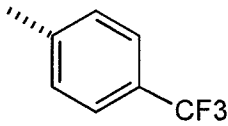
		
R-43	R-44	R-45
		
R-46	R-47	R-48
		
R-49	R-50	R-51
		
R-52	R-53	R-54
		
R-55	R-56	R-57

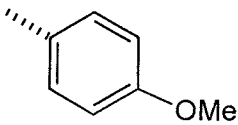
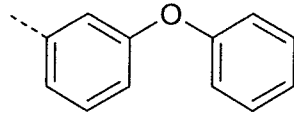
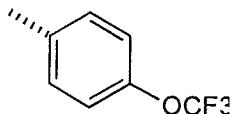
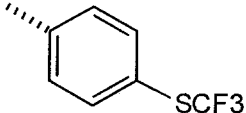
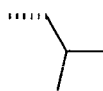
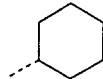
		
R-58	R-59	R-60
		
R-61	R-62	R-63
		
R-64	R-65	R-66
		
R-67	R-68	R-69
		
R-70	R-71	R-72

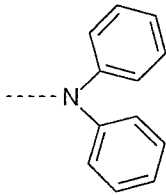
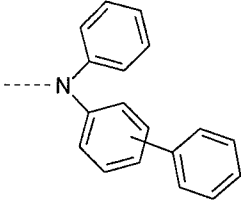
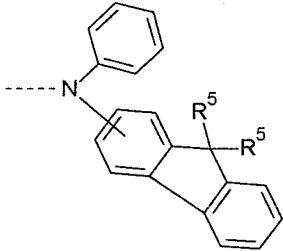
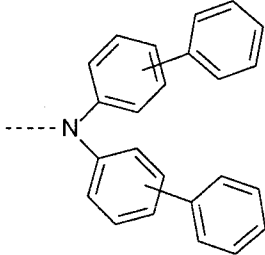
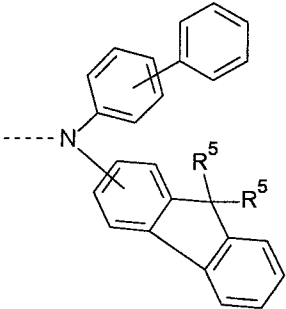
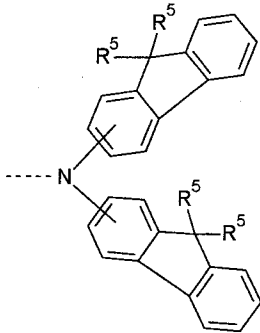
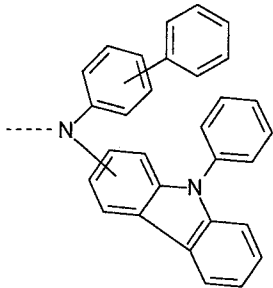
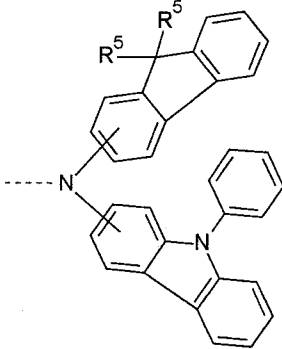
		
