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(74) 대리인

권오식, 박창희

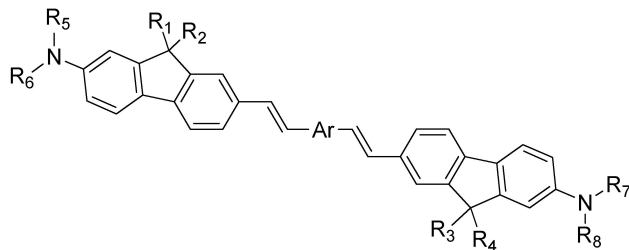
전체 청구항 수 : 총 10 항

(54) 신규한 유기 발광 화합물 및 이를 발광재료로서 채용하고 있는 유기 발광 소자

(57) 요약

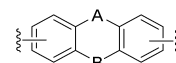
본 발명은 신규한 유기 발광 화합물 및 이를 발광재료로서 채용하고 있는 유기 발광 소자에 관한 것으로, 상세하게는 본 발명에 따른 유기 발광 화합물은 하기 화학식 1의 화합물인 것을 특징으로 한다.

[화학식 1]



[상기 화학식 1에서, Ar은 (C6-C60)아릴렌, N, O 및 S로부터 선택된 하나 이상을 포함하는 (C3-C60)헤테로아릴렌, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬렌, (C3-C60)시클로알킬렌, 아다만틸렌, (C7-C60)바이시클로알킬렌, (C2-C60)알케닐렌, (C2-C60)알키닐렌, (C1-C60)알킬

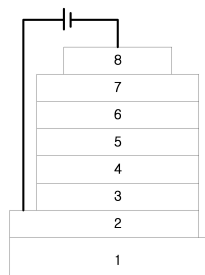
렌티오, (C6-C60)아킬렌옥시, (C6-C60)아릴렌옥시, (C6-C60)아릴렌티오 또는



이다.]

본 발명에 따른 유기 발광 화합물은 발광효율이 좋고 재료의 수명특성이 뛰어나 소자의 구동수명이 매우 양호한 OLED 소자를 제조할 수 있는 장점이 있다.

대표도 - 도1



(72) 발명자

김치식

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윤승수

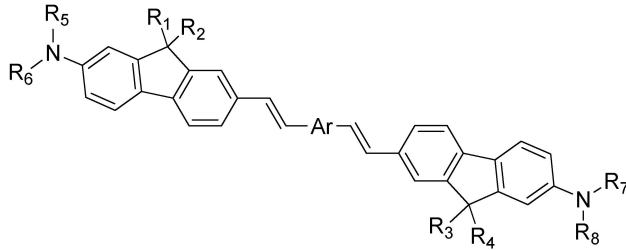
서울시 강남구 수서동 삼익아파트 405-1409

특허청구의 범위

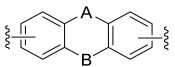
청구항 1

하기 화학식 1로 표시되는 유기 발광 화합물.

[화학식 1]



[상기 화학식 1에서, Ar은 (C6-C60)아릴렌, (C3-C60)헤테로아릴렌, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬렌, (C3-C60)시클로알킬렌, 아다만틸렌, (C7-C60)바이시클로알킬렌, (C2-C60)알케닐렌, (C2-C60)알킬닐렌, (C1-C60)알킬렌티오, (C1-C60)알킬렌옥시, (C6-C60)아릴렌옥시, (C6-C60)아

릴렌티오 또는  이고;

A 및 B는 서로 독립적으로 화학결합이거나, $-(CR_{11})(R_{12})_m-$, $-N(R_{13})-$, $-S-$, $-O-$, $-Si(R_{14})(R_{15})-$, $-P(R_{16})-$, $-C(=O)-$, $-B(R_{17})-$, $-In(R_{18})-$, $-Se-$, $-Ge(R_{19})(R_{20})-$, $-Sn(R_{21})(R_{22})-$, $-Ga(R_{23})-$ 또는 $-(R_{24})C=C(R_{25})-$ 이며, 단 A 및 B는 동시에 화학결합은 아니고;

R₁ 내지 R₈은 서로 독립적으로 수소, 중수소, 할로젠, (C1-C60)알킬, (C6-C60)아릴, N, O 및 S로부터 선택된 하나 이상을 포함하는 (C3-C60)헤테로아릴, 모폴리노, 티오모폴리노, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴, 트리(C6-C60)아릴실릴, 아다만틸, (C7-C60)바이시클로알킬, (C2-C60)알케닐, (C2-C60)알킬닐, 시아노, (C1-C60)알킬아미노, (C6-C60)아릴아미노, (C6-C60)아르(C1-C60)알킬, (C1-C60)알킬옥시, (C1-C60)알킬티오, (C6-C60)아릴옥시, (C6-C60)아릴티오, (C1-C60)알콕시카보닐, (C1-C60)알킬카보닐, (C6-C60)아릴카보닐, 카르복실, 니트로 또는 하이드록시이거나, R₁과 R₂, R₃와 R₄, R₅와 R₆ 및 R₇와 R₈는 융합고리를 포함하거나 포함하지 않는 (C3-C60)알킬렌 또는 (C3-C60)알케닐렌으로 연결되어 지환족 고리 및 단일환 또는 다환의 방향족 고리를 형성할 수 있으며;

R₁₁ 내지 R₂₅는 서로 독립적으로 수소, 중수소, 할로젠, (C1-C60)알킬, (C6-C60)아릴, N, O 및 S로부터 선택된 하나 이상을 포함하는 (C3-C60)헤테로아릴, 모폴리노, 티오모폴리노, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴, 트리(C6-C60)아릴실릴, 아다만틸, (C7-C60)바이시클로알킬, (C2-C60)알케닐, (C2-C60)알킬닐, 시아노, (C1-C60)알킬아미노, (C6-C60)아릴아미노, (C6-C60)아르(C1-C60)알킬, (C1-C60)알킬옥시, (C1-C60)알킬티오, (C6-C60)아릴옥시, (C6-C60)아릴티오, (C1-C60)알콕시카보닐, (C1-C60)알킬카보닐, (C6-C60)아릴카보닐, 카르복실, 니트로 또는 하이드록시이거나, R₁₁과 R₁₂, R₁₄와 R₁₅, R₁₉와 R₂₀, R₂₁와 R₂₂ 및 R₂₄와 R₂₅는 융합고리를 포함하거나 포함하지 않는 (C3-C60)알킬렌 또는 (C3-C60)알케닐렌으로 연결되어 지환족 고리 및 단일환 또는 다환의 방향족 고리를 형성할 수 있으며;

상기 Ar의 아릴렌, 헤테로아릴렌, 헤테로시클로알킬렌, 시클로알킬렌, 아다만틸렌, 바이시클로알킬렌, 알케닐렌, 알킬렌티오, 알킬렌옥시, 아릴렌옥시 또는 아릴렌티오 및 R₁ 내지 R₈, R₁₁ 내지 R₂₅의 알킬, 아릴, 헤테로아릴, 헤테로시클로알킬, 시클로알킬, 트리알킬실릴, 디알킬아릴실릴, 트리아릴실릴, 아다만틸, 바이시클로알킬, 알케닐, 아르알킬, 알킬옥시, 알킬티오, 아릴옥시, 아릴티오, 알킬아미노, 아릴아미노, 알콕시카보닐, 알킬카보닐 또는 아릴카보닐은 중수소, 할로젠, 할로젠이 치환 또는 비치환된 (C1-C60)알킬, (C6-C60)아릴, (C6-C60)아릴이 치환 또는 비치환된 N, O 및 S로부터 선택된 하나 이상을 포함하는 (C3-C60)헤테로아릴, 모폴리노,

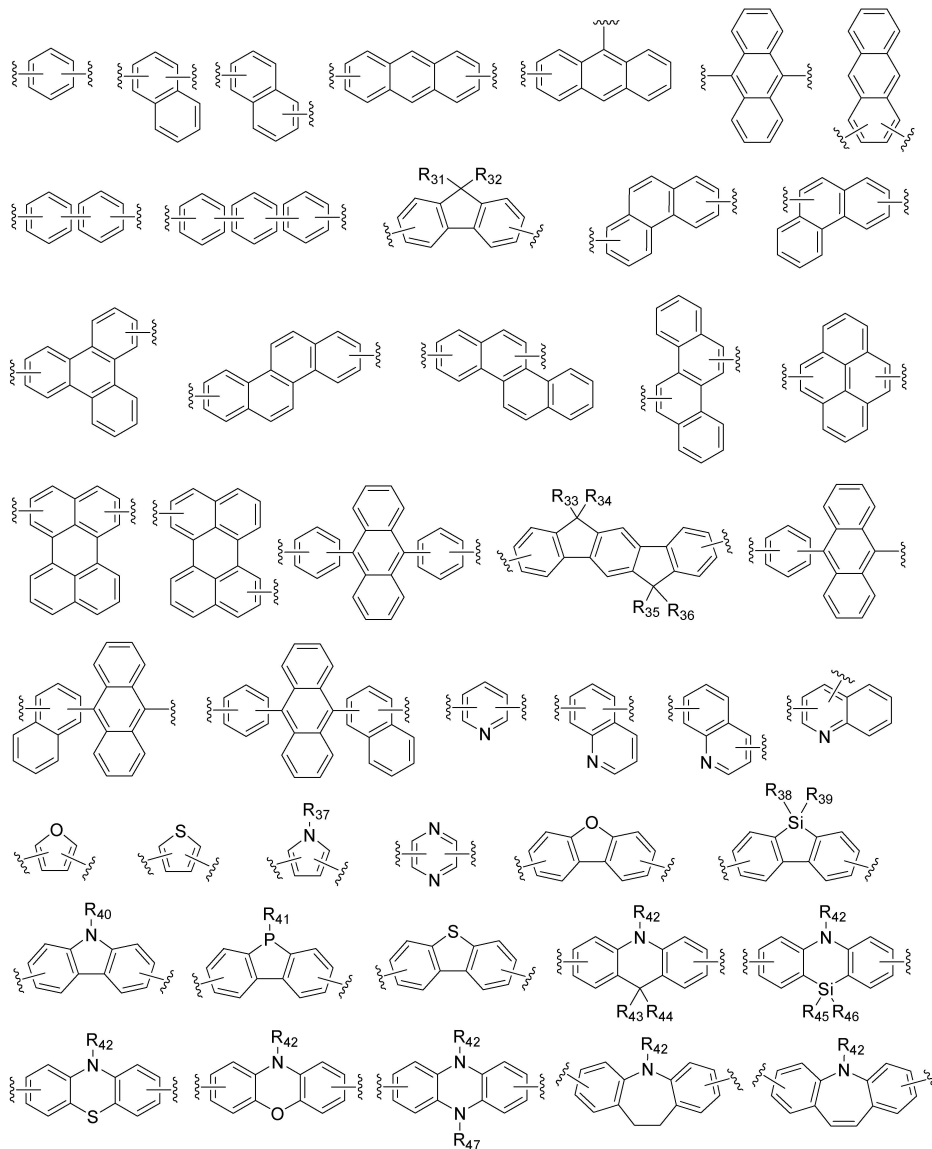
티오모폴리노, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴, 트리(C6-C60)아릴실릴, 아다만틸, (C7-C60)바이시클로알킬, (C2-C60)알케닐, (C2-C60)알키닐, 시아노, 카바졸릴, (C1-C60)알킬아미노, (C6-C60)아릴아미노, (C6-C60)아르(C1-C60)알킬, (C1-C60)알킬(C6-C60)아릴, (C1-C60)알킬옥시, (C1-C60)알킬티오, (C6-C60)아릴옥시, (C6-C60)아릴티오, (C1-C60)알콕시카보닐, (C1-C60)알킬카보닐, (C6-C60)아릴카보닐, 카르복실, 나이트로 또는 하이드록시로부터 이루어진 군으로부터 선택되는 하나 이상의 치환기가 더 치환될 수 있고;

m은 1 내지 3의 정수이다.]

청구항 2

제 1항에 있어서,

상기 Ar은 하기 구조에서 선택되는 것을 특징으로 하는 유기 발광 화합물.



[R₃₁ 내지 R₄₂는 서로 독립적으로 수소, 중수소, 할로젠, (C1-C60)알킬, (C6-C60)아릴, N, O 및 S로부터 선택된 하나 이상을 포함하는 (C3-C60)헤테로아릴, 모폴리노, 티오모폴리노, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴, 트리(C6-C60)아릴실릴, 아다만틸, (C7-C60)바이시클로알킬, (C2-C60)알케닐, (C2-C60)알키닐, 시아노, (C1-C60)알킬아미노, (C6-C60)아릴아미노, (C6-C60)아르(C1-C60)알킬, (C1-C60)알킬옥시, (C1-C60)알킬티오, (C6-C60)아릴옥시, (C6-C60)아릴티오, (C1-C60)알콕시카보닐, (C1-C60)알킬카보닐, (C6-C60)아릴카보닐, 카르복실, 나이트로 또는 하이드록시이거나, R₃₁과 R₃₂, R₃₃과 R₃₄, R₃₅와 R₃₆, R₃₈과 R₃₉, R₄₃과 R₄₄ 및 R₄₅와 R₄₆는 융합

고리를 포함하거나 포함하지 않는 (C3-C60)알킬렌 또는 (C3-C60)알케닐렌으로 연결되어 치환족 고리 및 단일환 또는 다환의 방향족 고리를 형성할 수 있고;

상기 R₃₁ 내지 R₄₂의 알킬, 아릴, 헤테로아릴, 헤테로시클로알킬, 시클로알킬, 트리알킬실릴, 디알킬아릴실릴, 트리아릴실릴, 아다만틸, 바이시클로알킬, 알케닐, 아르알킬, 알킬옥시, 알킬티오, 아릴옥시, 아릴티오, 알킬아미노, 아릴아미노, 알콕시카보닐, 알킬카보닐 또는 아릴카보닐은 중수소, 할로젠, 할로겐이 치환 또는 비치환된 (C1-C60)알킬, (C6-C60)아릴, (C6-C60)아릴이 치환 또는 비치환된 N, O 및 S로부터 선택된 하나 이상을 포함하는 (C3-C60)헤테로아릴, 모폴리노, 티오모폴리노, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴, 트리(C6-C60)아릴실릴, 아다만틸, (C7-C60)바이시클로알킬, (C2-C60)알케닐, (C2-C60)알키닐, 시아노, 카바졸릴, (C1-C60)알킬아미노, (C6-C60)아릴아미노, (C6-C60)아르(C1-C60)알킬, (C1-C60)알킬(C6-C60)아릴, (C1-C60)알킬옥시, (C1-C60)알킬티오, (C6-C60)아릴옥시, (C6-C60)아릴티오, (C1-C60)알콕시카보닐, (C1-C60)알킬카보닐, (C6-C60)아릴카보닐, 카르복실, 나이트로 또는 하이드록시로부터 이루어진 군으로부터 선택되는 하나 이상의 치환기가 더 치환될 수 있다.]

청구항 3

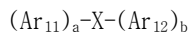
제 1항 또는 제 2항에 따른 유기 발광 화합물을 포함하는 것을 특징으로 하는 유기 발광 소자.

청구항 4

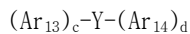
제 3항에 있어서,

상기 유기 발광 소자는 제1전극; 제2전극; 및 상기 제1전극과 제2전극 사이에 개재되는 1층 이상의 유기물층으로 이루어져 있으며, 상기 유기물층은 상기 유기 발광 화합물 하나 이상과 하기 화학식 2 또는 화학식 3의 화합물에서 선택되는 호스트하나 이상을 포함하는 것을 특징으로 하는 유기 발광 소자.

[화학식 2]



[화학식 3]



[상기 화학식 2 및 화학식 3에서,

X는 (C6-C60)아릴렌 또는 (C4-C60)헤테로아릴렌이고;

Y는 안트라세닐렌이며;

Ar₁₁ 내지 Ar₁₄은 서로 독립적으로 수소, 중수소이거나, (C1-C60)알킬, (C1-C60)알콕시, 할로젠, (C4-C60)헤테로아릴, (C5-C60)시클로알킬 또는 (C6-C60)아릴로부터 선택되고, 상기 Ar₁₁ 내지 Ar₁₄의 시클로알킬, 아릴 또는 헤테로아릴은 할로겐이 치환되거나 치환되지 않은 (C1-C60)알킬, (C1-C60)알콕시, (C3-C60)시클로알킬, 중수소, 할로젠, 시아노, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴 또는 트리(C6-C60)아릴실릴로 이루어진 군으로부터 선택된 하나 이상이 치환되거나 치환되지 않은 (C6-C60)아릴 또는 (C4-C60)헤테로아릴, 할로겐이 치환되거나 치환되지 않은 (C1-C60)알킬, (C1-C60)알콕시, (C3-C60)시클로알킬, 중수소, 할로젠, 시아노, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴 또는 트리(C6-C60)아릴실릴로 이루어지는 군에서 선택되는 하나 이상의 치환기가 더 치환될 수 있고;

a, b c, 및 d는 독립적으로 0 내지 4의 정수이다.]

청구항 5

제 4항에 있어서,

상기 유기물층에 아릴아민계 화합물 또는 스티릴아릴아민계 화합물로 이루어진 군으로부터 선택된 하나 이상의 화합물을 포함하는 것을 특징으로 하는 유기 발광 소자.

청구항 6

제 4항에 있어서,

상기 유기물층에 1족, 2족, 4주기, 5주기 전이금속, 란타계열금속 및 d-전이원소의 유기금속으로 이루어진 군으로부터 선택되는 하나 이상의 금속을 더 포함하는 것을 특징으로 하는 유기 발광 소자.

청구항 7

제 4항에 있어서,

상기 유기발광화합물과 500 내지 560nm의 파장을 발광피크로 갖는 화합물 또는 560nm이상의 파장을 발광피크로 갖는 화합물을 동시에 포함하는 유기 디스플레이인 것을 특징으로 하는 유기 발광 소자.

청구항 8

제 4항에 있어서,

상기 유기물층은 발광층 및 전하생성층을 포함하는 것을 특징으로 하는 유기 발광 소자.

청구항 9

제 4항에 있어서,

한 쌍의 전극중 하나 이상의 내측표면에 환원성 도판트(dopant)와 유기물의 혼합 영역, 또는 산화성 도판트와 유기물의 혼합 영역이 배치되는 것을 특징으로 하는 유기 발광 소자.

청구항 10

제 1항 또는 제 2항에 따른 유기 발광 화합물을 포함하는 것을 특징으로 하는 유기 태양 전지.

명세서

발명의 상세한 설명

기술 분야

[0001] 본 발명은 신규한 유기 발광 화합물 및 이를 발광층에 채용하는 유기 발광 소자에 관한 것으로, 보다 구체적으로는 청색 발광 재료로서 사용되는 신규한 유기 발광 화합물 및 이를 도판트로서 채용하고 있는 유기 발광 소자에 관한 것이다.

배경 기술

[0002] 표시 소자 중, 전기 발광 소자(electroluminescence device: EL device)는 자체 발광형 표시 소자로서 시야각이 넓고 콘트라스트가 우수할 뿐만 아니라 응답속도가 빠르다는 장점을 가지고 있으며, 1987년 이스트만 코닥(Eastman Kodak)사에서는 발광층 형성용 재료로서 저분자인 방향족 디아민과 알루미늄 착물을 이용하고 있는 유기 EL 소자를 처음으로 개발하였다[Appl. Phys. Lett. 51, 913, 1987].

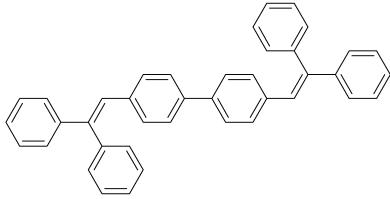
[0003] 유기 EL 소자에서 발광 효율, 수명 등의 성능을 결정하는 가장 중요한 요인은 발광 재료로서, 이러한 발광 재료에 요구되는 몇 가지 특성으로는 고체상태에서 형광 양자 수율이 커야하고, 전자와 정공의 이동도가 높아야 하며, 진공 증착시 쉽게 분해되지 않아야 하고, 균일한 박막을 형성, 안정해야 한다.

[0004] 유기 발광 재료는 크게 고분자 재료와 저분자 재료로 나눌 수 있는데, 저분자 계열의 재료는 분자 구조 면에서 금속 착화합물과 금속을 포함하지 않는 순수 유기 발광 재료가 있다. 이러한 발광 재료로는 트리스(8-퀴놀리놀라토)알루미늄 착제 등의 킬레이트 착제, 쿠마린 유도체, 테트라페닐부타디엔 유도체, 비스스타이릴아릴렌 유도체, 옥사다리아졸 유도체 등의 발광 재료가 알려져 있고, 이들로부터는 청색에서 적색까지의 가시 영역 발광을 얻을 수 있다고 보고되었고 컬러 표시 소자의 실현이 기대되고 있다.

[0005] 한편, 청색 재료의 경우, 이데미쓰-고산의 DPVBi(화학식 a) 이후로 많은 재료들이 개발되어 상업화되어 있으며, 이데미쓰-고산의 청색 재료 시스템과 코닥의 디나프틸안트라센(dinaphthylanthracen, 화학식 b), 테트라(t-부틸)페릴렌(tetra(t-butyl)perlyene, 화학식 c) 시스템 등이 알려져 있으나, 아직도 많은 연구 개발

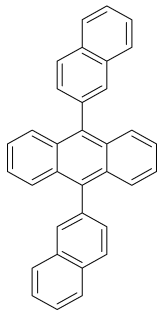
이 이루어져야 할 것으로 판단된다. 현재까지 가장 효율이 좋다고 알려진 이데미쓰-고산의 디스트릴(distryl)화합물의 시스템은 파워 효율의 경우, 6 lm/W이고, 소자 수명이 30,000 시간 이상으로 좋기는 하나, 구동 시간에 따른 색순도의 저하로 인하여 풀컬러 디스플레이에 적용했을 때, 수명이 불과 수천시간에 불과하다. 청색 발광은 발광 파장이 장파장 쪽으로 조금만 이동해도 발광 효율 측면에서는 유리해지나, 순청색을 만족시키지 못해 고품위의 디스플레이에는 적용이 쉽지 않은 문제점을 갖고 있으며, 색순도, 효율 및 열안정성에 문제가 있어 연구 개발이 시급한 부분이라고 하겠다.

[0006] [화학식 a]



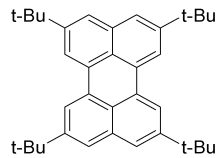
[0007]

[0008] [화학식 b]



[0009]

[0010] [화학식 c]



[0011]

발명의 내용

해결 하고자하는 과제

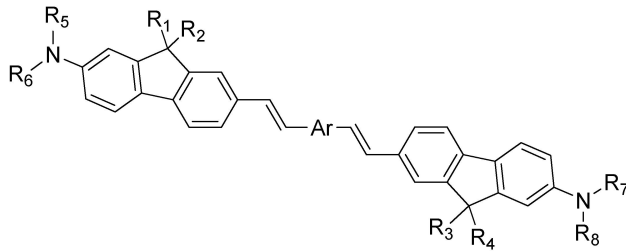
[0012] 따라서, 본 발명자들은 상기의 종래의 문제점을 해결하기 위하여 노력한 결과, 발광 효율이 뛰어나고 수명이 획기적으로 개선된 유기 발광 소자를 실현하기 위한 새로운 발광 화합물을 발명하게 되었다.