R-73	R-74	R-75
		
R-76	R-77	R-78
		
R-79	R-80	R-81
		
R-82	R-83	R-84
		
R-85	R-86	R-87

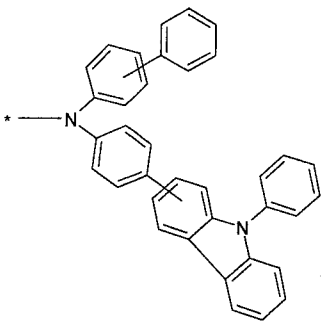
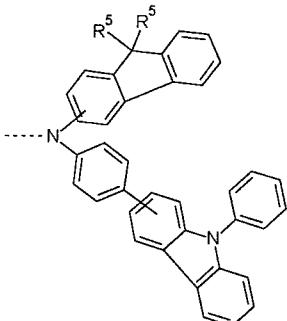
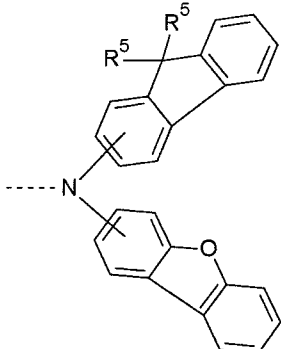
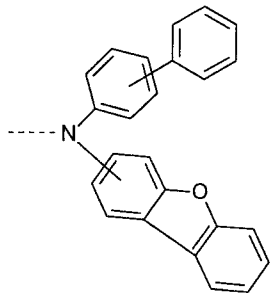
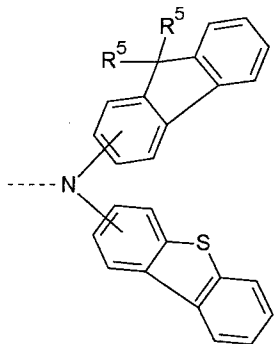
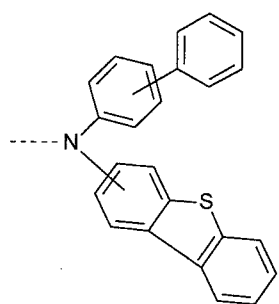
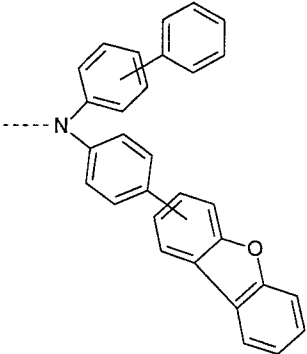
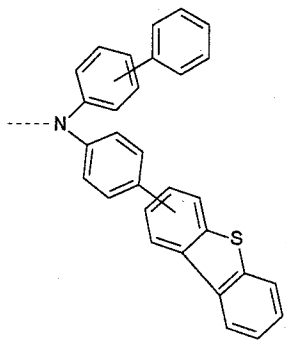
		
R-88	R-89	R-90
		
R-91	R-92	R-93
		
R-94	R-95	R-96
		
R-97	R-98	R-99
		
R-100	R-101	R-102

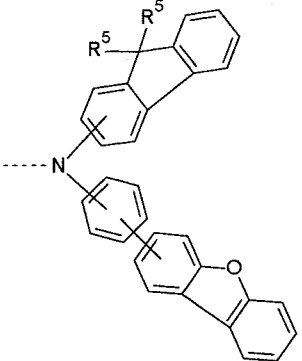
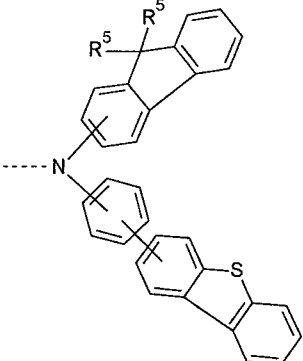
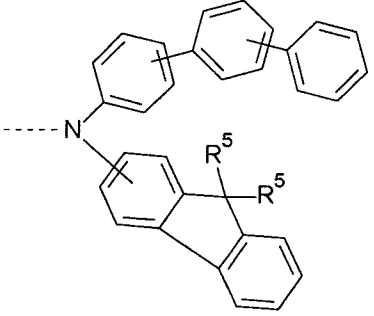
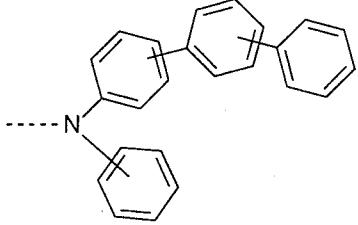
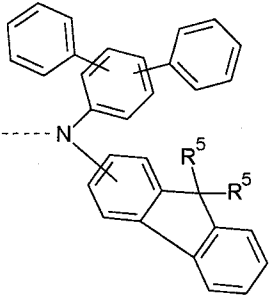
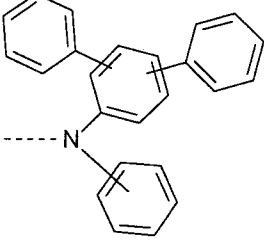
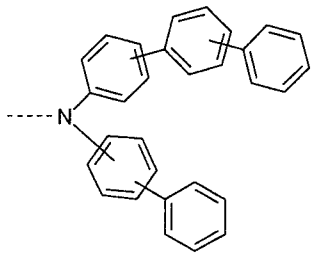
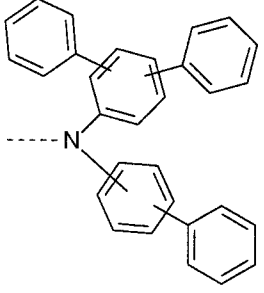
		
R-103	R-104	R-105
		
R-106	R-107	R-108
		
R-109	R-110	R-111
		
R-112	R-113	R-114
		
R-115	R-116	R-117
		
R-118	R-119	R-120

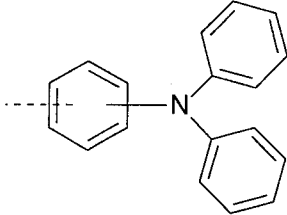
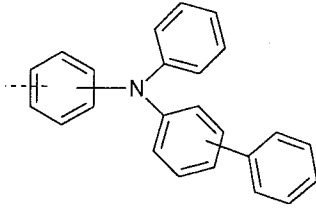
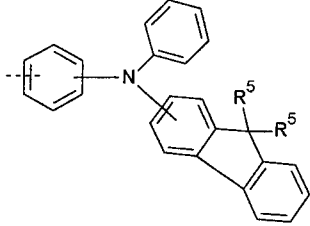
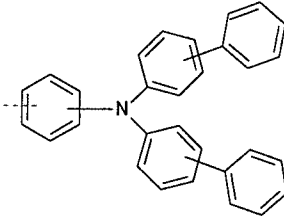
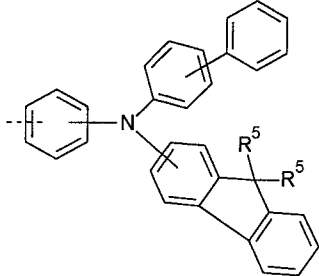
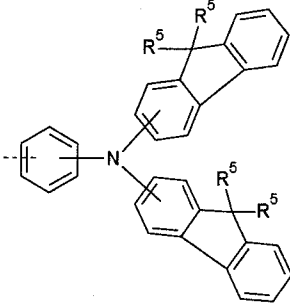
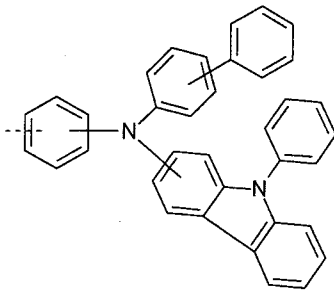
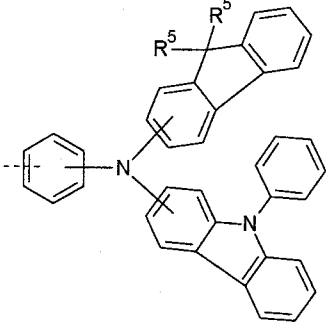
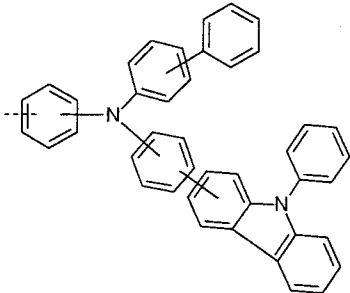
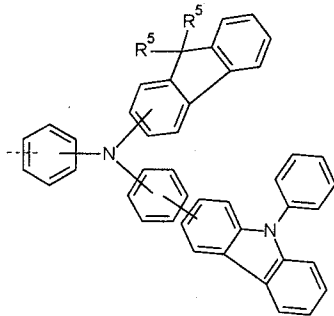
		