[0013] 본 발명의 목적은 상기한 문제점들을 해결하기 위하여 기존의 도판트 재료보다 발광 효율 및 소자 수명이 좋으며, 적절한 색좌표를 갖는 우수한 골격의 유기 발광 화합물을 제공하는 것이며, 또 다른 목적으로서 상기 유기 발광 화합물을 발광 재료로서 채용하는 고효율 및 장수명의 유기 발광 소자를 제공하는 것이다.

과제 해결수단

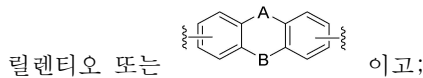
[0014] 본 발명은 하기 화학식 1로 표시되는 유기 발광 화합물 및 이를 포함하는 유기 발광 소자에 관한 것으로서, 본 발명에 따른 유기 발광 화합물은 발광효율이 좋고 재료의 색순도 및 수명특성이 뛰어나 구동수명이 매우 우수한 OLED 소자를 제조할 수 있는 장점이 있다.

[0015] [화학식 1]



[0016]

[0017] [상기 화학식 1에서, Ar은 (C6-C60)아릴렌, (C3-C60)헤테로아릴렌, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬렌, (C3-C60)시클로알킬렌, 아다만틸렌, (C7-C60)바이시클로알킬렌, (C2-C60)알케닐렌, (C2-C60)알키닐렌, (C1-C60)알킬렌티오, (C1-C60)알킬렌옥시, (C6-C60)아릴렌옥시, (C6-C60)아



[0018] A 및 B는 서로 독립적으로 화학결합이거나, $-(CR_{11})(R_{12})_m-$, $-N(R_{13})-$, $-S-$, $-O-$, $-Si(R_{14})(R_{15})-$, $-P(R_{16})-$, $-C(=O)-$, $-B(R_{17})-$, $-In(R_{18})-$, $-Se-$, $-Ge(R_{19})(R_{20})-$, $-Sn(R_{21})(R_{22})-$, $-Ga(R_{23})-$ 또는 $-(R_{24})C=C(R_{25})-$ 이며, 단 A 및 B는 동시에 화학결합은 아니고;

[0019] R₁ 내지 R₈은 서로 독립적으로 수소, 중수소, 할로젠, (C1-C60)알킬, (C6-C60)아릴, N, O 및 S로부터 선택된 하나 이상을 포함하는 (C3-C60)헤테로아릴, 모폴리노, 티오모폴리노, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴, 트리(C6-C60)아릴실릴, 아다만틸, (C7-C60)바이시클로알킬, (C2-C60)알케닐, (C2-C60)알키닐, 시아노, (C1-C60)알킬아미노, (C6-C60)아릴아미노, (C6-C60)아르(C1-C60)알킬, (C1-C60)알킬옥시, (C1-C60)알킬티오, (C6-C60)아릴옥시, (C6-C60)아릴티오, (C1-C60)알콕시카보닐, (C1-C60)알킬카보닐, (C6-C60)아릴카보닐, 카르복실, 나이트로 또는 하이드록시이거나, R₁과 R₂, R₃와 R₄, R₅와 R₆ 및 R₇와 R₈는 융합고리를 포함하거나 포함하지 않는 (C3-C60)알킬렌 또는 (C3-C60)알케닐렌으로 연결되어 지환족 고리 및 단일환 또는 다환의 방향족 고리를 형성할 수 있으며;

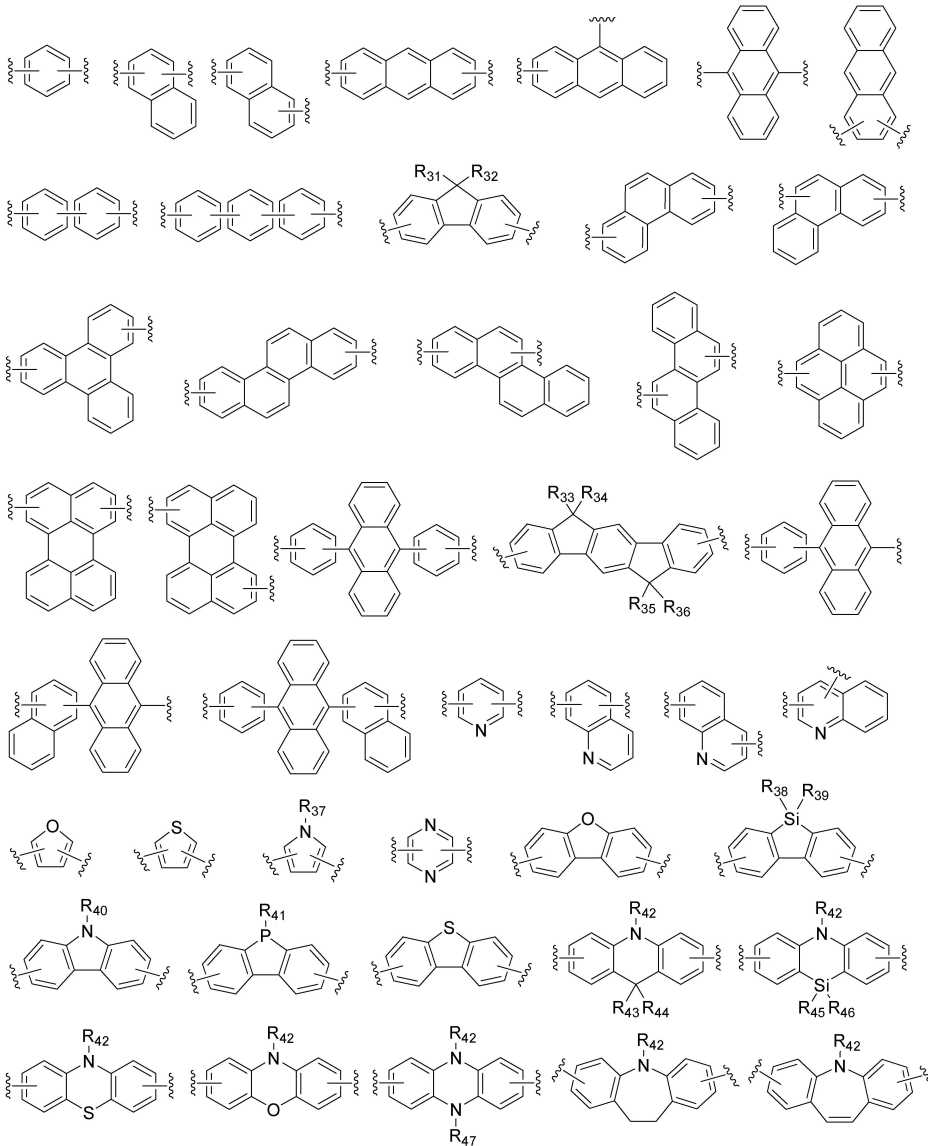
[0020] R₁₁ 내지 R₂₅는 서로 독립적으로 수소, 중수소, 할로젠, (C1-C60)알킬, (C6-C60)아릴, N, O 및 S로부터 선택된 하나 이상을 포함하는 (C3-C60)헤테로아릴, 모폴리노, 티오모폴리노, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴, 트리(C6-C60)아릴실릴, 아다만틸, (C7-C60)바이시클로알킬, (C2-C60)알케닐, (C2-C60)알키닐, 시아노, (C1-C60)알킬아미노, (C6-C60)아릴아미노, (C6-C60)아르(C1-C60)알킬, (C1-C60)알킬옥시, (C1-C60)알킬티오, (C6-C60)아릴옥시, (C6-C60)아릴티오, (C1-C60)알콕시카보닐, (C1-C60)알킬카보닐, (C6-C60)아릴카보닐, 카르복실, 나이트로 또는 하이드록시이거나, R₁₁과 R₁₂, R₁₄와 R₁₅, R₁₉와 R₂₀, R₂₁와 R₂₂ 및 R₂₄와 R₂₅는 융합고리를 포함하거나 포함하지 않는 (C3-C60)알킬렌 또는 (C3-C60)알케닐렌으로 연결되어 지환족 고리 및 단일환 또는 다환의 방향족 고리를 형성할 수 있으며;

[0021] 상기 Ar의 아릴렌, 헤테로아릴렌, 헤테로시클로알킬렌, 시클로알킬렌, 아다만틸렌, 바이시클로알킬렌, 알케닐렌, 알킬렌티오, 알킬렌옥시, 아릴렌옥시 또는 아릴렌티오 및 R₁ 내지 R₈, R₁₁ 내지 R₂₅의 알킬, 아릴, 헤테로아릴, 헤테로시클로알킬, 시클로알킬, 트리아릴실릴, 디알킬아릴실릴, 트리아릴실릴, 아다만틸, 바이시클로알킬, 알케닐, 아르알킬, 알킬옥시, 알킬티오, 아릴옥시, 아릴티오, 알킬아미노, 아릴아미노, 알콕시카보닐, 알킬카보닐 또는 아릴카보닐은 중수소, 할로젠, 할로젠이 치환 또는 비치환된 (C1-C60)알킬, (C6-C60)아릴, (C6-C60)아릴이 치환 또는 비치환된 N, O 및 S로부터 선택된 하나 이상을 포함하는 (C3-C60)헤테로아릴, 모폴리노, 티오모폴리노, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴, 트리(C6-C60)아릴실릴, 아다만틸, (C7-C60)바이시클로알킬, (C2-C60)알케닐, (C2-C60)알키닐, 시아노, 카바졸릴, (C1-C60)알킬아미노, (C6-C60)아릴아미노, (C6-C60)아르(C1-C60)알킬, (C1-C60)알킬(C6-C60)아릴, (C1-C60)알킬옥시, (C1-C60)알킬티오, (C6-C60)아릴옥시, (C6-C60)아릴티오, (C1-C60)알콕시카보닐, (C1-C60)알킬카보닐, (C6-C60)아릴카보닐, 카르복실,

나이트로 또는 하이드록시로부터 이루어진 군으로부터 선택되는 하나 이상의 치환기가 더 치환될 수 있고;

- [0022] m은 1 내지 3의 정수이다.]
- [0023] 본 발명에 기재된 “알킬”, “알콕시” 및 그 외 “알킬” 부분을 포함하는 치환체는 직쇄 또는 분쇄 형태를 모두 포함한다.
- [0024] 본 발명에 기재된 「아릴」은 하나의 수소 제거에 의해서 방향족 탄화수소로부터 유도된 유기 라디칼로, 각 고리에 적절하게는 4 내지 7개, 바람직하게는 5 또는 6개의 고리원자를 포함하는 단일 또는 융합고리계를 포함한다. 구체적인 예로 페닐, 나프틸, 비페닐, 안트릴, 테트라히드로나프틸, 인다닐(indanyl), 플루오레닐, 페난트릴, 트라이페닐레닐, 피렌일, 페릴렌일, 크라이세닐, 나프타세닐, 플루오란텐일 등을 포함하지만, 이에 한정되지 않는다.
- [0025] 본 발명에 기재된 「헤테로아릴」은 방향족 고리 골격 원자로서 N, O 및 S로부터 선택되는 1 내지 4개의 헤테로원자를 포함하고, 나머지 방향족 고리 골격 원자가 탄소인 아릴 그룹을 의미하는 것으로, 5 내지 6원 단환 헤테로아릴, 및 하나 이상의 벤젠 환과 축합된 다환식 헤테로아릴이며, 부분적으로 포화될 수도 있다. 상기 헤테로아릴기는 고리내 헤테로원자가 산화되거나 사원화되어, 예를 들어 N-옥사이드 또는 4차 염을 형성하는 2가 아릴 그룹을 포함한다. 구체적인 예로 퓨릴, 티오펜일, 피롤릴, 피란일, 이미다졸릴, 피라졸릴, 티아졸릴, 티아디아졸릴, 이소티아졸릴, 이속사졸릴, 옥사졸릴, 옥사디아졸릴, 트리아진일, 테트라진일, 트리아졸릴, 테트라졸릴, 퓨라잔일, 피리딜, 피라진일, 피리미딘일, 피리다진일 등의 단환 헤테로아릴, 벤조퓨란일, 벤조티오펜일, 이소벤조퓨란일, 벤조이미다졸릴, 벤조티아졸릴, 벤조이소티아졸릴, 벤조이속사졸릴, 벤조옥사졸릴, 이소인돌릴, 인돌릴, 인다졸릴, 벤조티아디아졸릴, 퀴놀릴, 이소퀴놀릴, 신놀리닐, 퀴나졸리닐, 퀴놀리진일, 퀴녹살리닐, 카바졸릴, 페난트리딘일, 벤조디옥솔릴 등의 다환식 헤테로아릴 및 이들의 상응하는 N-옥사이드(예를 들어, 피리딜 N-옥사이드, 퀴놀릴 N-옥사이드), 이들의 4차 염 등을 포함하지만, 이에 한정되지 않는다.
- [0026] 또한, 본 발명에 기재되어 있는 “(C1-C60)알킬” 부분이 포함되어 있는 치환체들은 1 내지 60개의 탄소수를 가질 수도 있고, 1 내지 20개의 탄소수를 가질 수도 있고, 1 내지 10개의 탄소수를 가질 수도 있다. “(C6-C60)아릴” 부분이 포함되어 있는 치환체들은 6 내지 60개의 탄소수를 가질 수도 있고, 6 내지 20개의 탄소수를 가질 수도 있고, 6 내지 12개의 탄소수를 가질 수도 있다. “(C3-C60)헤테로아릴” 부분이 포함되어 있는 치환체들은 3 내지 60개의 탄소수를 가질 수도 있고, 4 내지 20개의 탄소수를 가질 수도 있고, 4 내지 12개의 탄소수를 가질 수도 있다. “(C3-C60)시클로알킬” 부분이 포함되어 있는 치환체들은 3 내지 60개의 탄소수를 가질 수도 있고, 3 내지 20개의 탄소수를 가질 수도 있고, 3 내지 7개의 탄소수를 가질 수도 있다. “(C2-C60)알케닐 또는 알키닐” 부분이 포함되어 있는 치환체들은 2 내지 60개의 탄소수를 가질 수도 있고, 2 내지 20개의 탄소수를 가질 수도 있고, 2 내지 10개의 탄소수를 가질 수도 있다.

[0027] 상기 Ar은 하기 구조에서 선택되어지나, 이에 한정되는 것은 아니다.



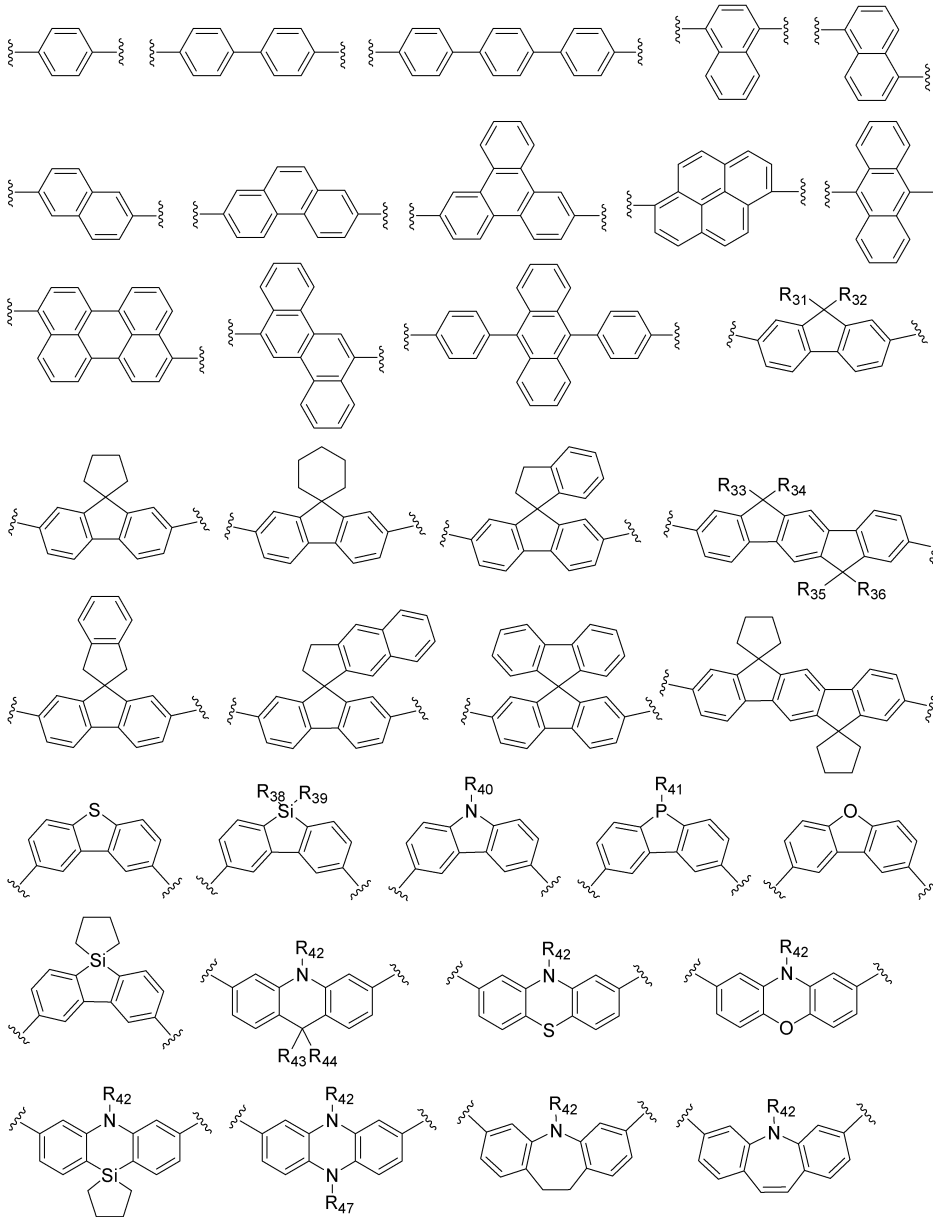
[0028]

[0029] [R₃₁ 내지 R₄₂는 서로 독립적으로 수소, 중수소, 할로젠, (C1-C60)알킬, (C6-C60)아릴, N, O 및 S로부터 선택된 하나 이상을 포함하는 (C3-C60)헤테로아릴, 모폴리노, 티오모폴리노, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴, 트리(C6-C60)아릴실릴, 아다만틸, (C7-C60)바이시클로알킬, (C2-C60)알케닐, (C2-C60)알키닐, 시아노, (C1-C60)알킬아미노, (C6-C60)아릴아미노, (C6-C60)아르(C1-C60)알킬, (C1-C60)알킬옥시, (C1-C60)알킬티오, (C6-C60)아릴옥시, (C6-C60)아릴티오, (C1-C60)알콕시카보닐, (C1-C60)알킬카보닐, (C6-C60)아릴카보닐, 카르복실, 나이트로 또는 하이드록시이거나, R₃₁과 R₃₂, R₃₃과 R₃₄, R₃₅와 R₃₆, R₃₈과 R₃₉, R₄₃과 R₄₄ 및 R₄₅와 R₄₆는 융합 고리를 포함하거나 포함하지 않는 (C3-C60)알킬렌 또는 (C3-C60)알케닐렌으로 연결되어 지환족 고리 및 단일환 또는 다환의 방향족 고리를 형성할 수 있고;

[0030] 상기 R₃₁ 내지 R₄₂의 알킬, 아릴, 헤테로아릴, 헤테로시클로알킬, 시클로알킬, 트리알킬실릴, 디알킬아릴실릴, 트리아릴실릴, 아다만틸, 바이시클로알킬, 알케닐, 아르알킬, 알킬옥시, 알킬티오, 아릴옥시, 아릴티오, 알킬아미노, 아릴아미노, 알콕시카보닐, 알킬카보닐 또는 아릴카보닐은 중수소, 할로젠, 할로젠이 치환 또는 비치환된 (C1-C60)알킬, (C6-C60)아릴, (C6-C60)아릴이 치환 또는 비치환된 N, O 및 S로부터 선택된 하나 이상을 포함하는 (C3-C60)헤테로아릴, 모폴리노, 티오모폴리노, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴, 트리(C6-C60)아릴실릴, 아다만틸, (C7-C60)바이시클로알킬, (C2-C60)알케닐, (C2-C60)알키닐, 시아노, 카바졸릴, (C1-C60)알킬아미노, (C6-C60)아릴아미노, (C6-C60)아르(C1-C60)알킬, (C1-C60)알킬(C6-C60)아릴, (C1-C60)알킬옥

시, (C1-C60)알킬티오, (C6-C60)아릴옥시, (C6-C60)아릴티오, (C1-C60)알콕시카보닐, (C1-C60)알킬카보닐, (C6-C60)아릴카보닐, 카르복실, 나이트로 또는 하이드록시로부터 이루어진 군으로부터 선택되는 하나 이상의 치환기가 더 치환될 수 있다.]

[0031] 보다 구체적으로 상기 Ar은 하기 구조로 예시되어지나, 이에 한정되는 것은 아니다.



[0032]

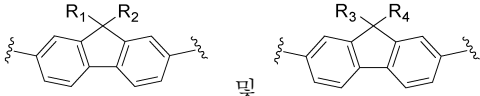
[0033]

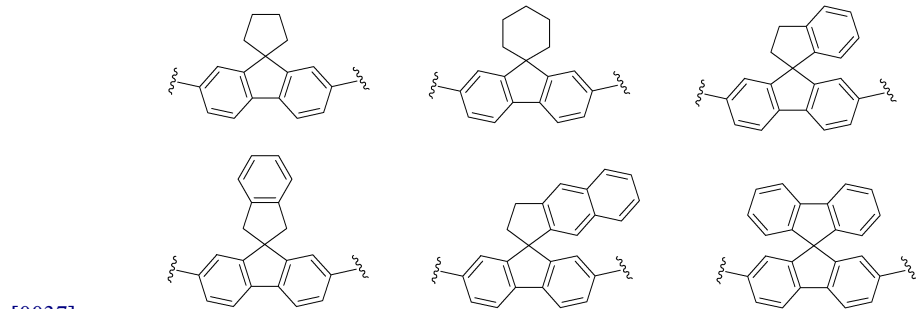
[R₃₁, R₃₂, R₃₃, R₃₄, R₃₅, R₃₆, R₃₈, R₃₉, R₄₀, R₄₁, R₄₂, R₄₃, R₄₄ 및 R₄₇은 서로 독립적으로 수소, 중수소, 메틸, 에틸, n-프로필, i-프로필, n-부틸, i-부틸, t-부틸, n-펜틸, i-펜틸, n-헥실, n-헵틸, n-옥틸, 2-에틸헥실, n-노닐, 데실, 도데실, 헥사데실, 벤질, 트리플루오르메틸, 퍼플루오르에틸, 트리플루오르에틸, 퍼플루오르프로필, 퍼플루오르부틸, 메톡시, 에톡시, n-프로폭시, i-프로폭시, n-부톡시, i-부톡시, t-부톡시, n-펜톡시, i-펜톡시, n-헥실옥시, n-헵톡시, 트리메틸실릴, 트리에틸실릴, 트리프로필실릴, 트리(t-부틸)실릴, t-부틸디메틸실릴, 디메틸페닐실릴, 트리페닐실릴, 시클로프로필, 시클로부틸, 시클로펜틸, 시클로헥실, 시클로헵틸, 시클로옥틸, 시클로노닐, 시클로데실, 페닐, 나프틸, 비페닐, 9,9-디메틸플루오레닐, 9,9-디페닐플루오레닐, 페난트릴, 안트릴, 플루오란텐일, 트리페닐렌일, 피렌일, 크라이세닐, 나프타세닐, 페틸렌일, 모폴리노, 티오모폴리노, 아다만틸, 바이시클로[2.2.1]헵틸, 바이시클로[2.2.2]옥틸, 바이시클로[3.2.1]옥틸, 바이시클로[5.2.0]노닐, 바이시클로[4.2.2]데실, 바이시클로[2.2.2]옥틸, 4-펜틸바이시클로[2.2.2]옥틸, 에테닐, 페닐에테닐, 에티닐, 페닐에티닐, 시아노, 디메틸아미노, 디페닐아미노, 모노메틸아미노, 모노페닐아미노, 페닐옥시, 페닐티오, 메톡시카보닐, 에톡시카보닐, t-부톡시카보닐, 카르복실, 나이트로, 클로로, 플루오르 또는 하이드록시

이다.]