R-121	R-122	R-123
		
R-124	R-125	R-126
		
R-127	R-128	R-129
		
R-130	R-131	R-132
		
R-133	R-134	R-135
		
R-136	R-137	R-138

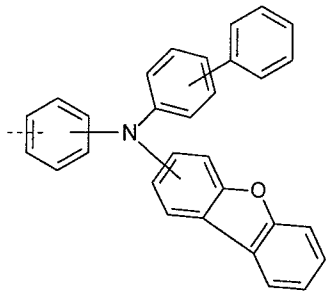
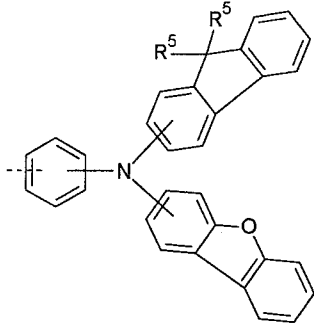
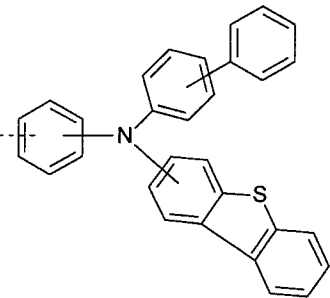
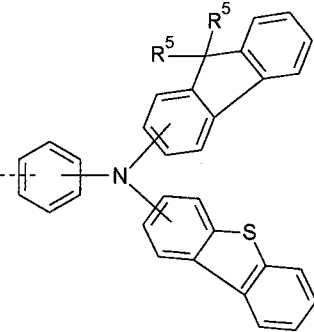
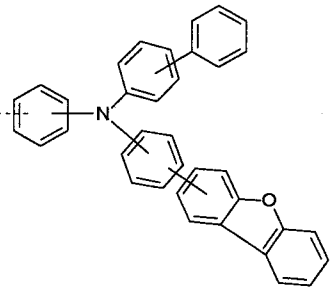
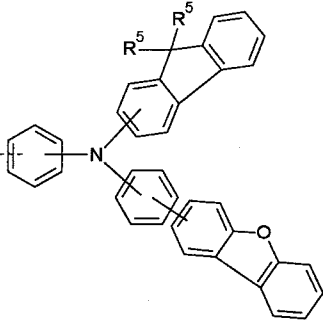
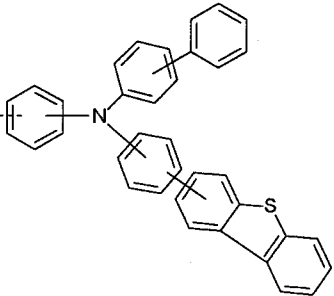
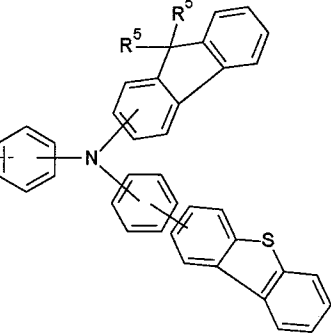
		
R-139	R-140	R-141
	-CH3	-CH2CH3
R-142	R-143	R-144
		
R-145	R-146	R-147
-CF2CF3	-CF3	-SCF3
R-148	R-149	R-150
-OCF3	-OCF2CF3	-SCF2CF3
R-151	R-152	R-153
		
R-154	R-155	R-156
	-SCH3	-OCH2CH3
R-157	R-158	R-159
-OCH3	-Si(CH3)2Ph	-Si(CH3)3
R-160	R-161	R-162
-Si(CH3)2t-Bu	-Si(iPr)3	
R-163	R-164	

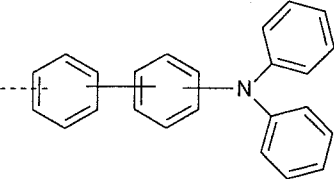
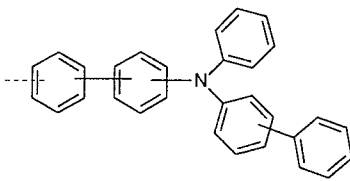
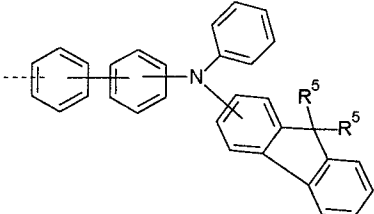
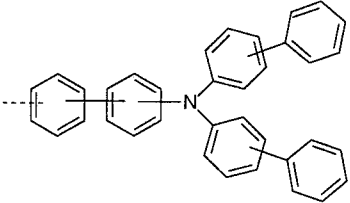
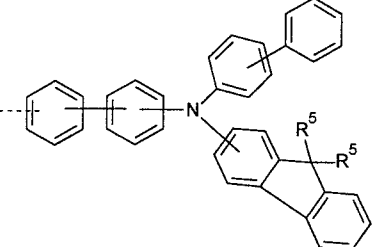
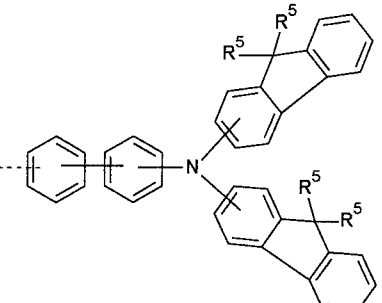
	
R-165	R-166
	
R-167	R-168
	
R-169	R-170
	
R-171	R-172

	
R-173	R-174
	
R-175	R-176
	
R-177	R-178
	
R-179	R-180

	
R-181	R-182
	
R-183	R-184
	
R-185	R-186
	
R-187	R-188

	
R-189	R-190
	
R-191	R-192
	
R-193	R-194
	
R-195	R-196
	

R-197 	R-198 
R-199 	R-200 
R-201 	R-202 
R-203 	R-204 
R-205	R-206

	
R-207	R-208
	
R-209	R-210
	
R-211	R-212

其中該等基團在自由位置可以基團 R^5 取代，及其中虛線標誌至式(I)的螺聯茚部分之鍵結位置。

【第7項】

根據申請專利範圍第1或2項之化合物，其中 R^2 為H。

【第8項】

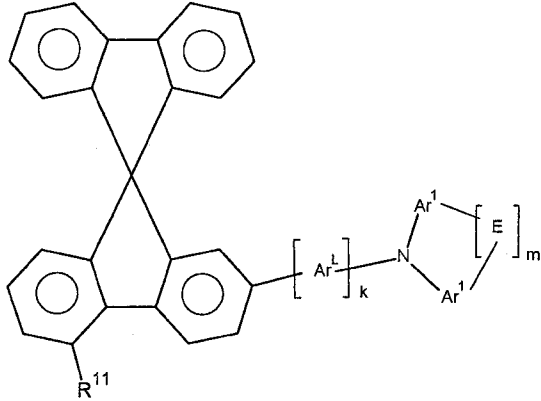
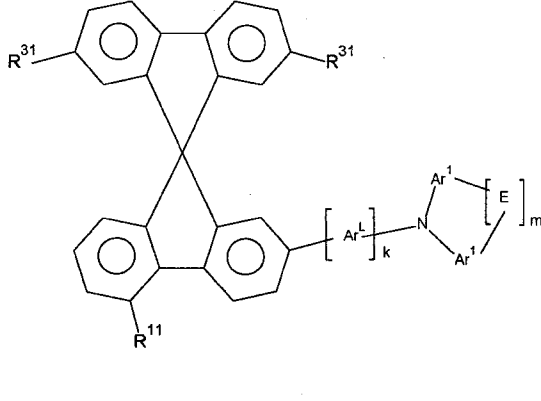
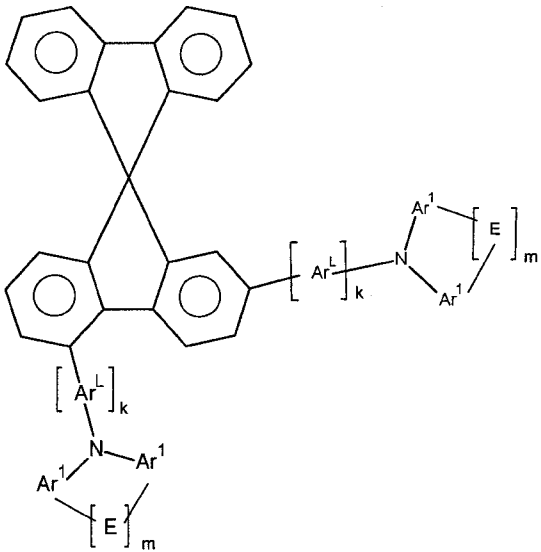
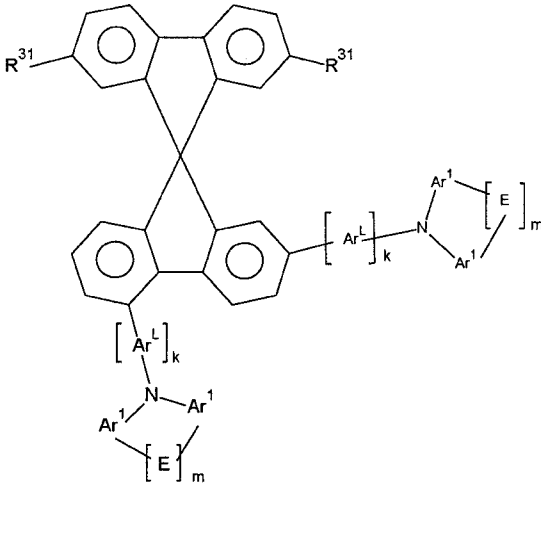
根據申請專利範圍第1或2項之化合物，其中 R^3 係相同或不同地選自H、F、甲基、三級丁基、和苯基。