[0034] 또한, 보다 구체적으로 상기 R₁ 내지 R₄는 서로 독립적으로 수소, 중수소, 메틸, 에틸, n-프로필, i-프로필, n-부틸, i-부틸, t-부틸, n-펜틸, i-펜틸, n-헥실, n-헵틸, n-옥틸, 2-에틸헥실, n-노닐, 데실, 도데실, 헥사데실, 벤질, 트리플루오르메틸, 퍼플루오르에틸, 트리플루오르에틸, 퍼플루오르프로필, 퍼플루오르부틸, 메톡시, 에톡시, n-프로폭시, i-프로폭시, n-부톡시, i-부톡시, t-부톡시, n-펜톡시, i-펜톡시, n-헥실옥시, n-헵톡시, 트리메틸실릴, 트리에틸실릴, 트리프로필실릴, 트리(t-부틸)실릴, t-부틸디메틸실릴, 디메틸페닐실릴, 트리페닐실릴, 시클로프로필, 시클로부틸, 시클로펜틸, 시클로헥실, 시클로헵틸, 시클로옥틸, 시클로노닐, 시클로데실, 페닐, 나프틸, 비페닐, 9,9-디메틸플루오레닐, 9,9-디페닐플루오레닐, 페난트릴, 안트릴, 플루오란텐일, 트리페닐렌일, 피렌일, 크라이세닐, 나프타세닐, 페릴렌일, 모폴리노, 티오모폴리노, 아다만틸, 바이시클로[2.2.1]헵틸, 바이시클로[2.2.2]옥틸, 바이시클로[3.2.1]옥틸, 바이시클로[5.2.0]노닐, 바이시클로[4.2.2]데실, 바이시클로[2.2.2]옥틸, 4-펜틸바이시클로[2.2.2]옥틸, 에테닐, 페닐에테닐, 에티닐, 페닐에티닐, 시아노, 디메틸아미노, 디페닐아미노, 모노메틸아미노, 모노페닐아미노, 페닐옥시, 페닐티오, 메톡시카보닐, 에톡시카보닐, t-부톡시카보닐, 카르복실, 나이트로, 클로로, 플루오르 또는 하이드록시로부터 선택되어지며;

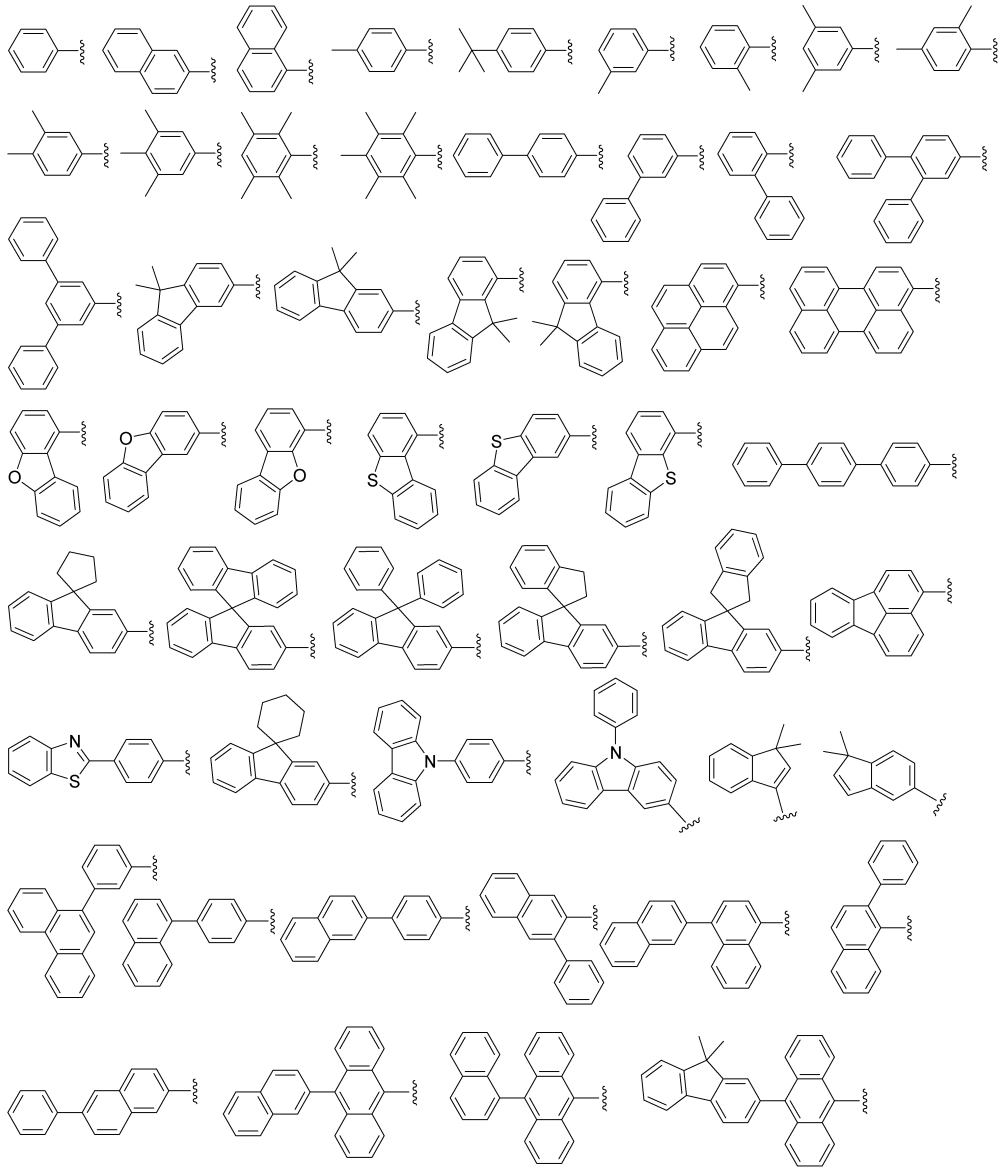
[0035] R₁과 R₂ 또는 R₃와 R₄는 융합고리를 포함하거나 포함하지 않는 (C3-C60)알킬렌 또는 (C3-C60)알케닐렌으로 연결되어 지환족 고리 및 단일환 또는 다환의 방향족 고리를 형성할 수 있다.

[0036] 상기  에서 R₁과 R₂ 또는 R₃와 R₄가 융합고리를 포함하거나 포함하지 않는 알킬렌 또는 알케닐렌으로 연결되어 형성된 지환족 고리 및 단일환 또는 다환의 방향족 고리는 하기 구조에서 선택되어진다.

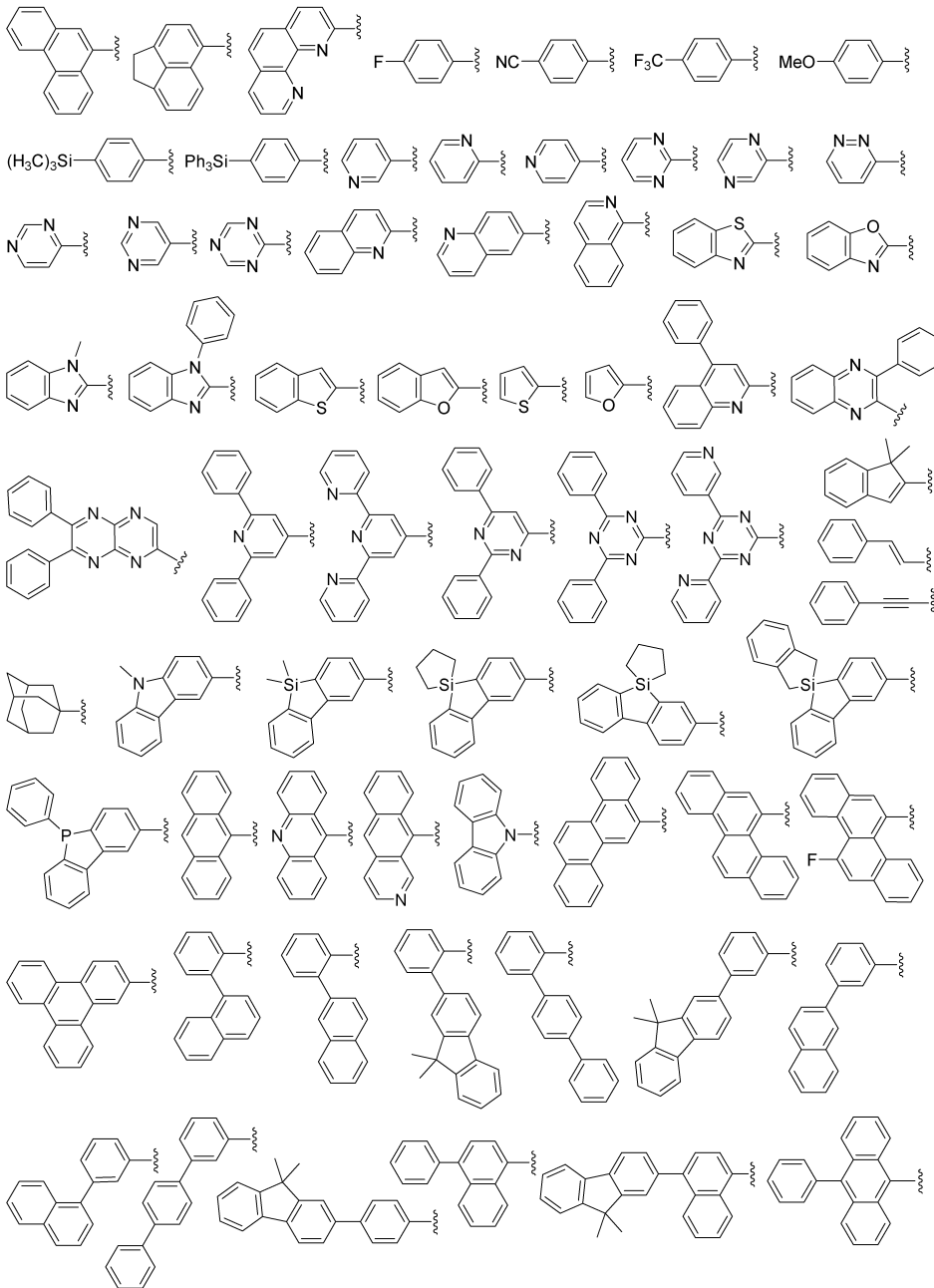


[0037]

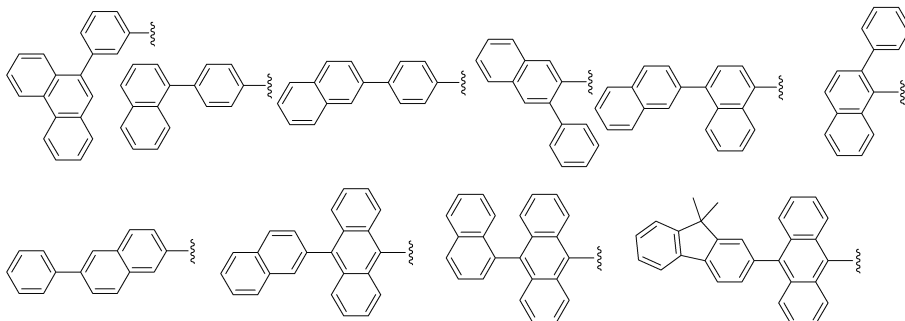
[0038] 또한, 보다 구체적으로, 상기 R₅ 내지 R₈은 서로 독립적으로 하기 구조로 예시될 수 있으나, 이에 한정되는 것은 아니다.



[0039]



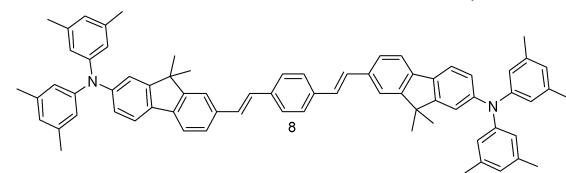
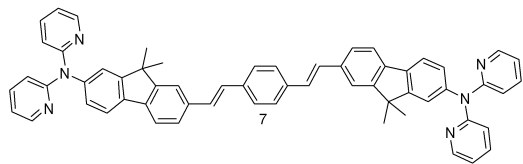
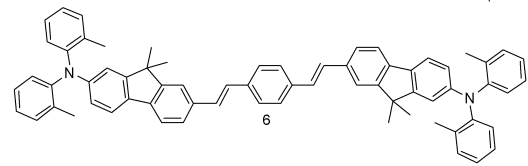
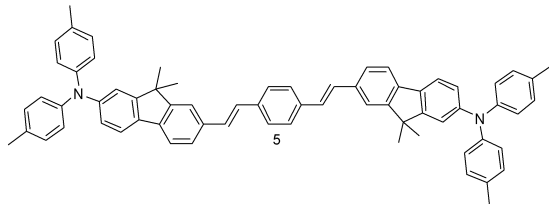
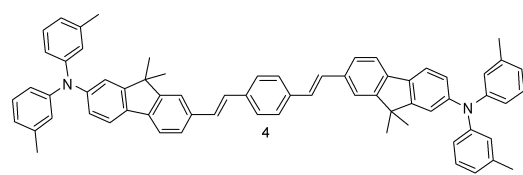
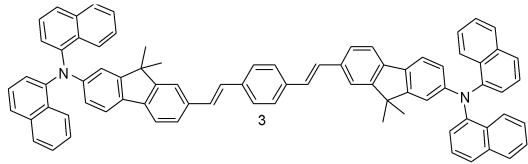
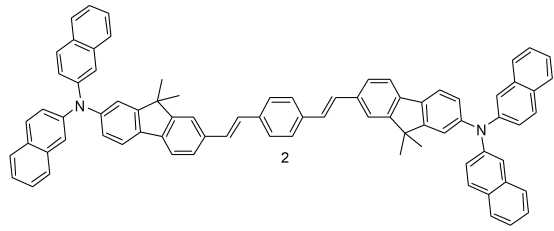
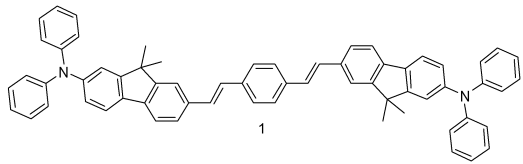
[0040]



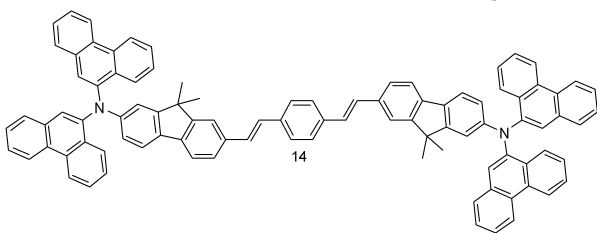
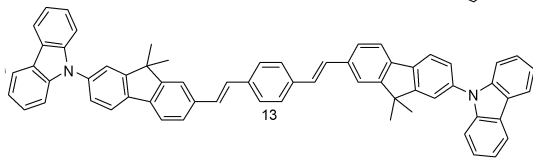
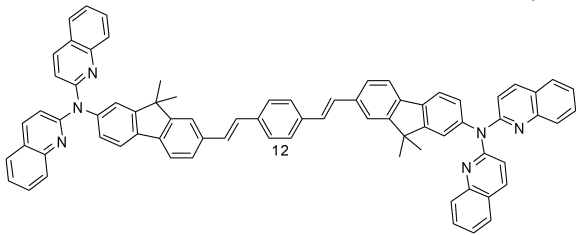
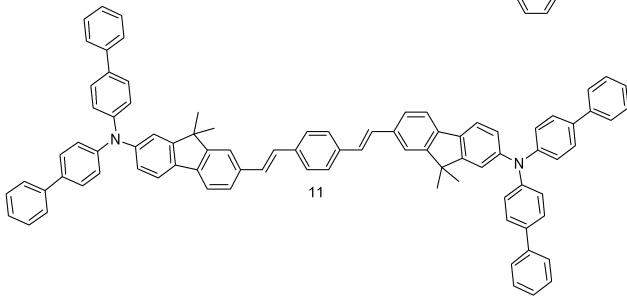
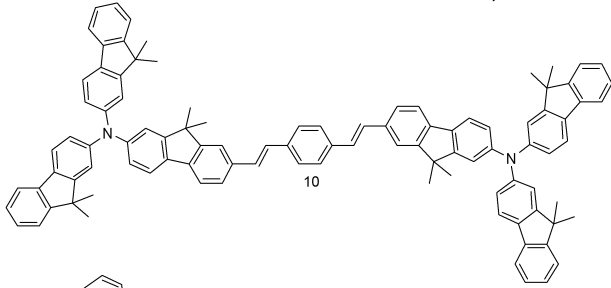
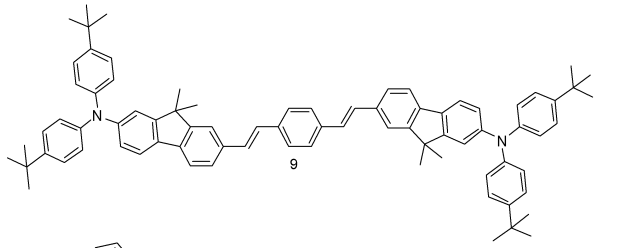
[0041]

[0042]

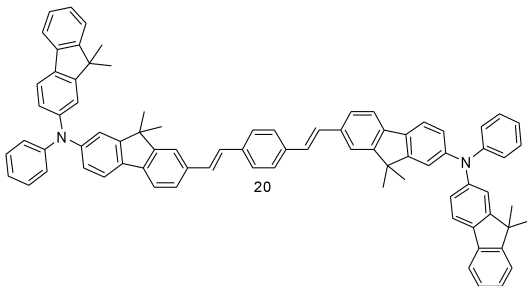
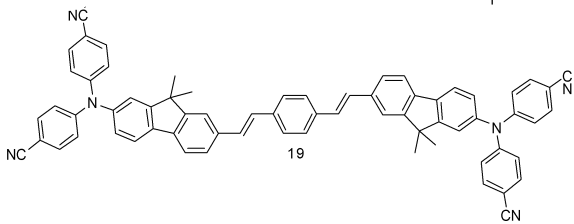
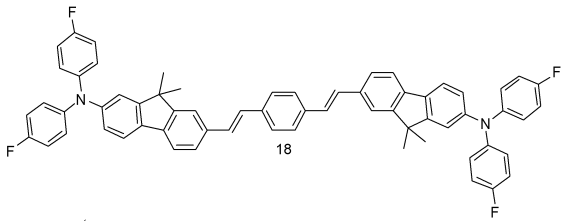
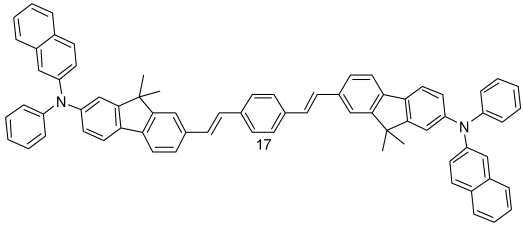
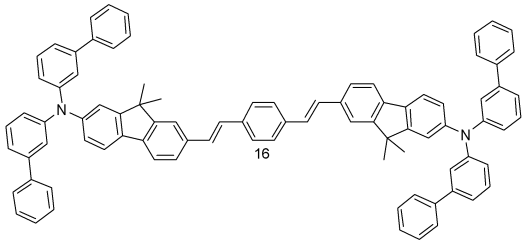
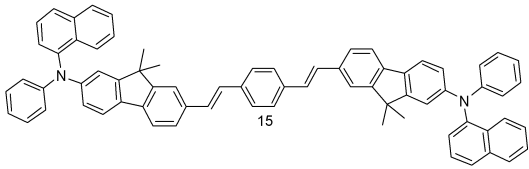
본 발명에 따른 유기 발광 화합물은 보다 구체적으로 하기의 화합물로서 예시될 수 있으나, 하기 화합물이 본 발명을 한정하는 것은 아니다.



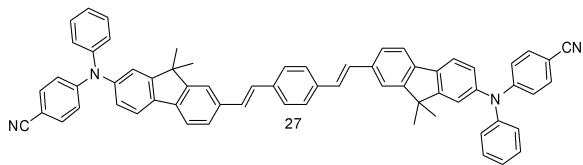
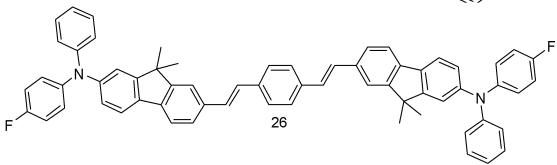
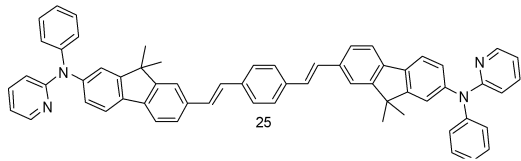
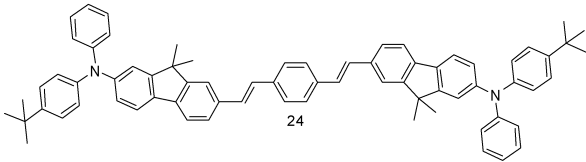
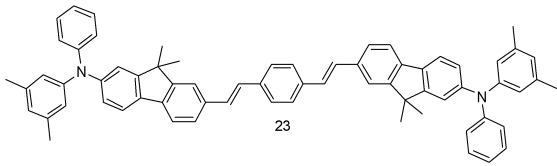
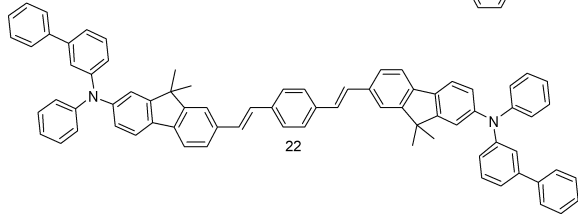
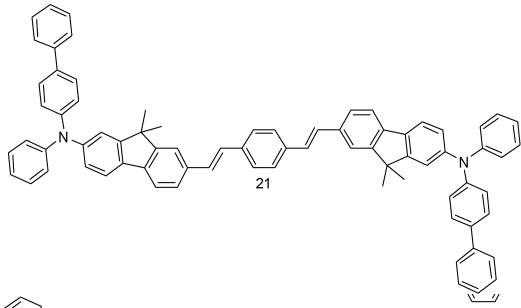
[0043]



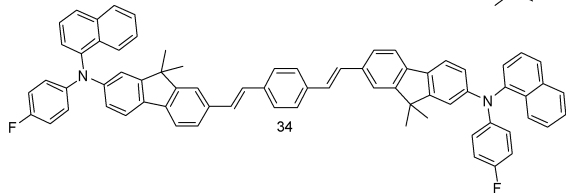
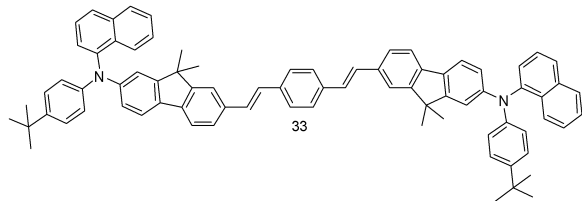
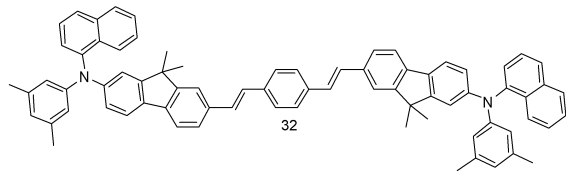
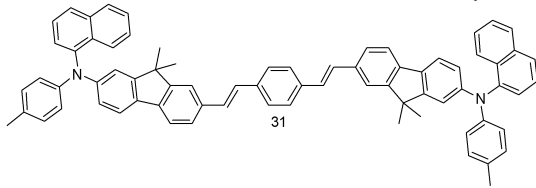
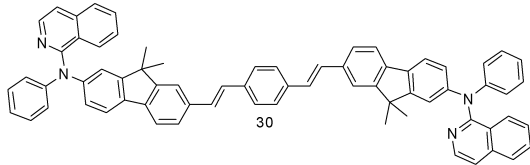
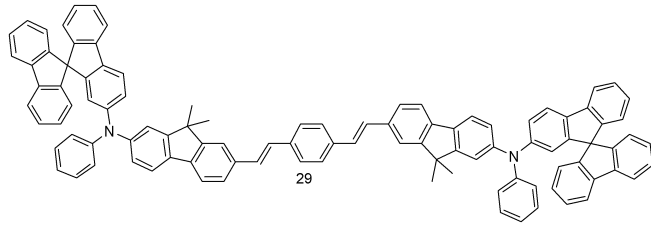
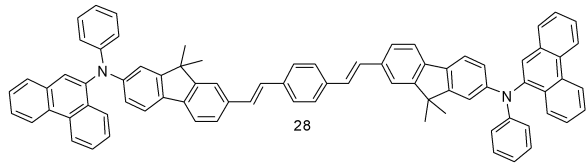
[0044]



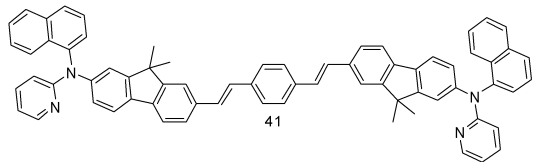
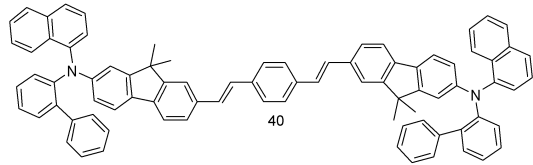
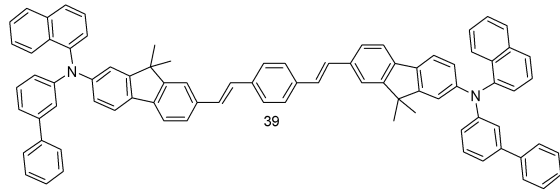
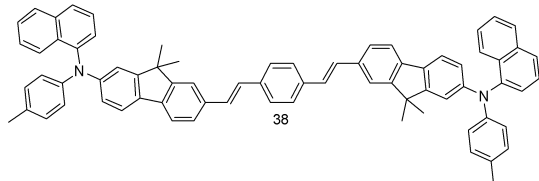
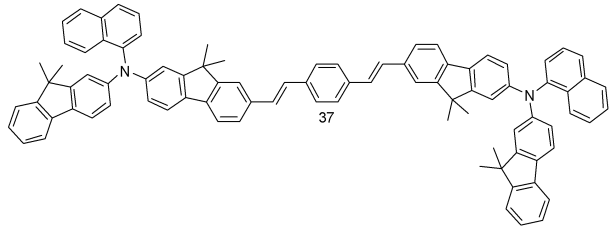
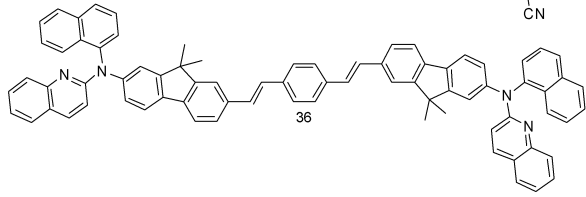
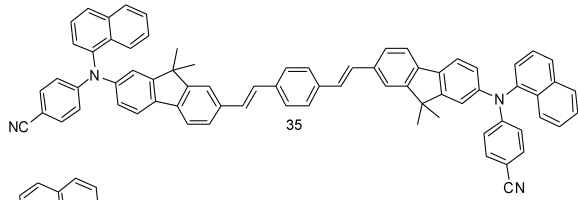
[0045]



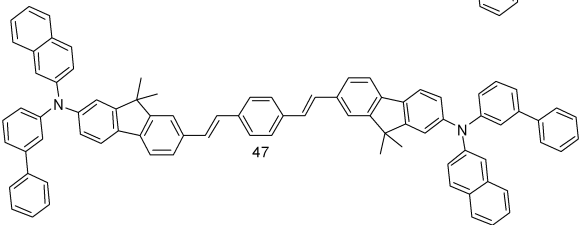
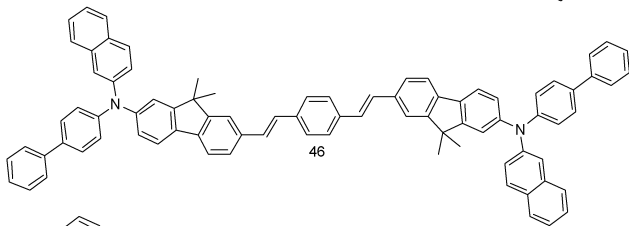
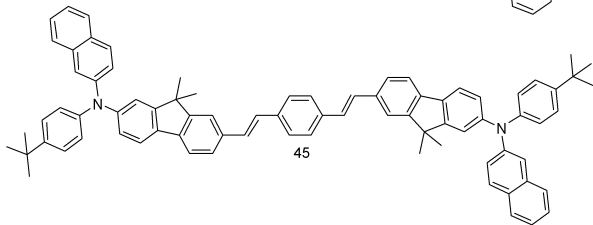
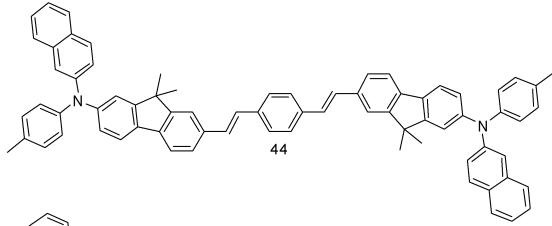
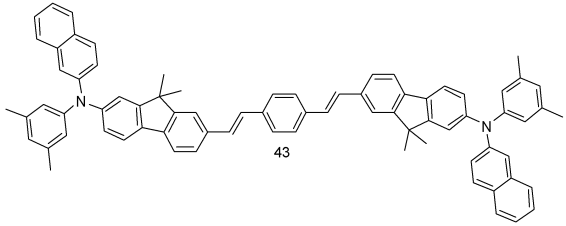
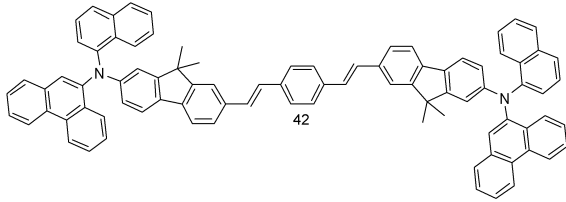
[0046]



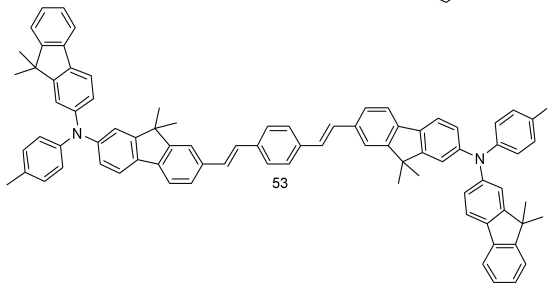
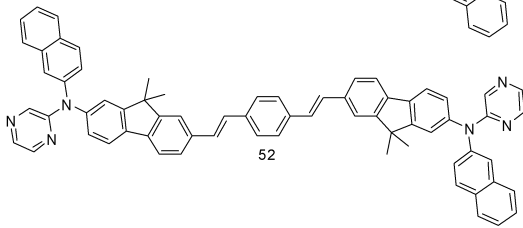
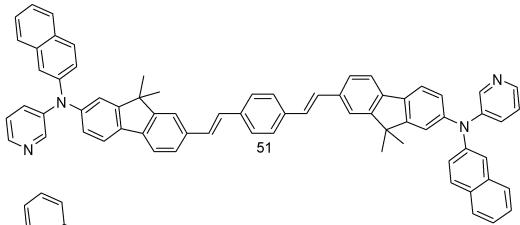
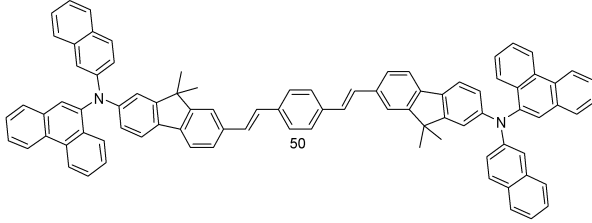
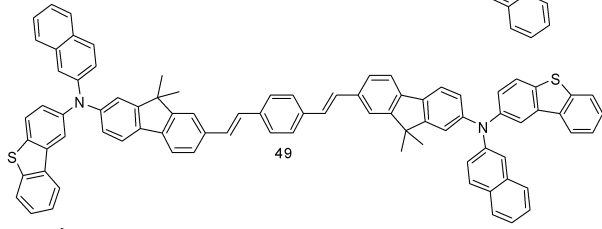
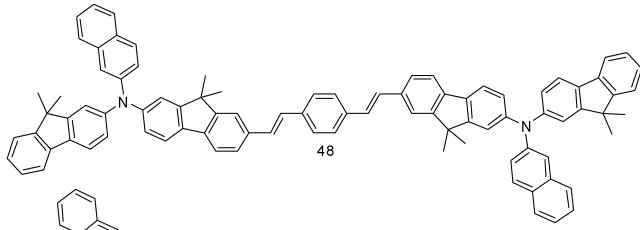
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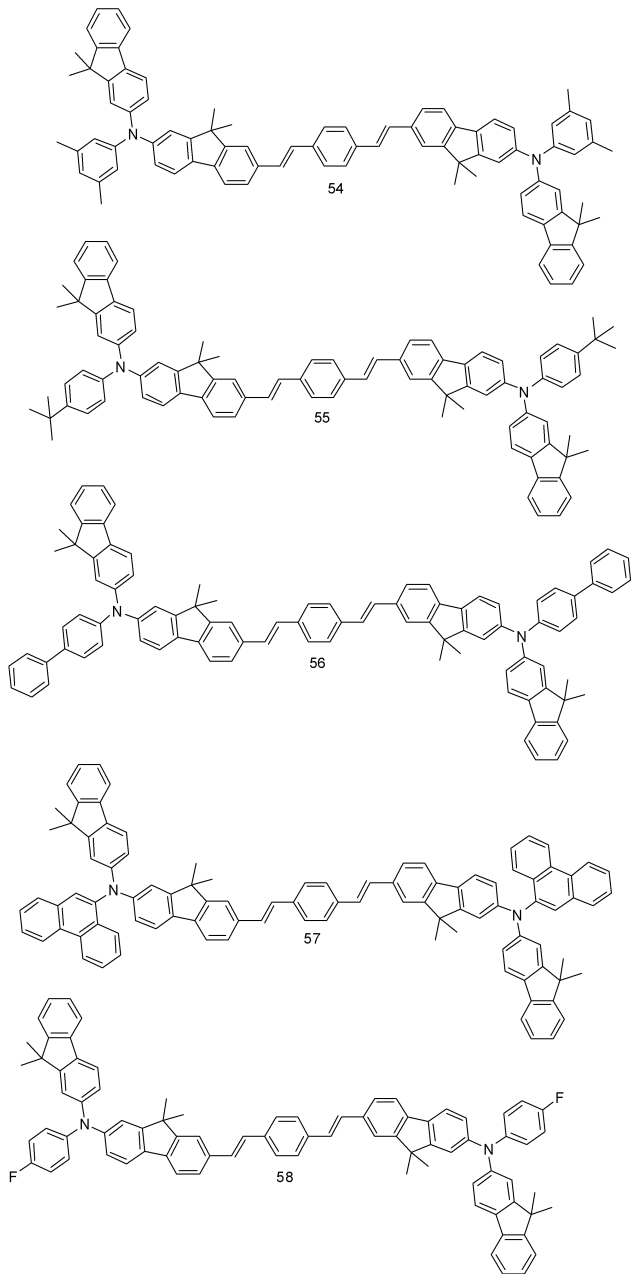
[0048]