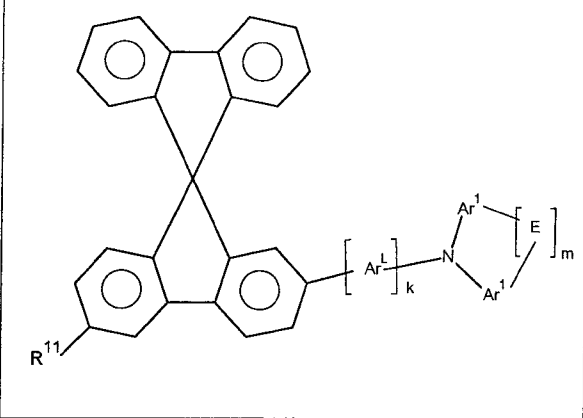
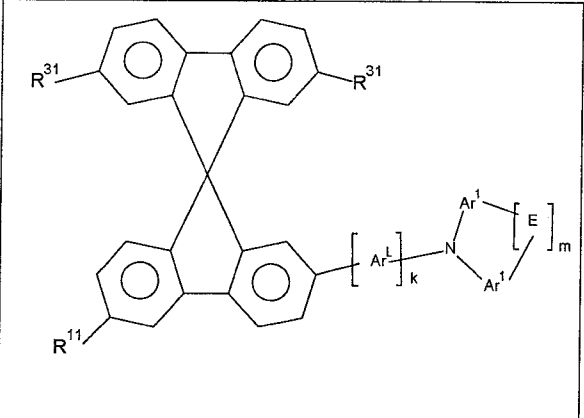
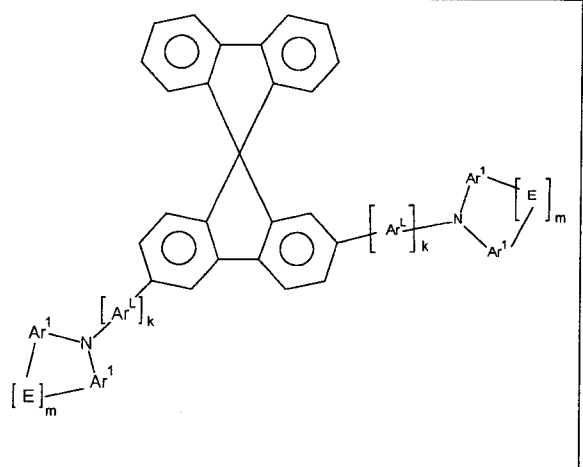
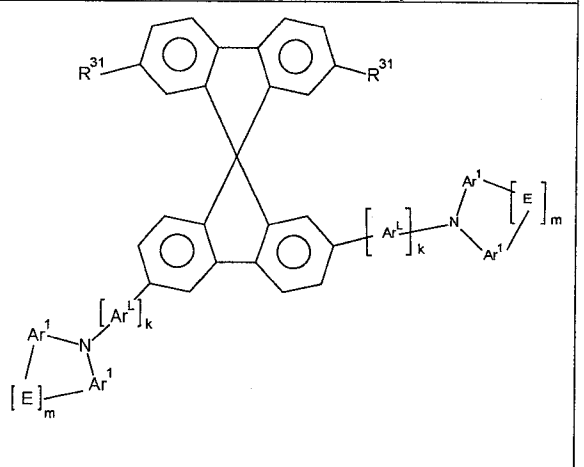
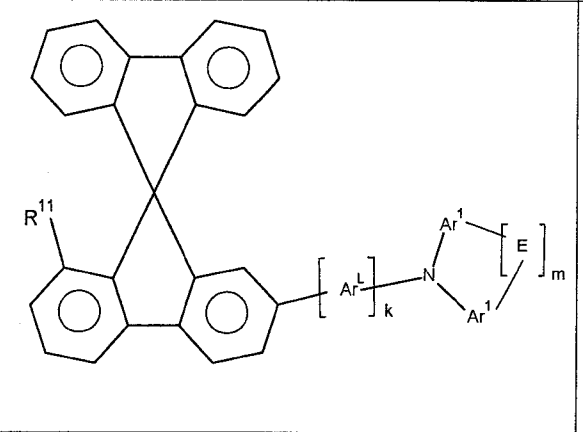
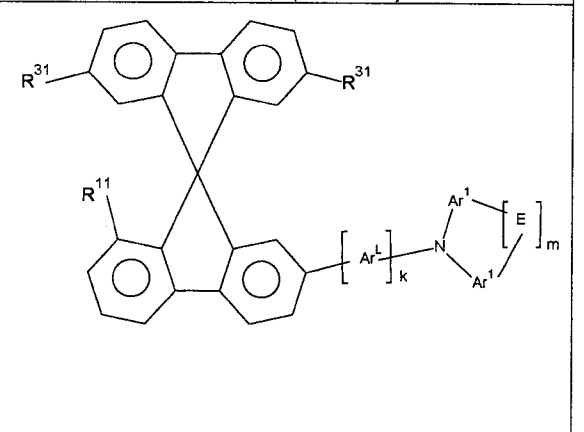
【第9項】

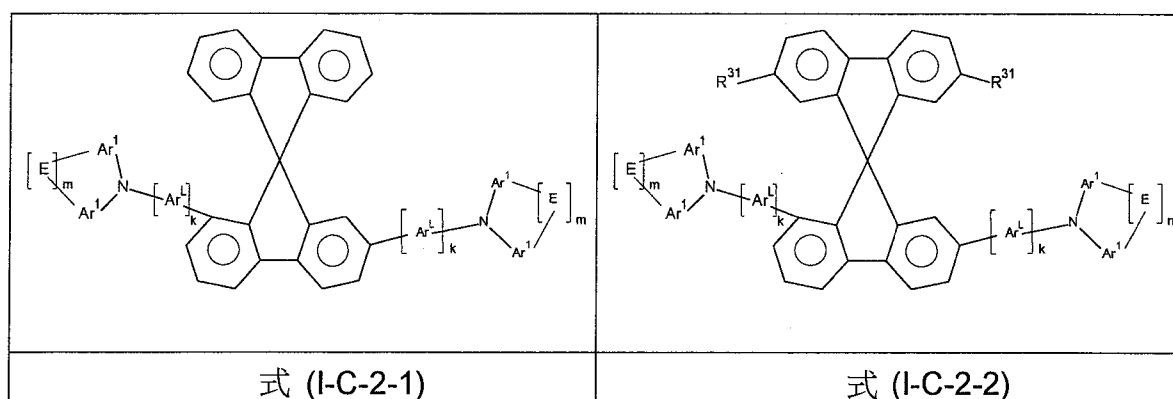
根據申請專利範圍第1或2項之化合物，其中位於兩個六環之間的鍵之鄰位的基團 Z^1 為 CR^1 ，及其他基團 Z^1 為 CR^2 。

【第10項】

根據申請專利範圍第1或2項之化合物，其中該化合物符合式(I-A-1-1)至(I-C-2-2)中之一者

	
式 (I-A-1-1)	式 (I-A-1-2)
	