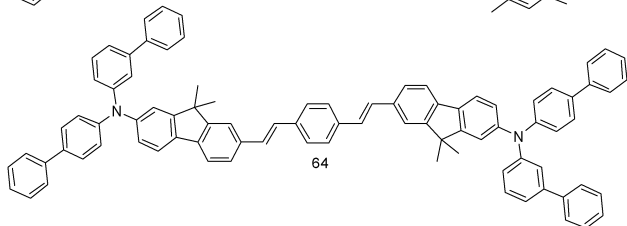
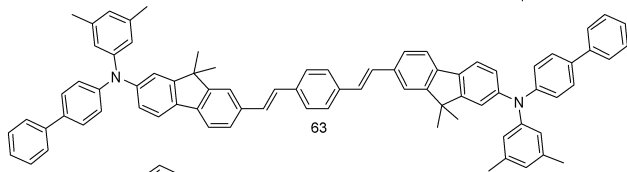
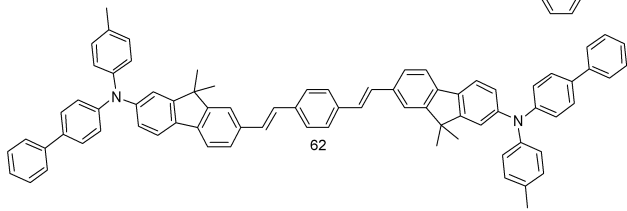
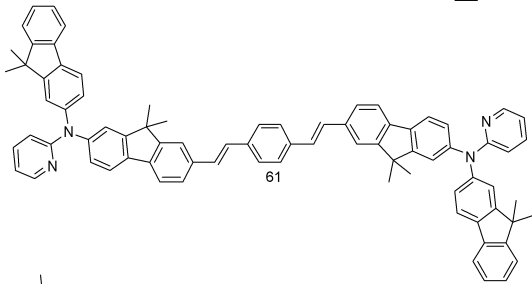
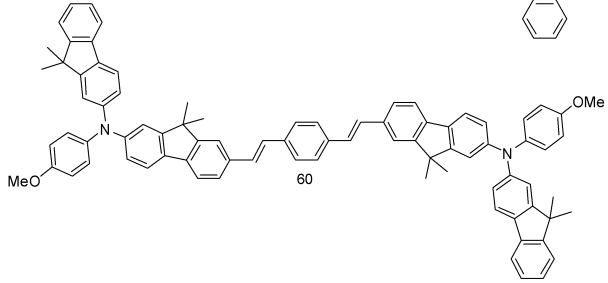
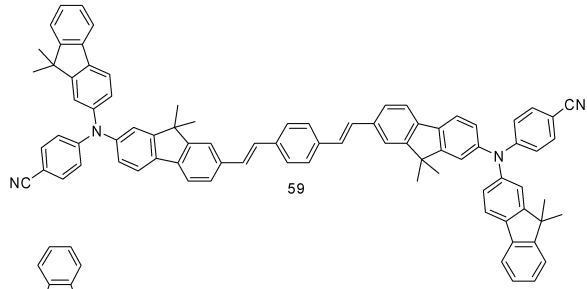
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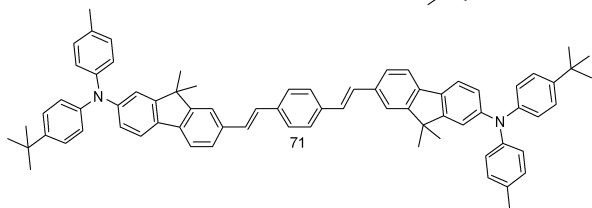
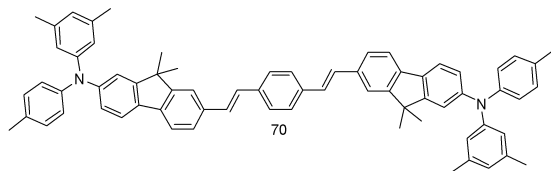
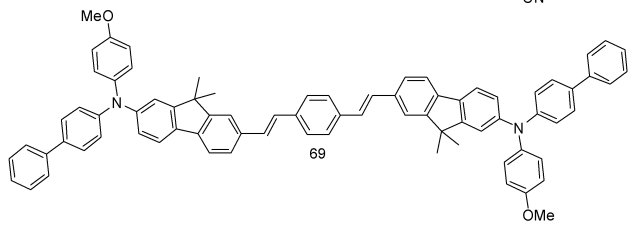
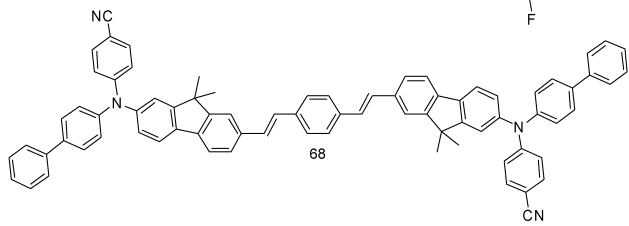
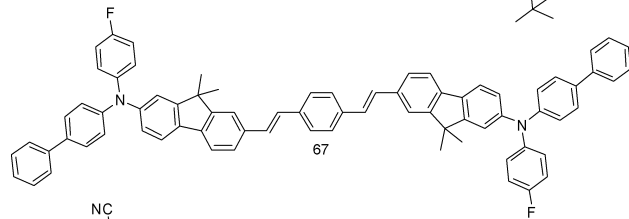
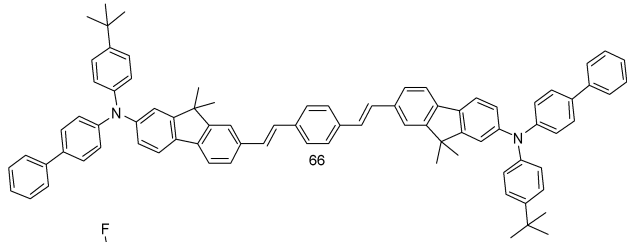
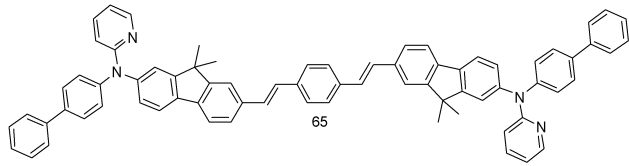
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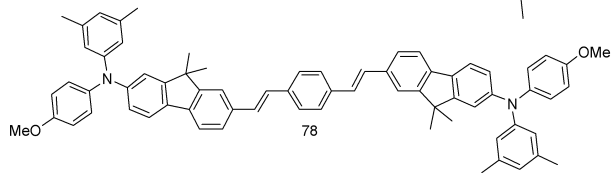
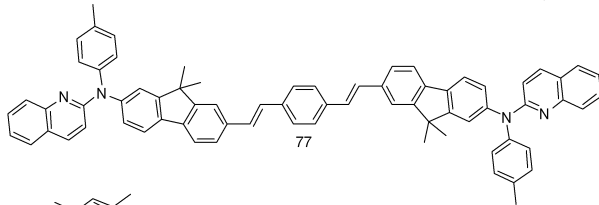
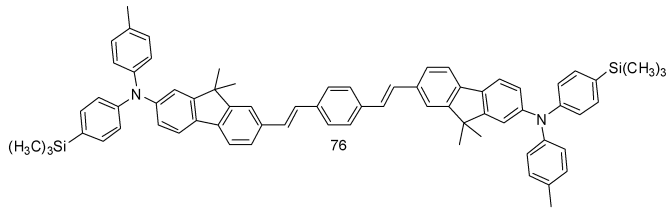
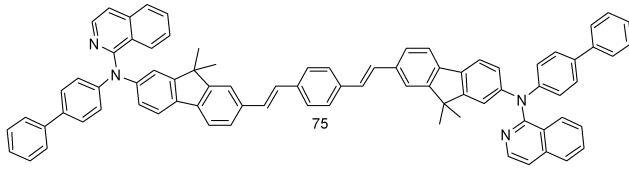
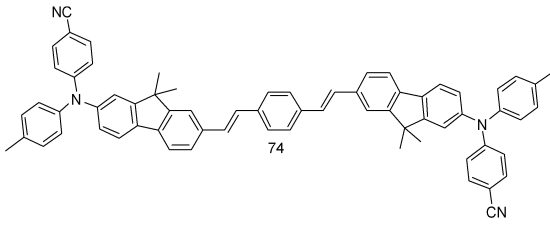
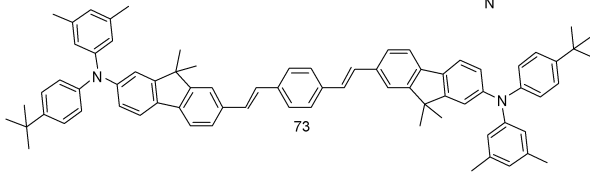
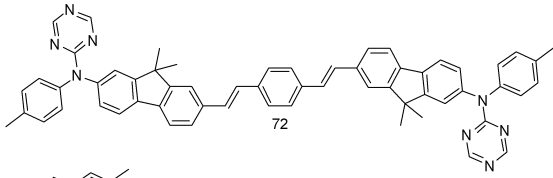
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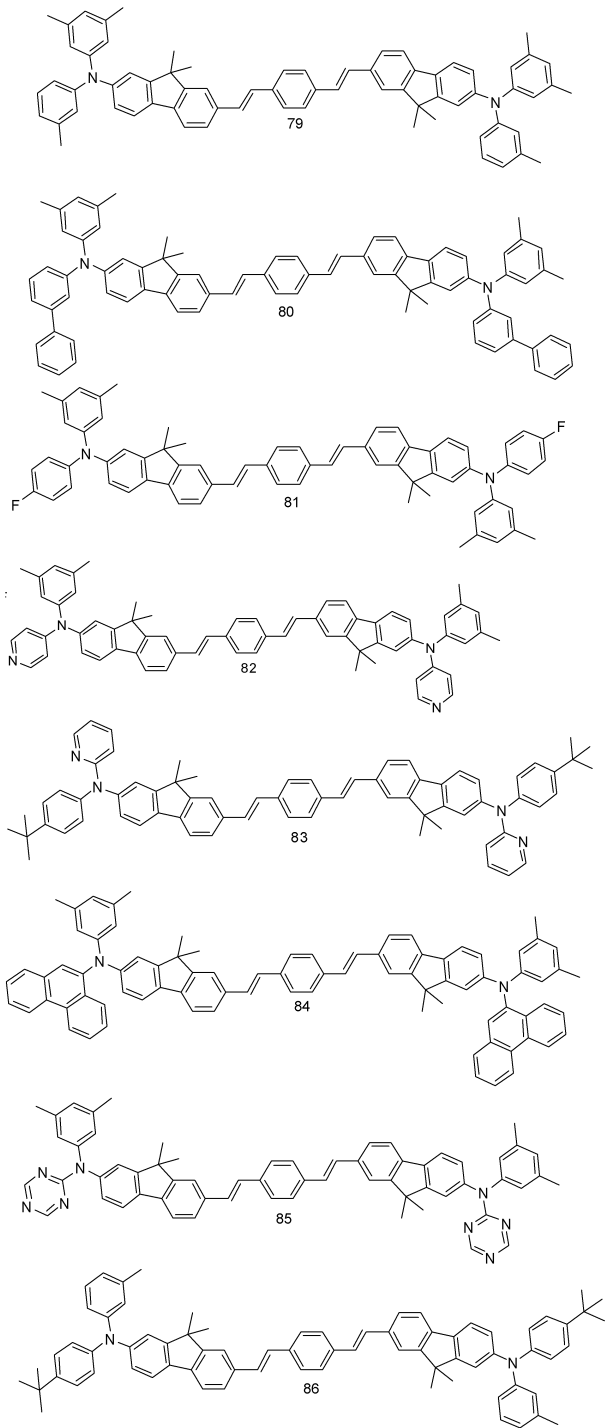
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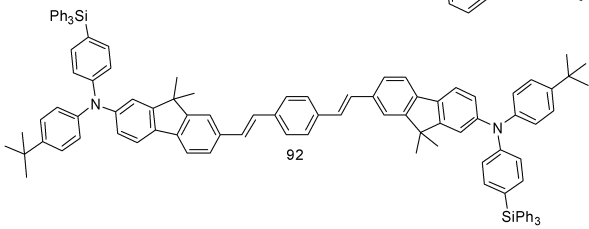
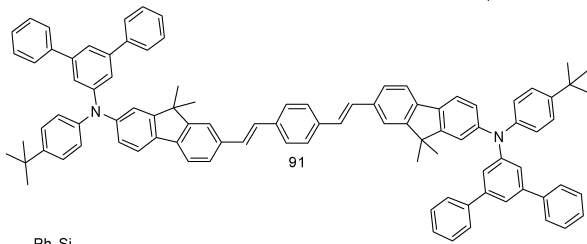
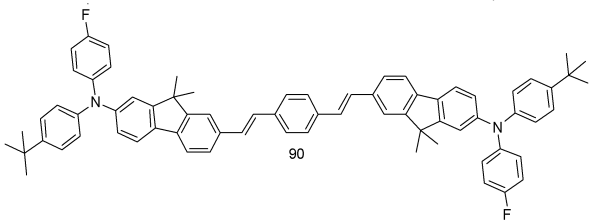
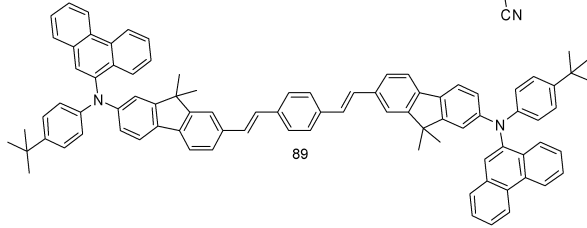
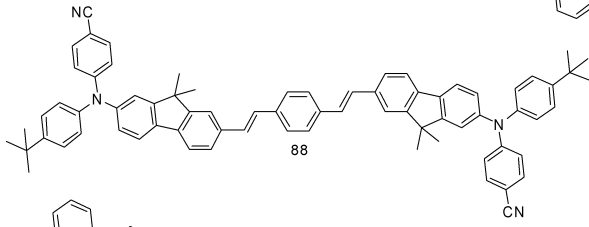
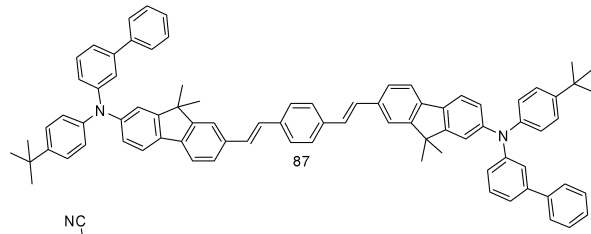
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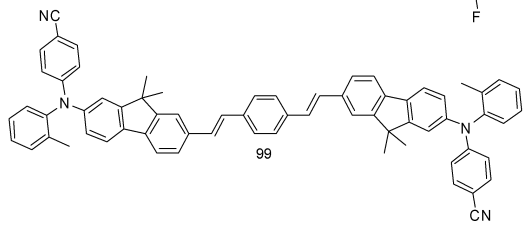
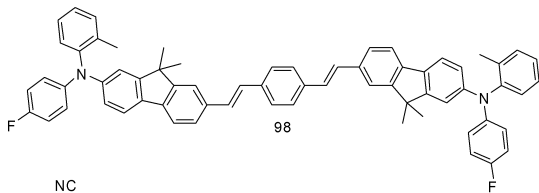
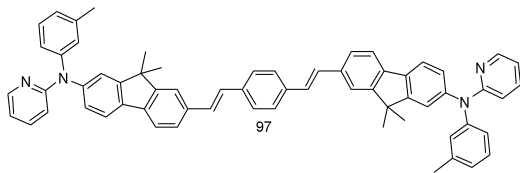
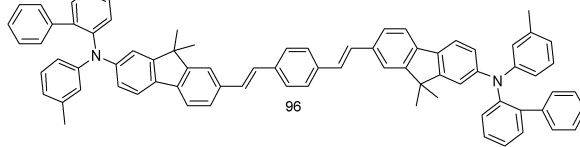
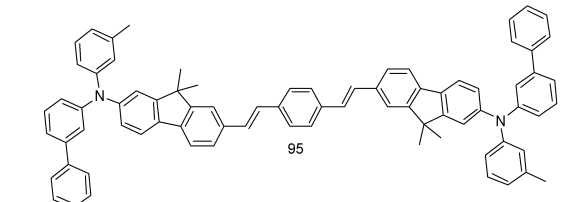
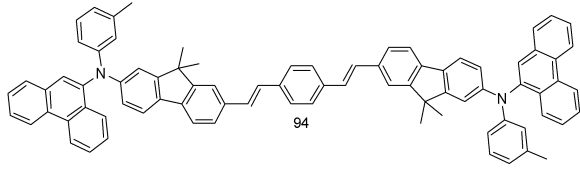
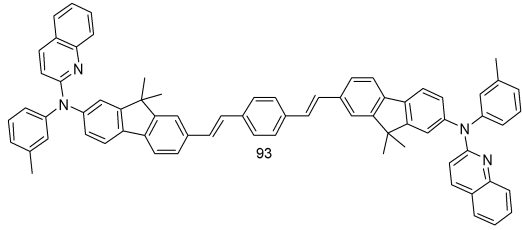
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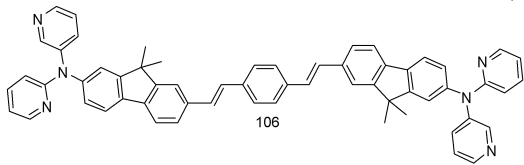
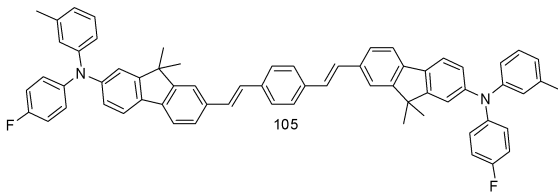
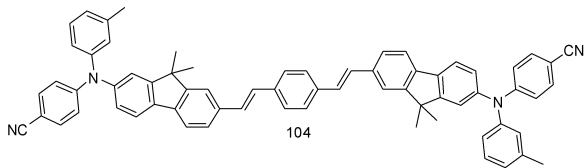
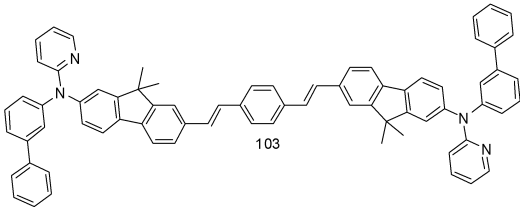
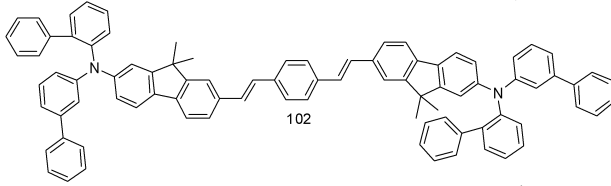
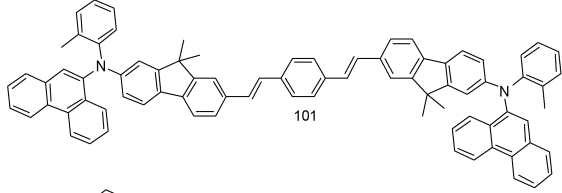
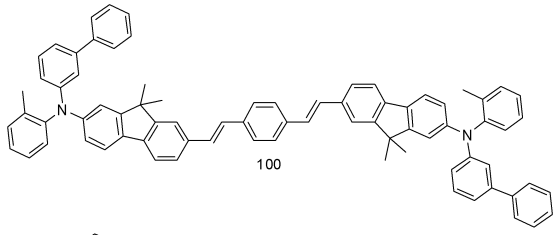
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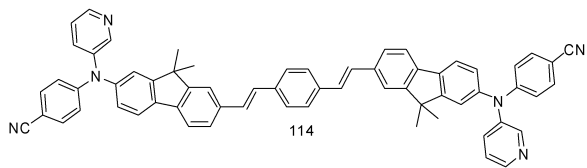
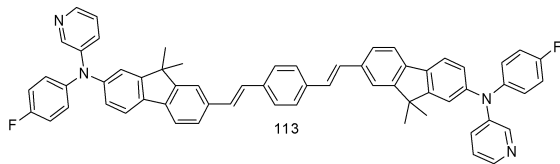
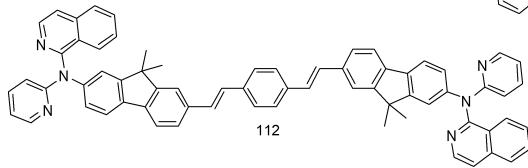
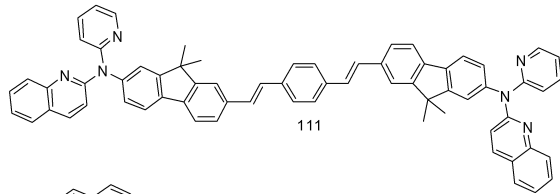
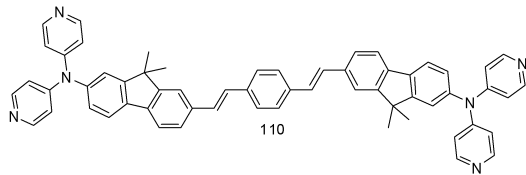
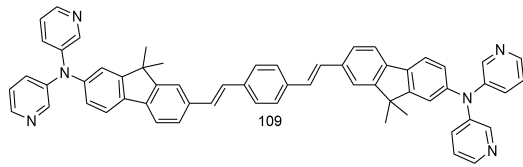
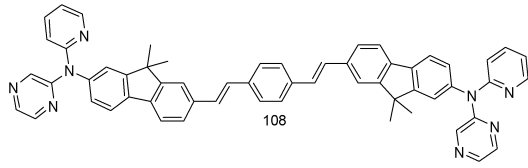
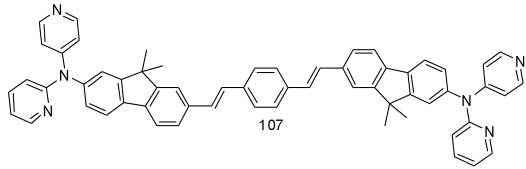
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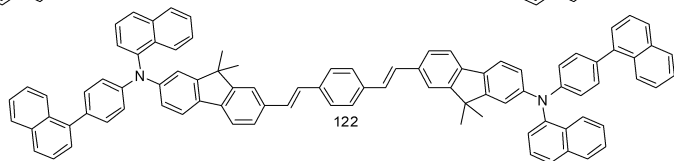
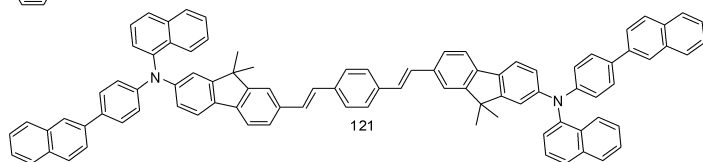
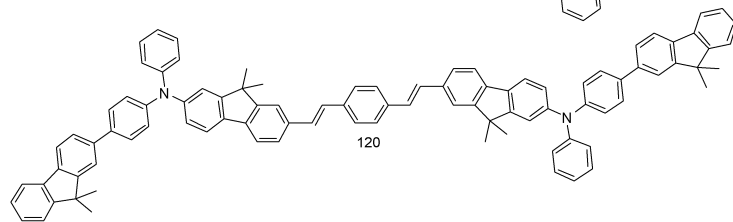
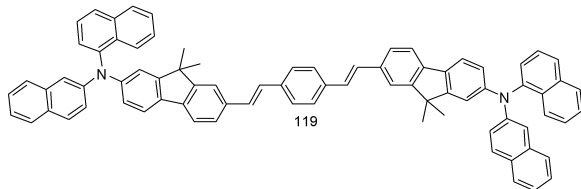
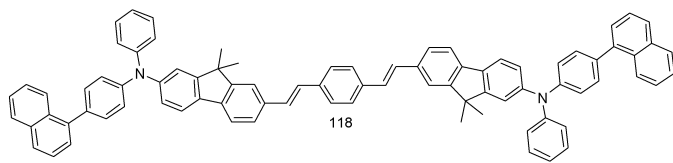
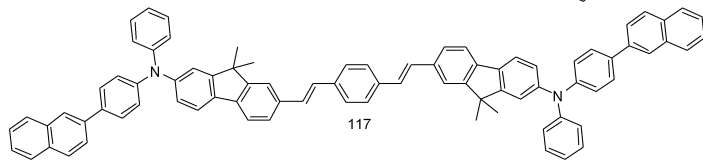
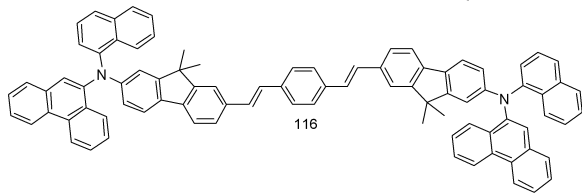
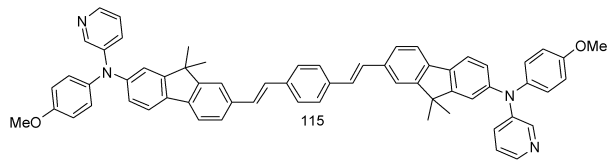
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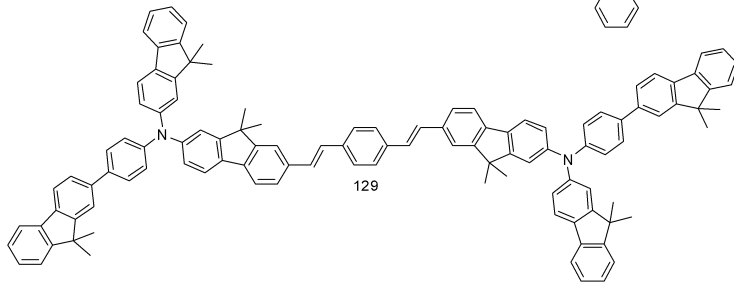
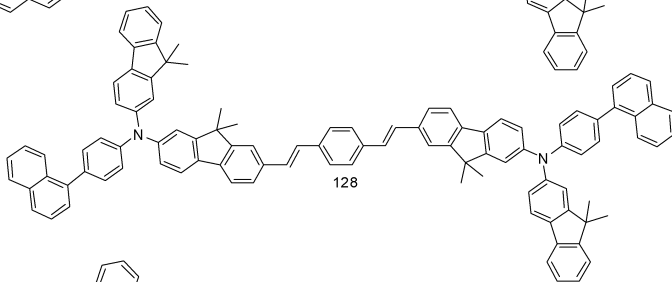
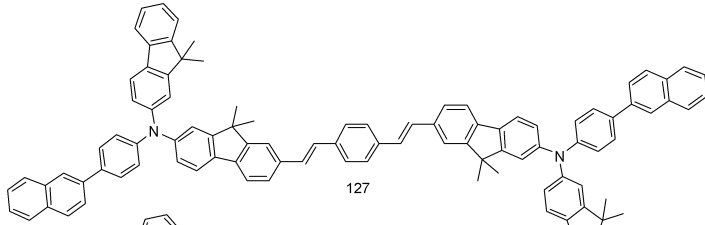
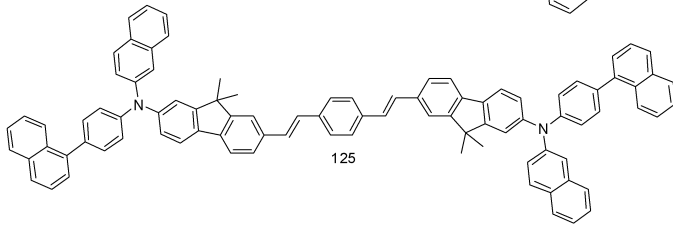
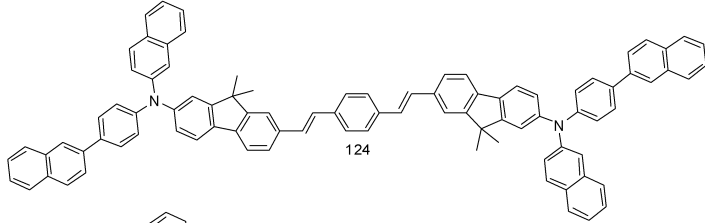
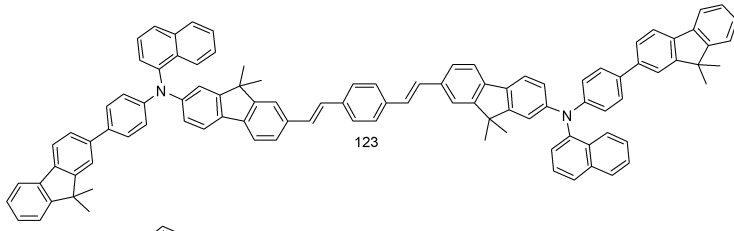
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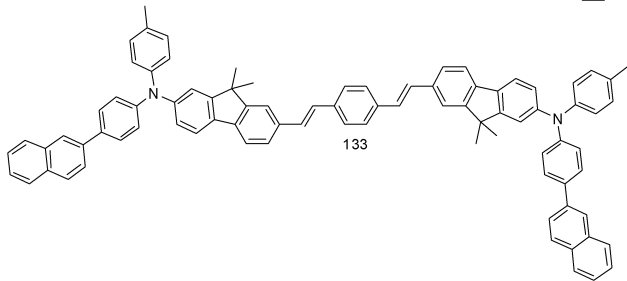
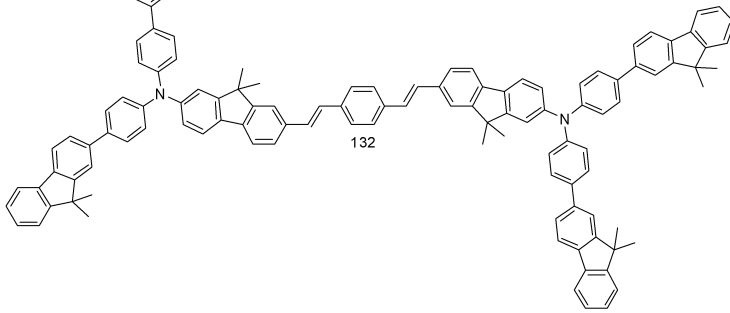
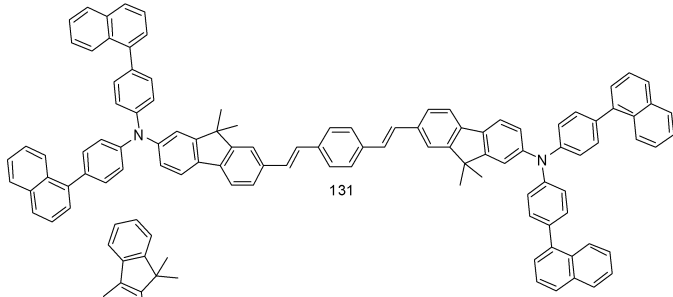
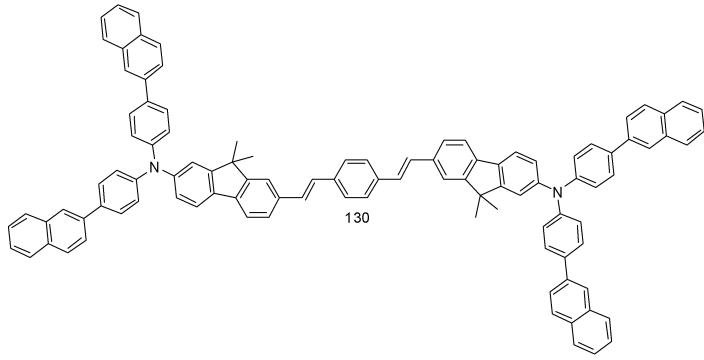
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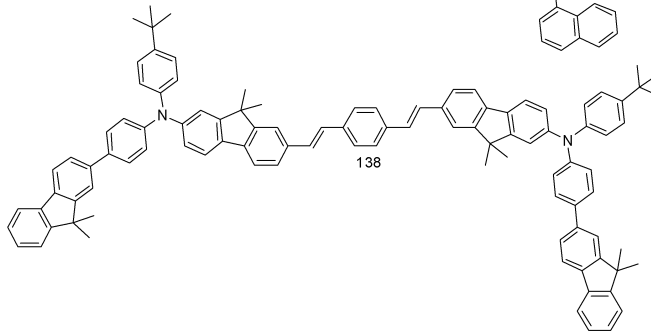
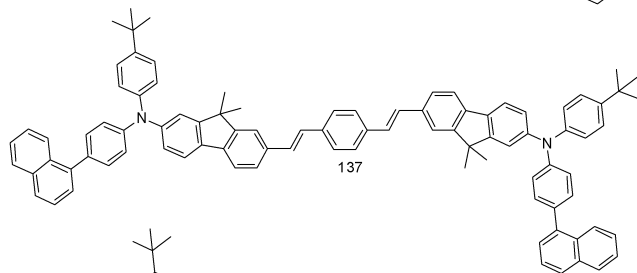
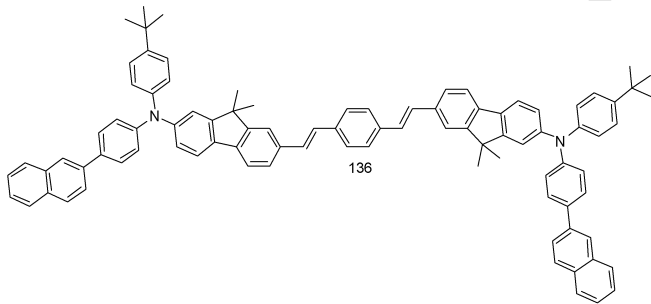
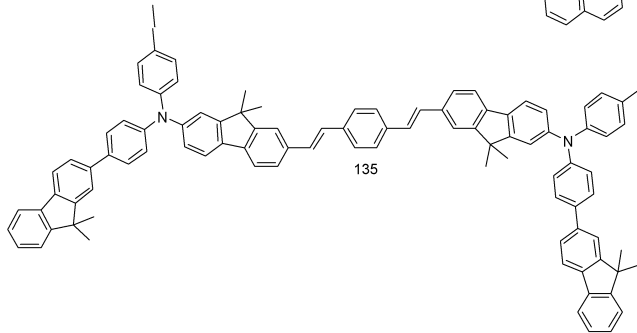
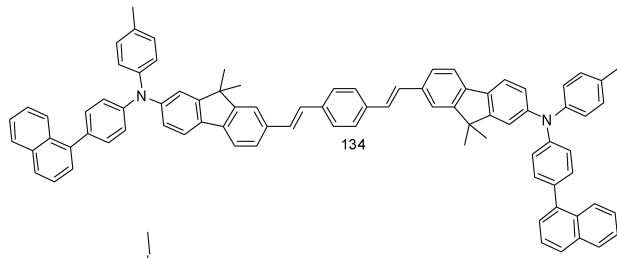
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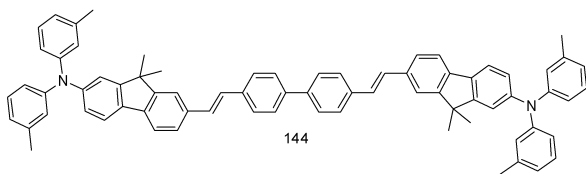
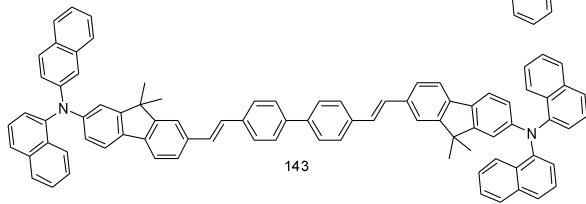
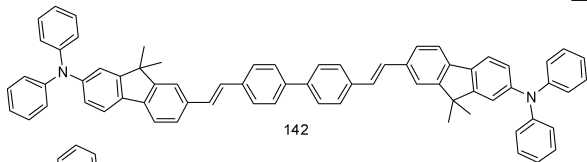
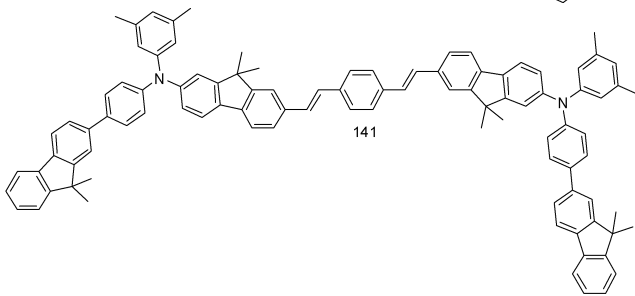
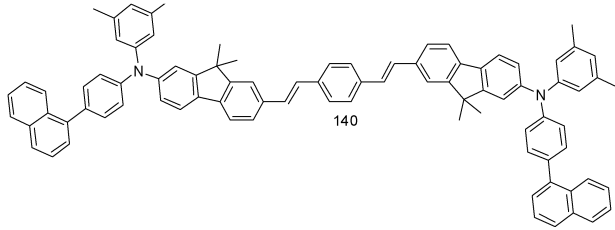
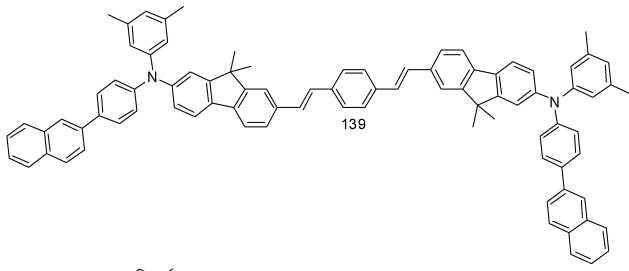
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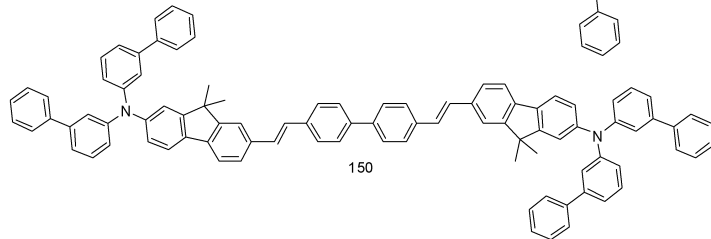
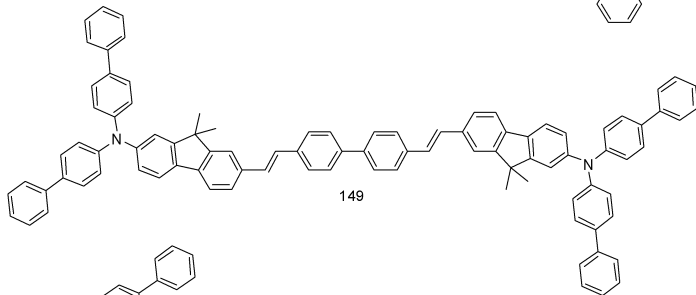
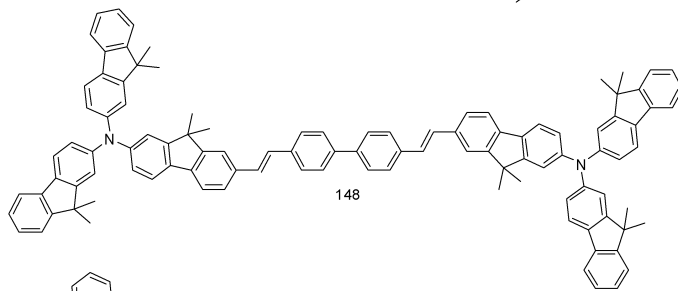
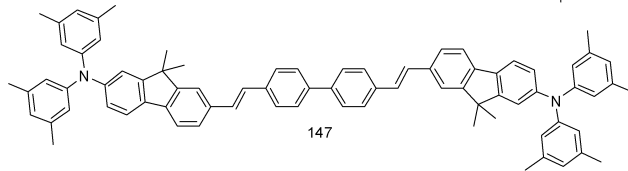
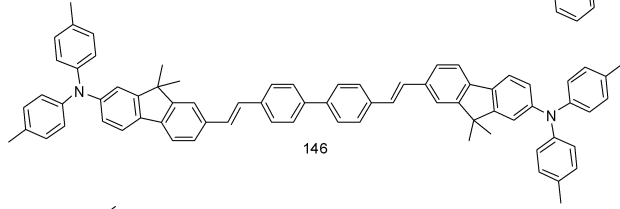
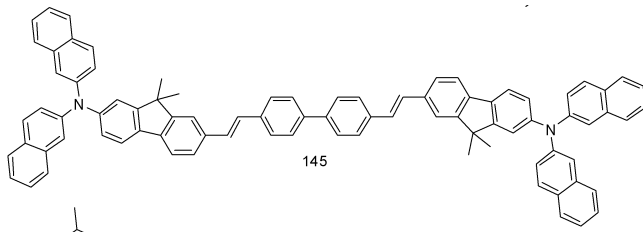
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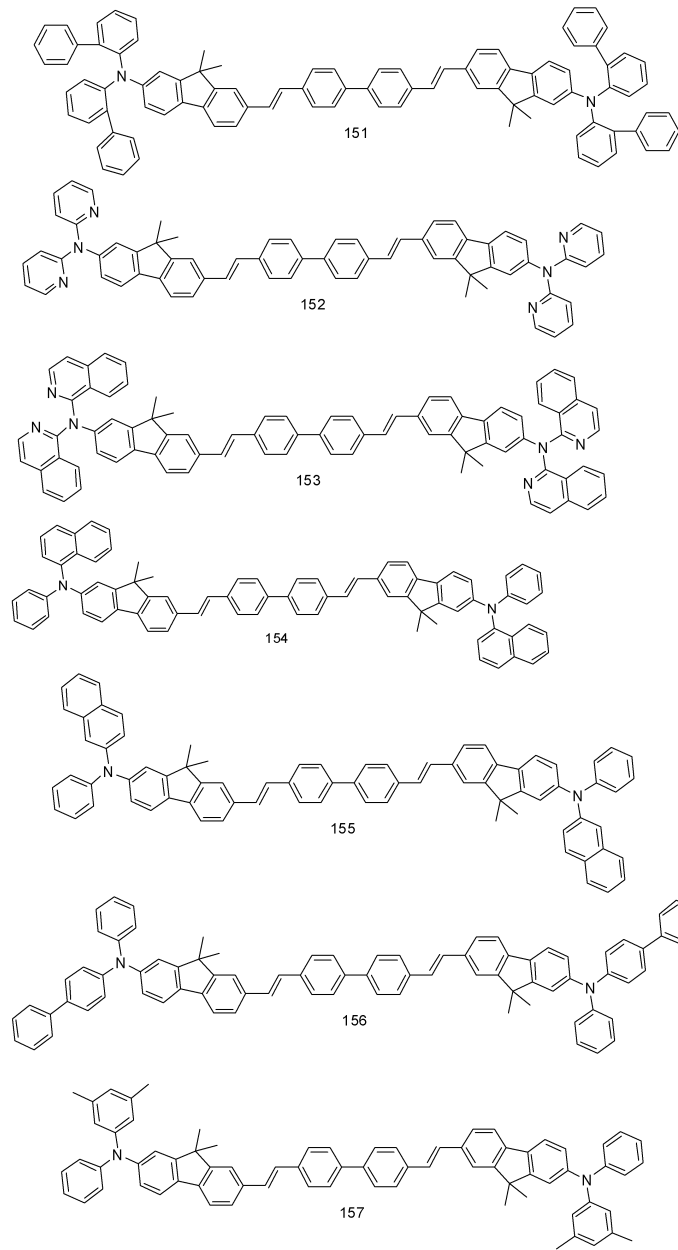
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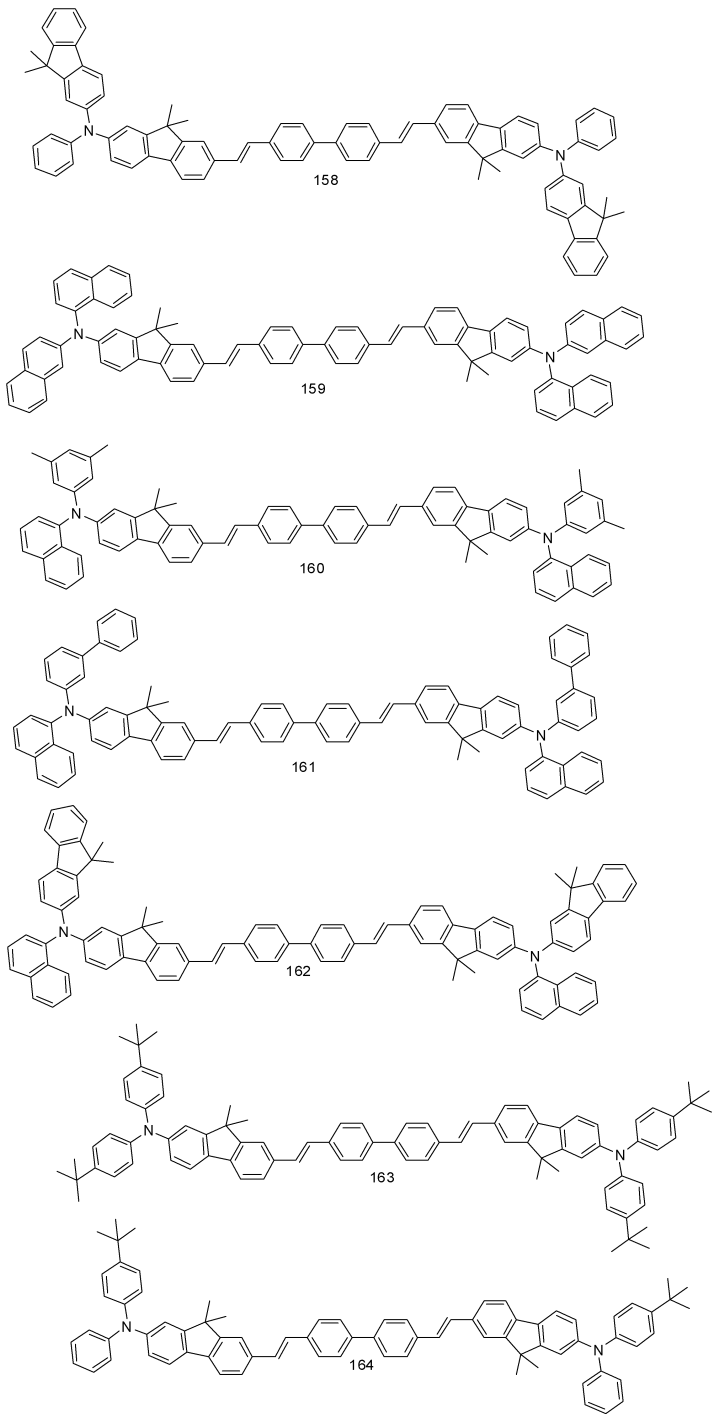
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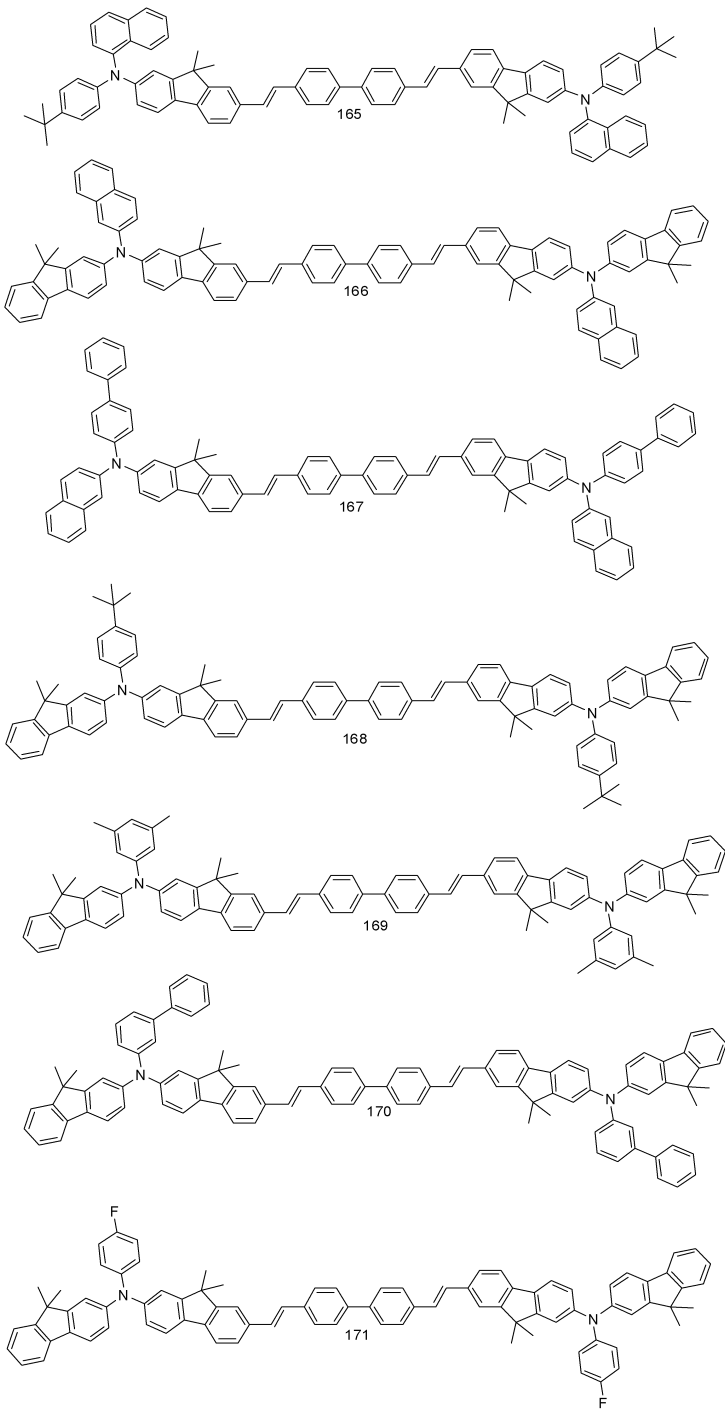
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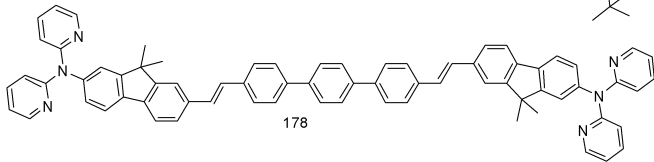
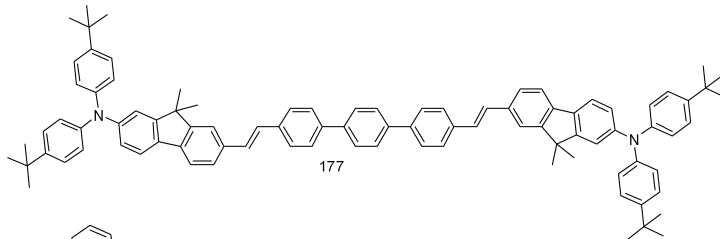
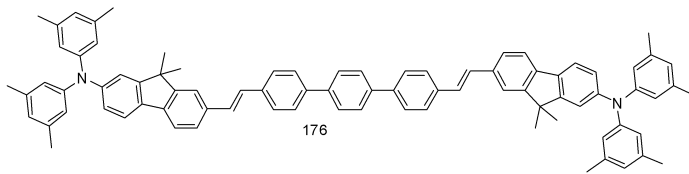
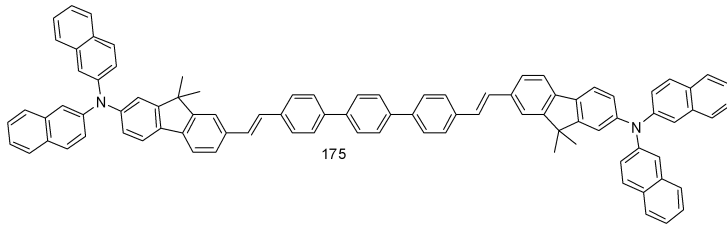
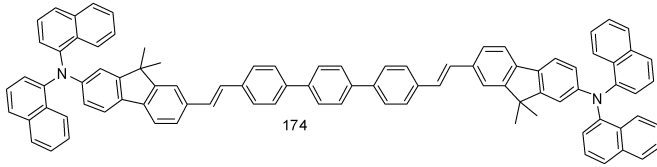
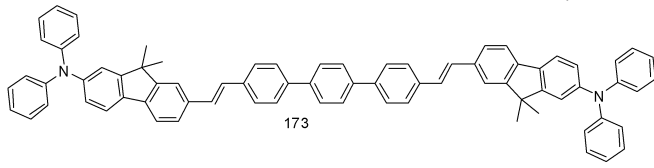
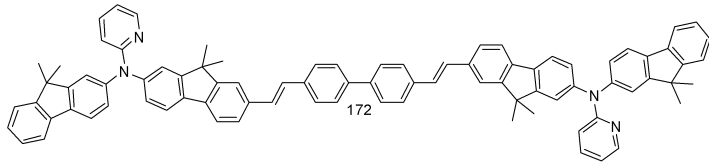
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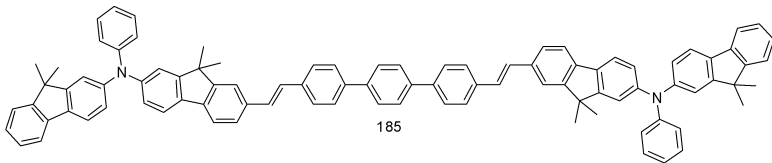
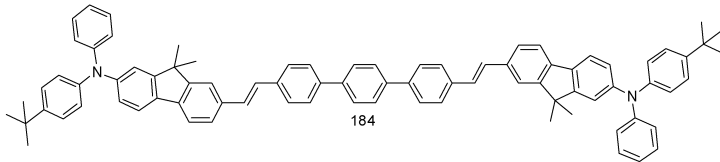
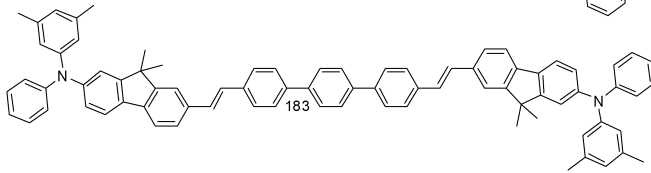
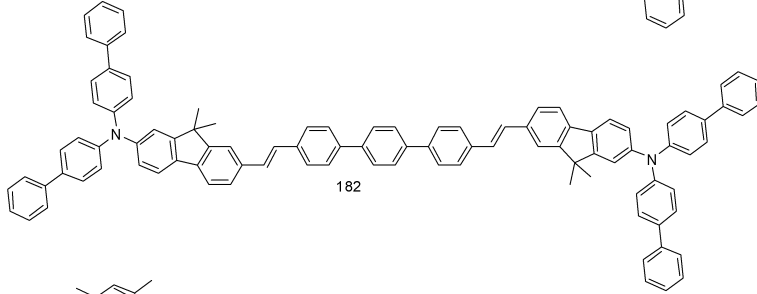
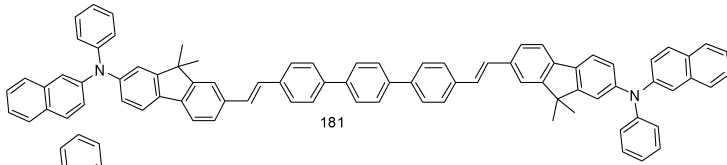
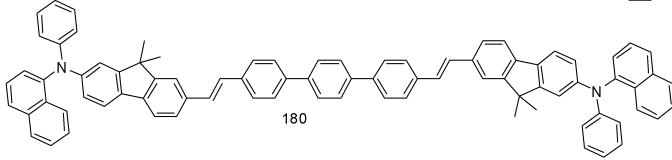
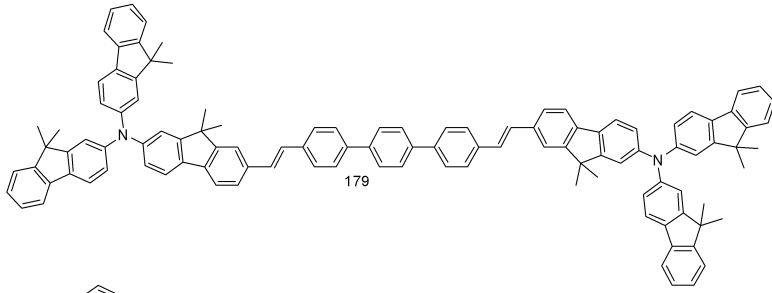
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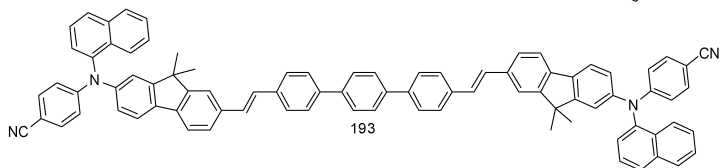
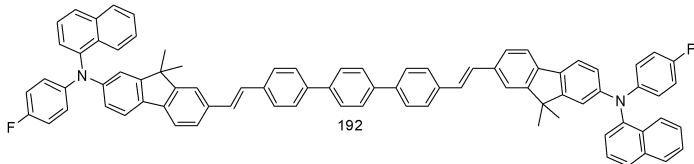
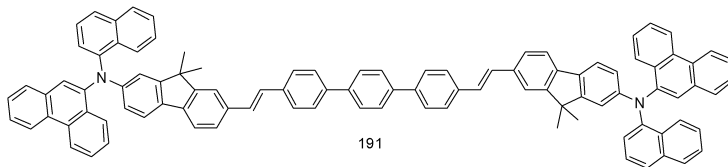
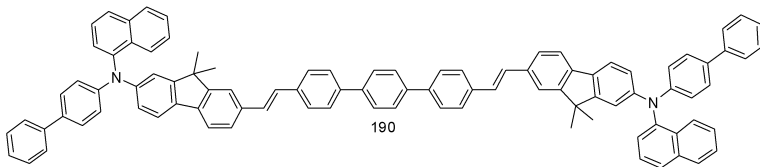
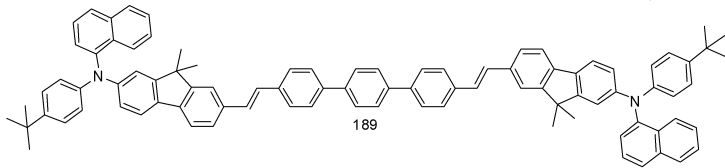
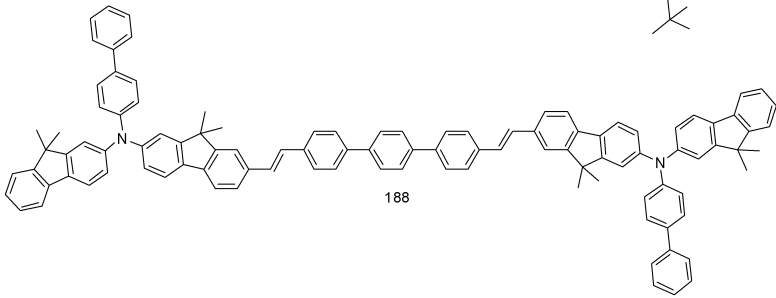
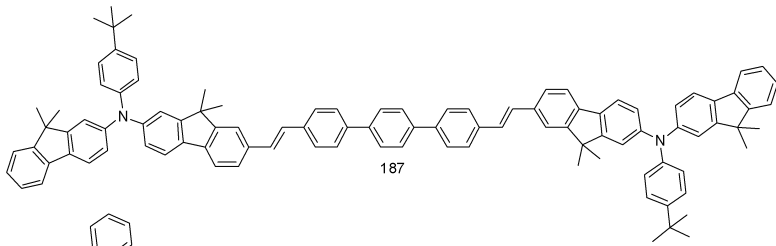
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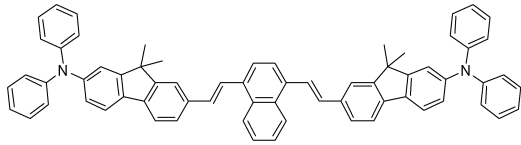
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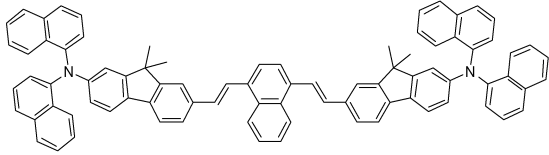
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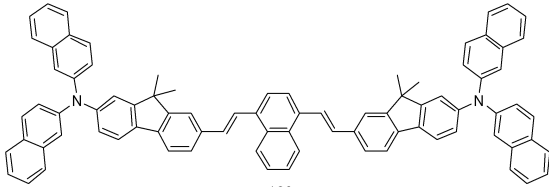
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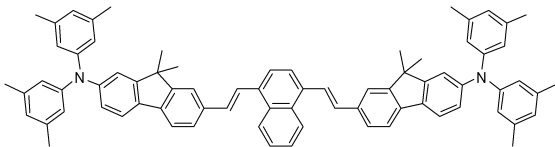
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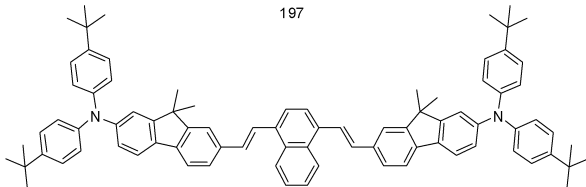
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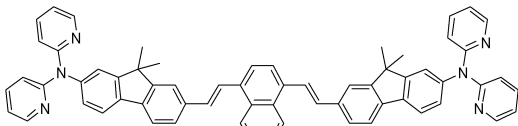
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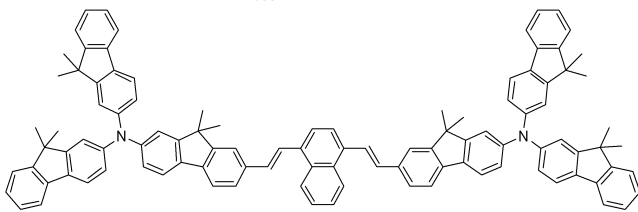
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198