式 (I-A-2-1)	式 (I-A-2-2)

	
式 (I-B-1-1)	式 (I-B-1-2)
	
式 (I-B-2-1)	式 (I-B-2-2)
	
式 (I-C-1-1)	式 (I-C-1-2)



其中所出現之變數係定義於申請專利範圍第1至9項中之一或多項，

其中 R^{11} 在每次出現時係相同或不同地選自 $Si(R^5)_3$ 、具有1至20個C原子之直鏈烷基、烷氧基或烷硫基(thioalkyl)、具有3至20個C原子之支鏈或環狀烷基、烷氧基、或烷硫基、具有6至40個芳族環原子之芳族環系統、和具有5至40個芳族環原子之雜芳族環系統，其中該等烷基、烷氧基和烷硫基及該等芳族和雜芳族環系統在各情況下可經一或多個基團 R^5 取代；及

其中 R^{31} 係相同或不同地選自 H、F、具有1至20個C原子之直鏈烷基、具有3至20個C原子之支鏈或環狀烷基、具有6至30個芳族環原子之芳族環系統、和具有5至30個芳族環原子之雜芳族環系統；其中該等烷基、芳族環系統和雜芳族環系統在各情況下可經一或多個基團 R^5 取代。

【第11項】

一種製備根據申請專利範圍第1至10項中之一或多項之化合物之方法，其特徵在於其包含下列反應步驟

1) 將在苯基-苯基鍵的鄰位之位置具有一個反應性基

團且在其他位置上帶有兩個額外的反應性基團之聯苯衍生物金屬化，其中該金屬化係在苯基-苯基鍵的鄰位之位置進行；

2) 將金屬化之聯苯衍生物加成至茚酮衍生物；

3) 將所得加成產物環化為螺聯茚衍生物，其中該環化係在酸性條件下或用路易士酸進行，及其中該螺聯茚衍生物帶有兩個反應性基團；及

4) 使螺聯茚衍生物與選自芳族環系統、雜芳族環系統和胺基團之基團在二個反應性基團之位置偶合。

【第12項】

一種寡聚物，其包含一或多種根據申請專利範圍第1至10項中之一或多項之式(I)化合物，其中至該寡聚物之鍵可位於式(I)中經 R^1 、 R^2 、 R^3 或 R^4 取代之任何所欲位置上。

【第13項】

一種聚合物，其包含一或多種根據申請專利範圍第1至10項中之一或多項之式(I)化合物，其中至該聚合物之鍵可位於式(I)中經 R^1 、 R^2 、 R^3 或 R^4 取代之任何所欲位置上。

【第14項】

一種樹枝狀聚合物，其包含一或多種根據申請專利範圍第1至10項中之一或多項之式(I)化合物，其中至該樹枝狀聚合物之鍵可位於式(I)中經 R^1 、 R^2 、 R^3 或 R^4 取代之任何所欲位置上。

【第15項】

一種調配物，其包含至少一種根據申請專利範圍第1

至10項中之一或多項之式(I)化合物、至少一種根據申請專利範圍第12項之寡聚物、至少一種根據申請專利範圍第13項之聚合物或至少一種根據申請專利範圍第14項之樹枝狀聚合物，以及至少一種溶劑。

【第16項】

一種電子裝置，其包含至少一種根據申請專利範圍第1至10項中之一或多項之化合物、至少一種根據申請專利範圍第12項之寡聚物、至少一種根據申請專利範圍第13項之聚合物或至少一種根據申請專利範圍第14項之樹枝狀聚合物。

【第17項】

根據申請專利範圍第16項之電子裝置，其中該電子裝置為包含陽極、陰極及至少一個發光層之有機電致發光裝置，其中該裝置之至少一個有機層(其為發光層、電洞傳輸層、電子阻擋層或電洞注入層)包含至少一種化合物。

【第18項】

一種根據申請專利範圍第1至10項中之一或多項之化合物、根據申請專利範圍第12項之寡聚物、根據申請專利範圍第13項之聚合物或根據申請專利範圍第14項之樹枝狀聚合物用於電子裝置之用途。