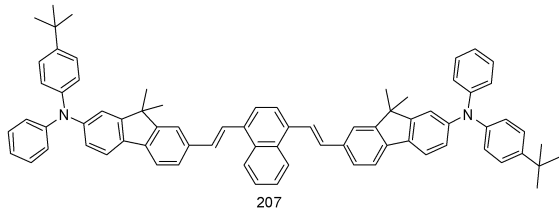
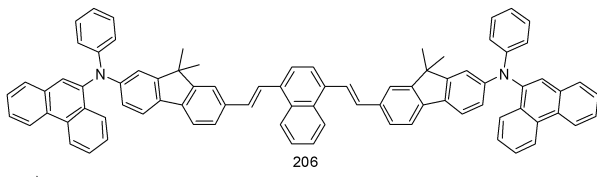
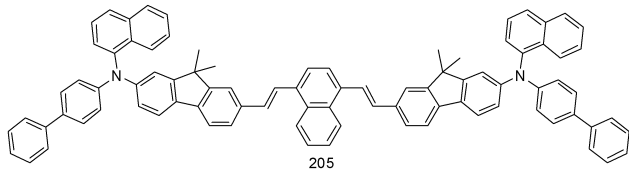
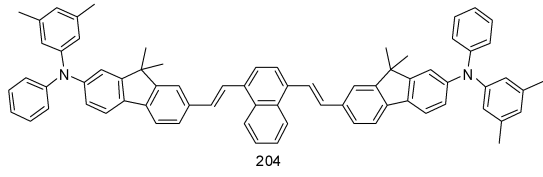
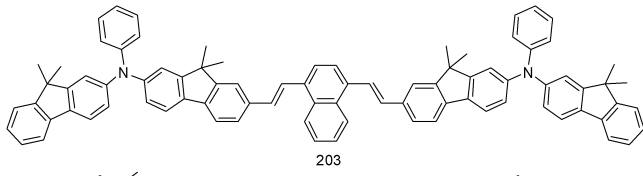
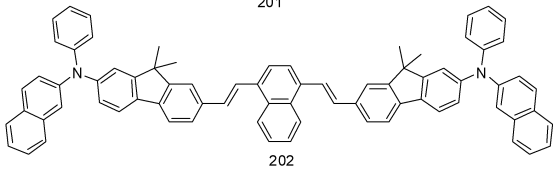
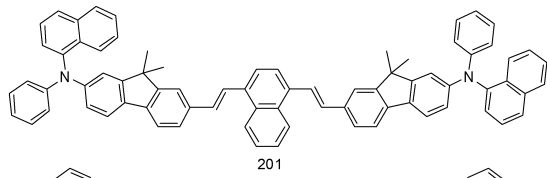


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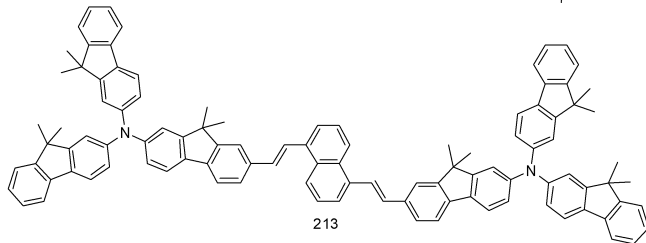
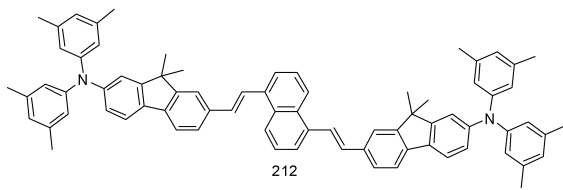
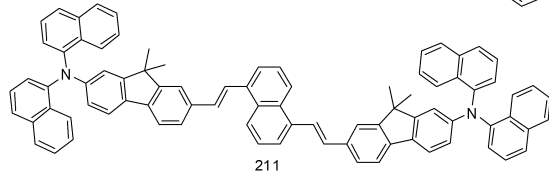
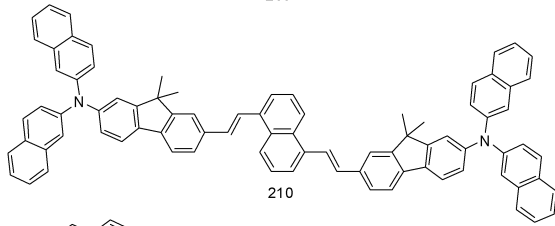
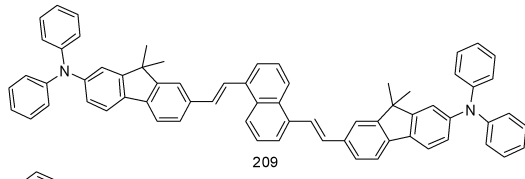
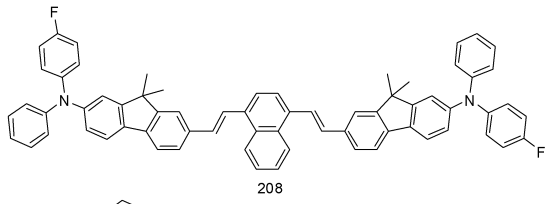


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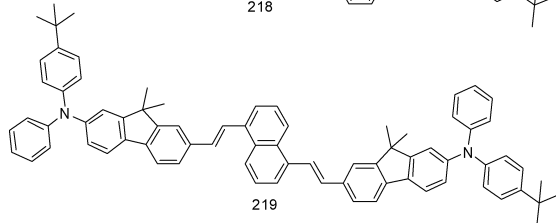
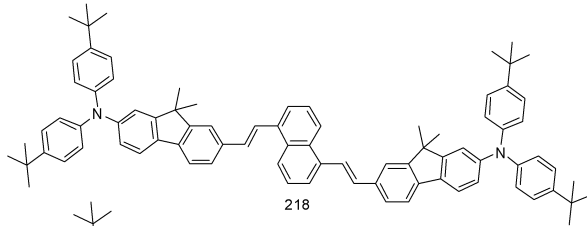
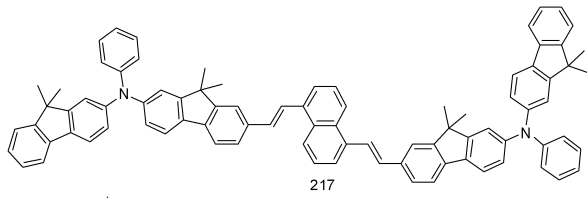
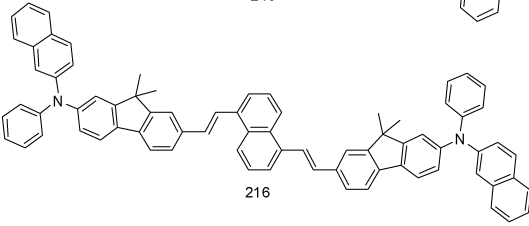
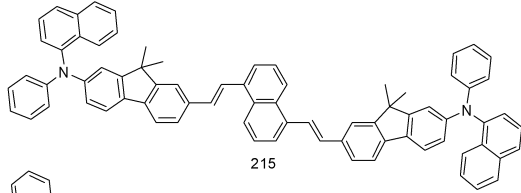
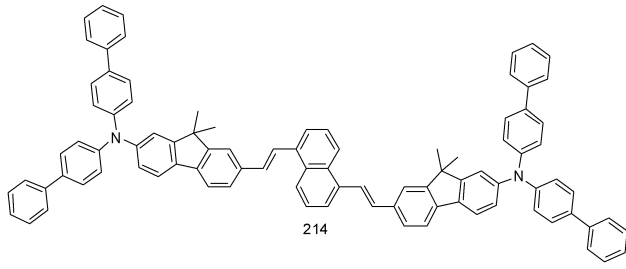
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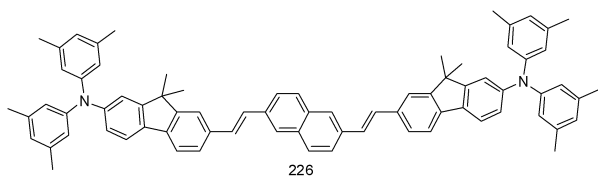
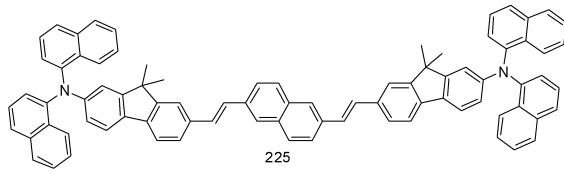
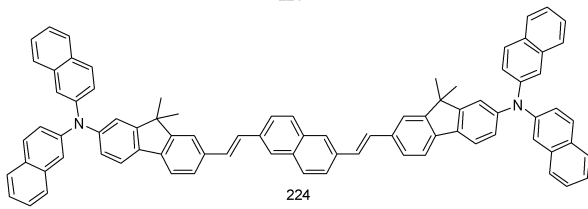
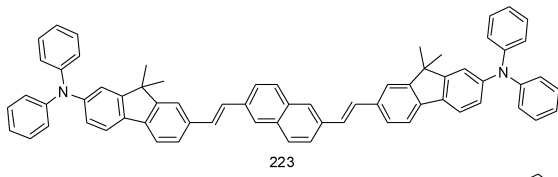
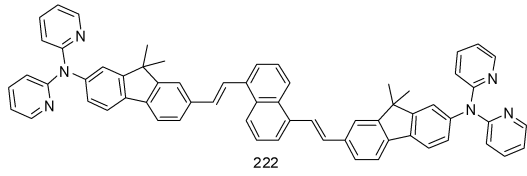
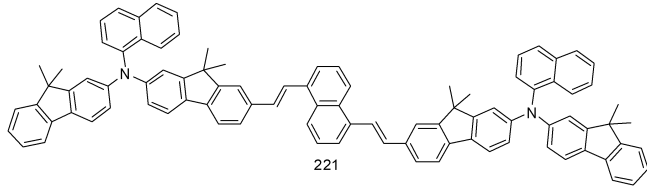
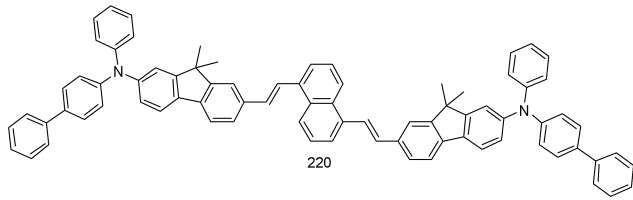
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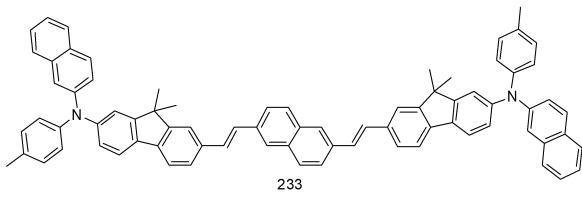
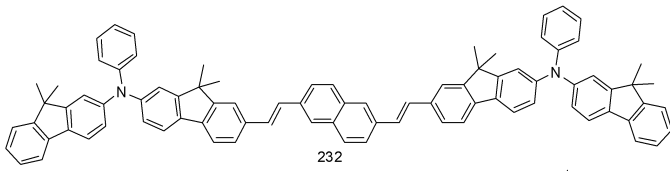
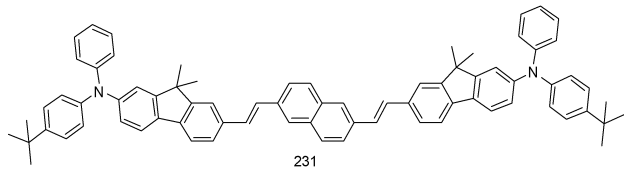
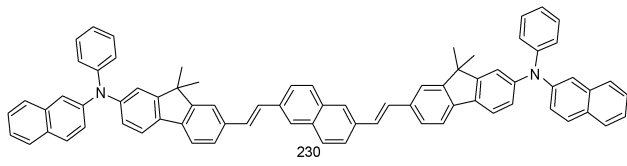
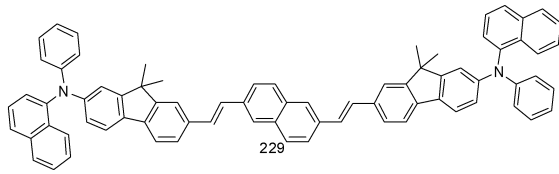
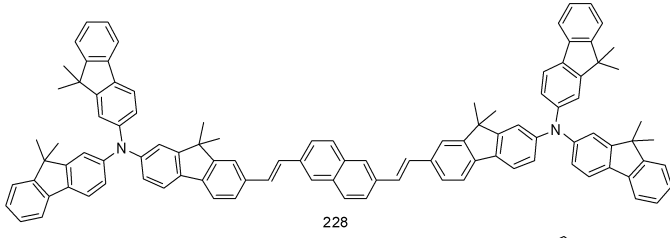
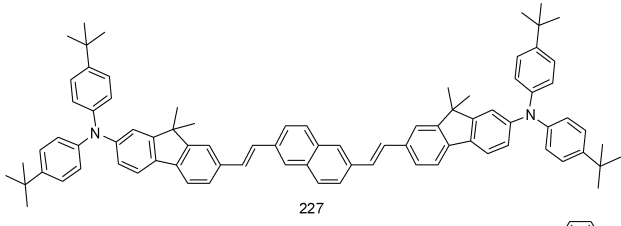
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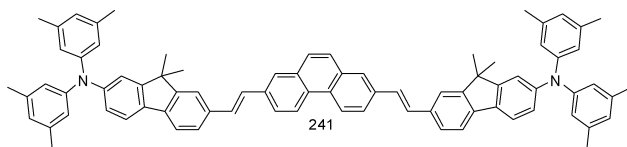
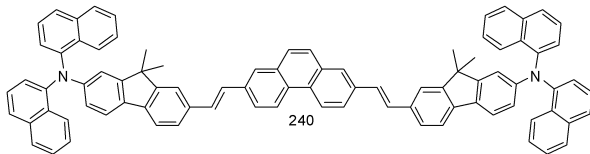
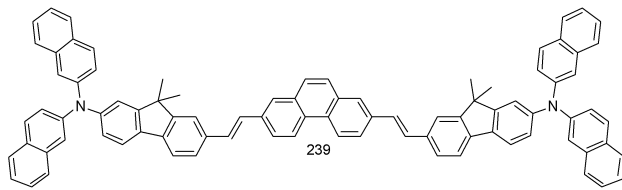
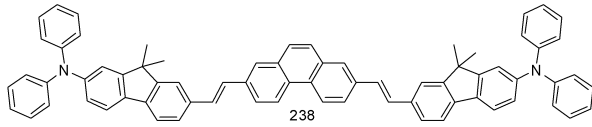
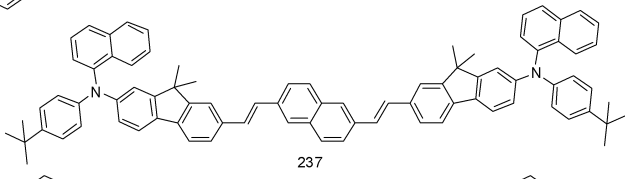
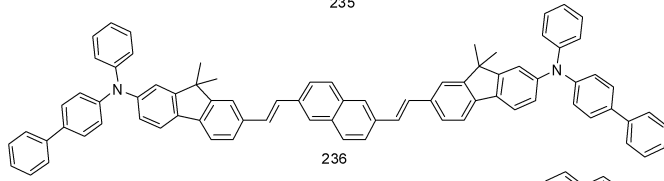
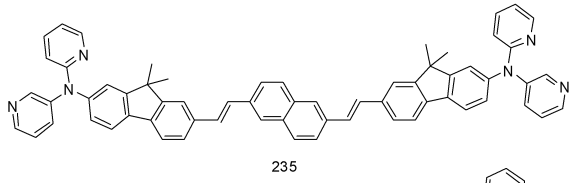
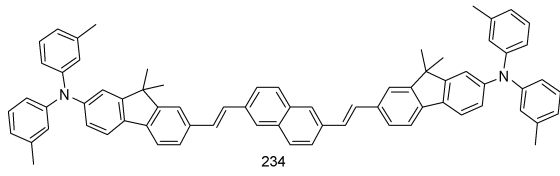
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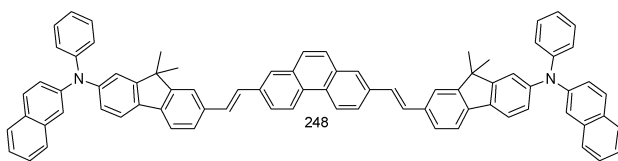
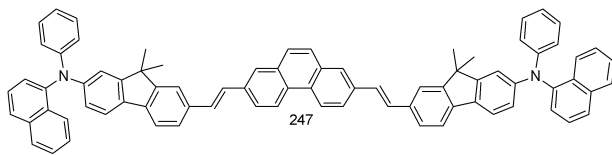
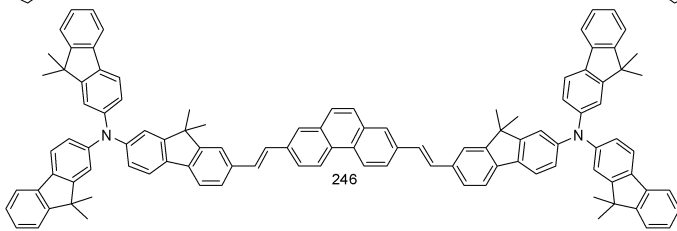
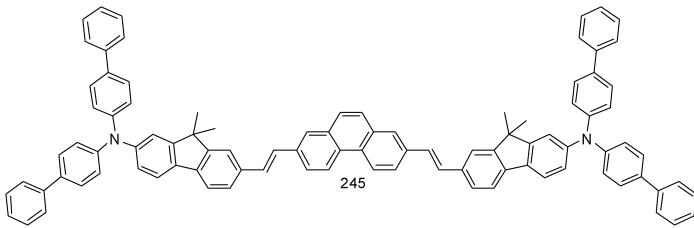
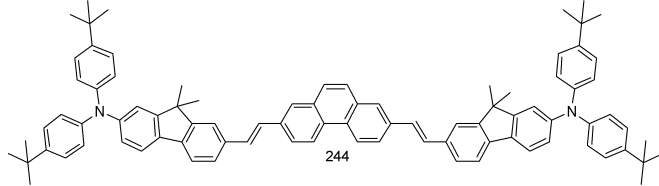
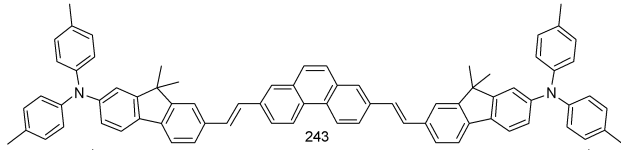
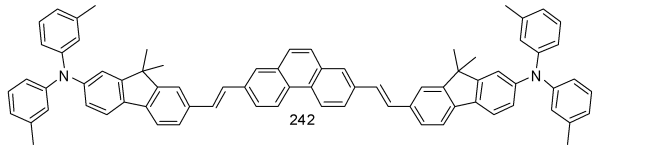
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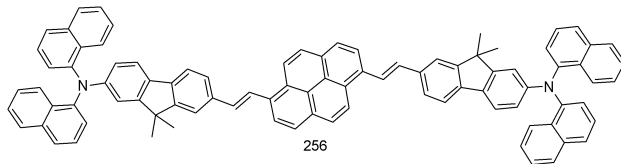
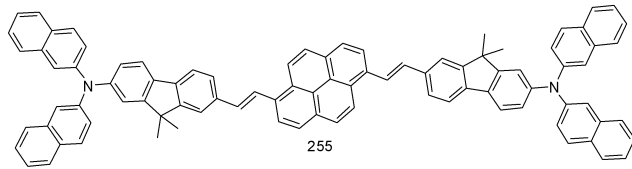
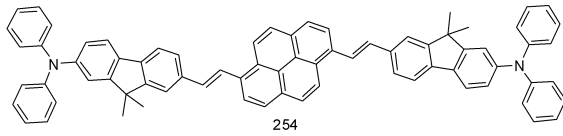
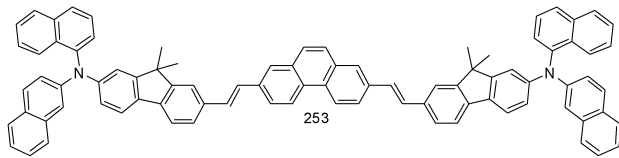
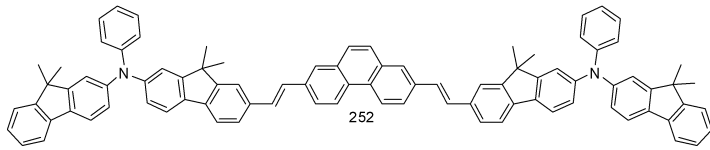
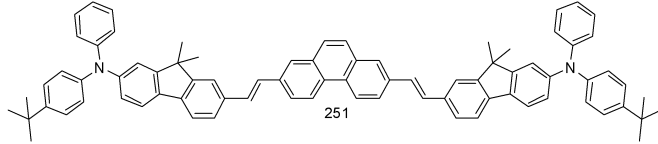
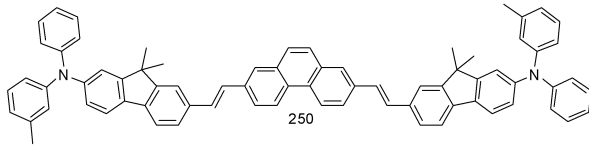
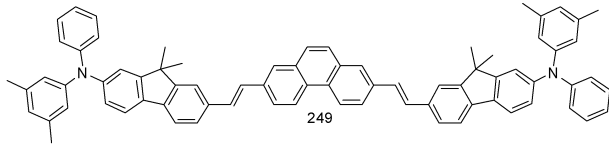
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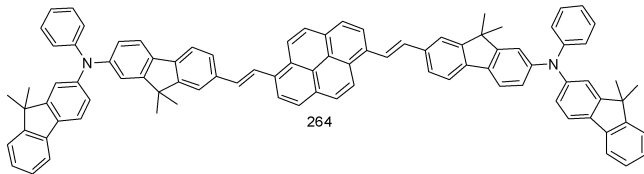
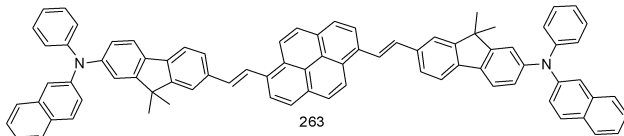
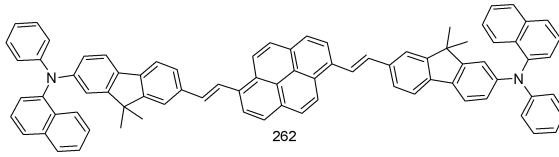
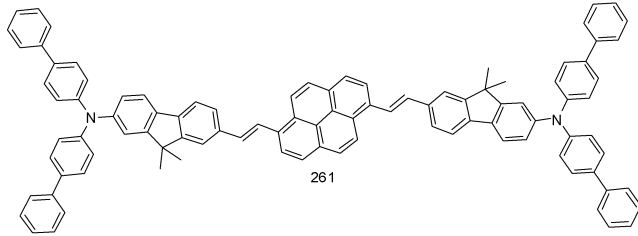
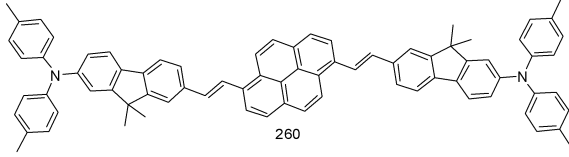
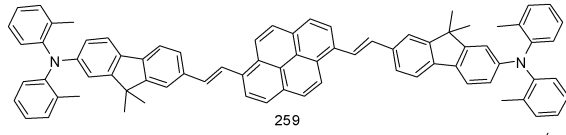
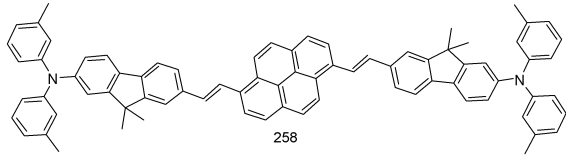
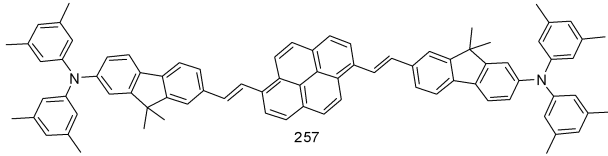
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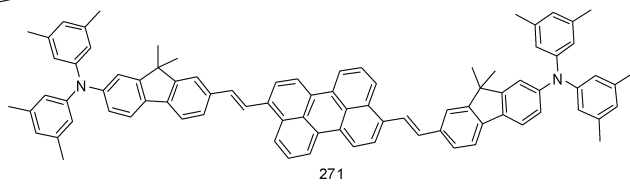
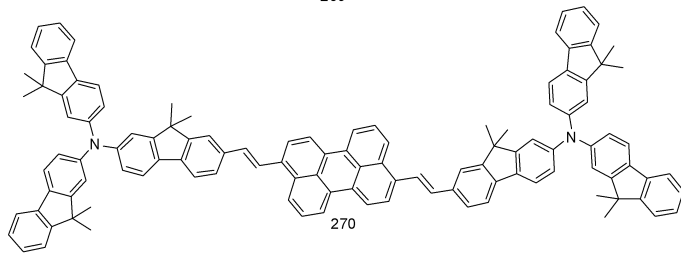
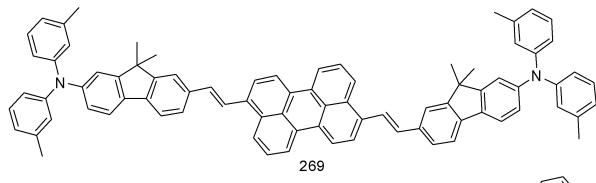
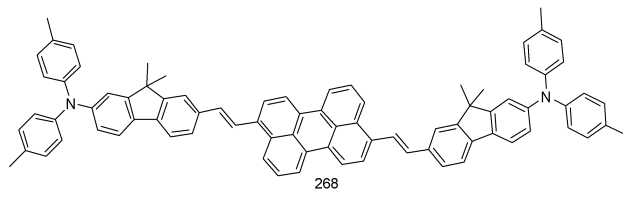
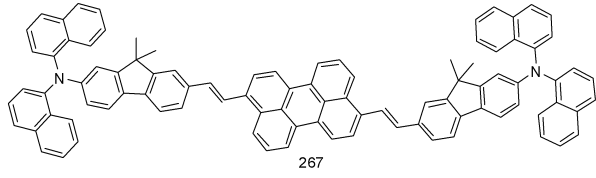
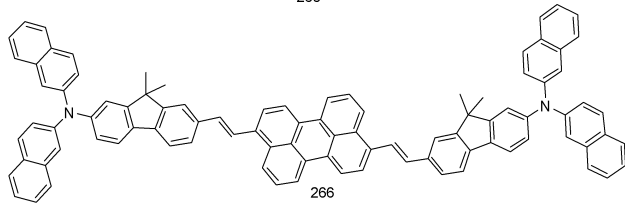
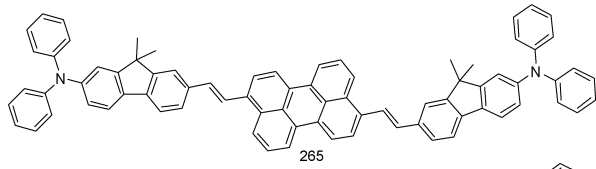
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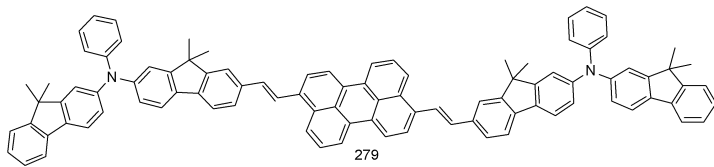
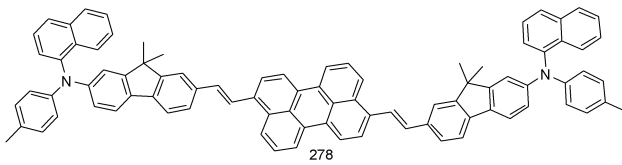
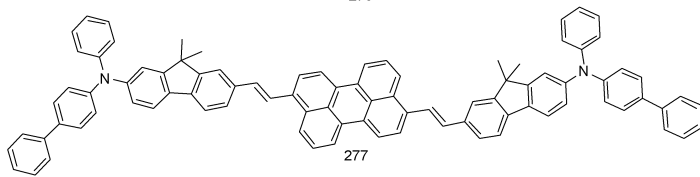
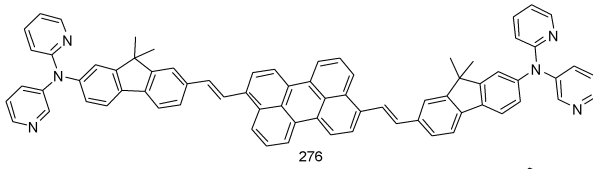
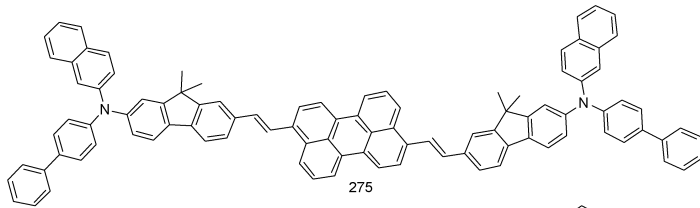
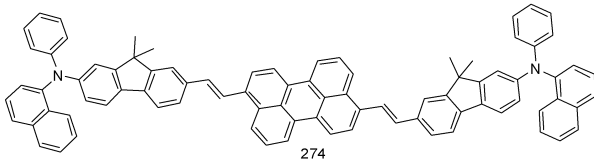
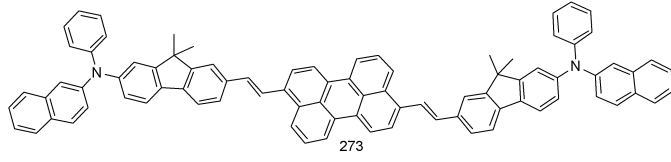
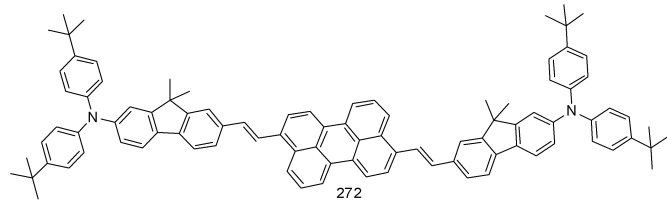
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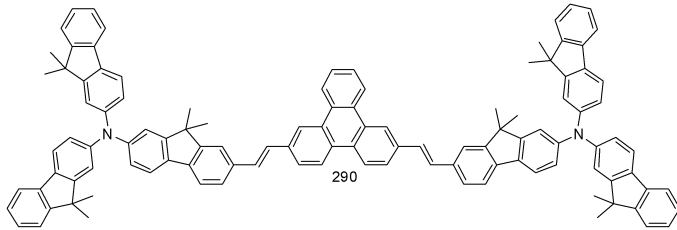
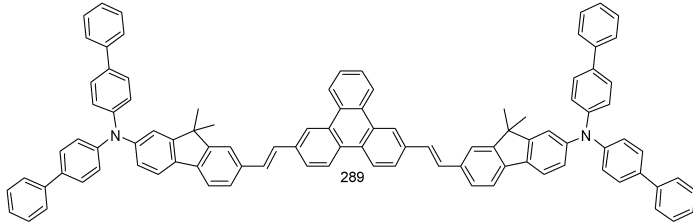
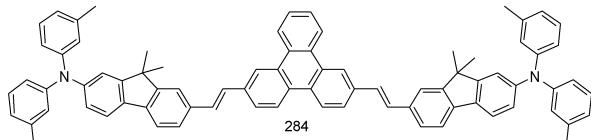
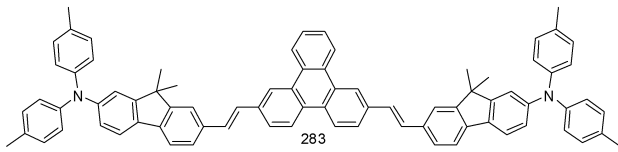
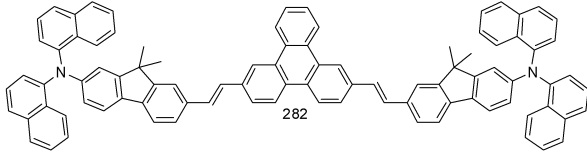
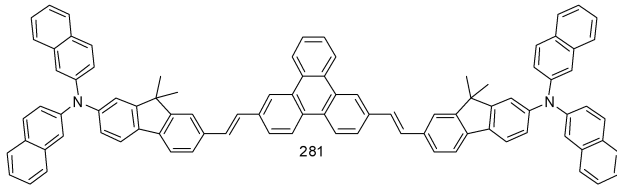
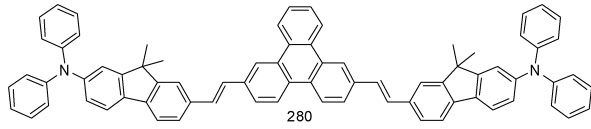
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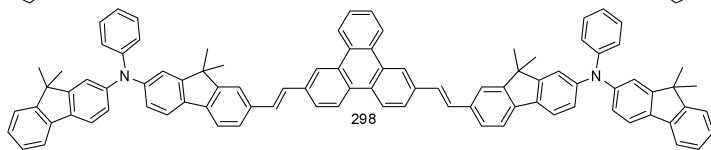
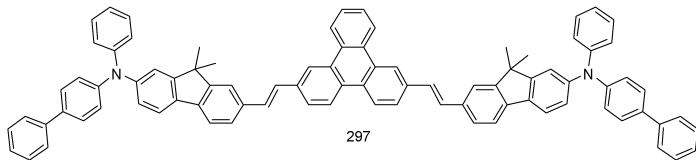
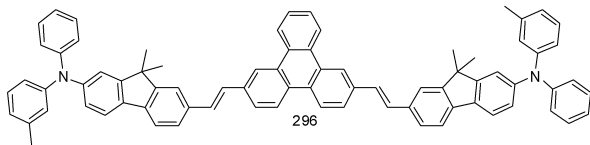
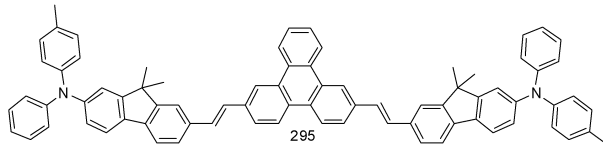
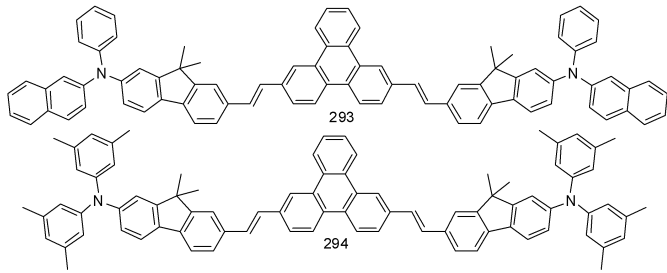
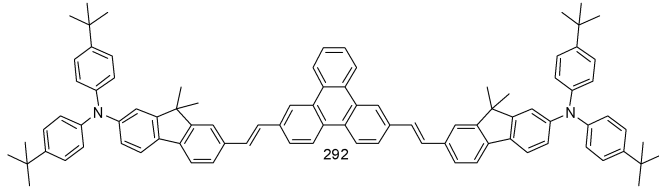
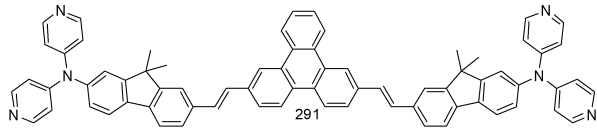
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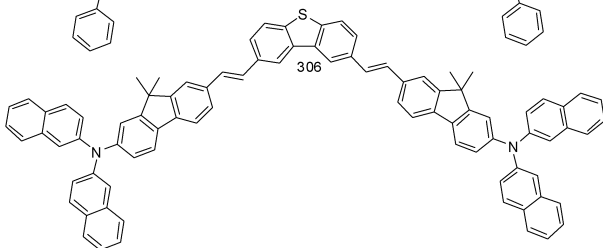
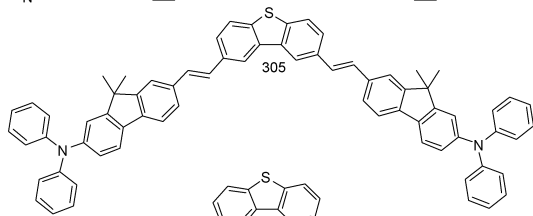
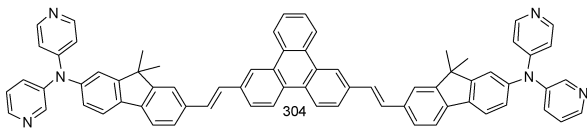
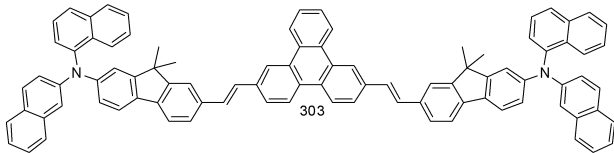
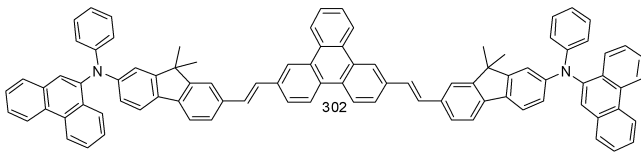
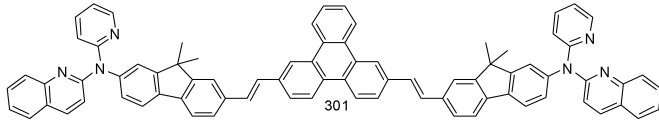
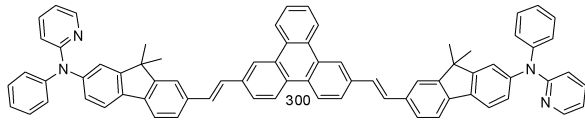
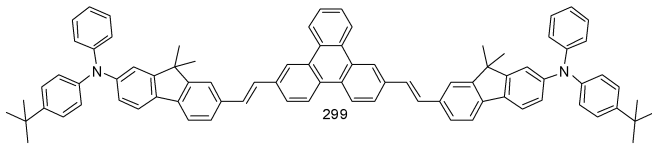
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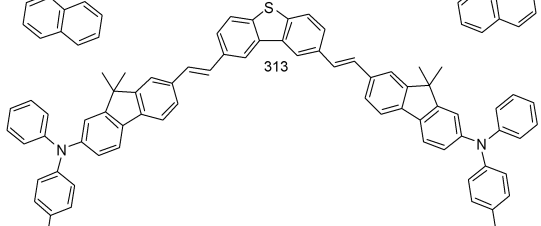
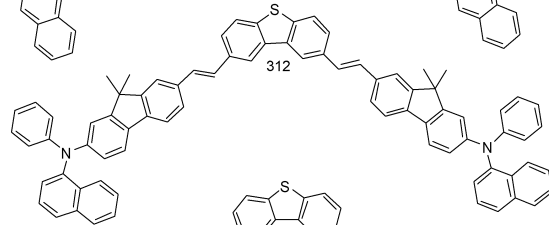
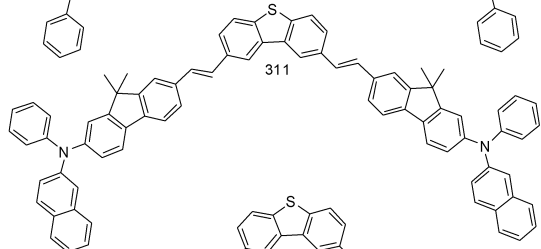
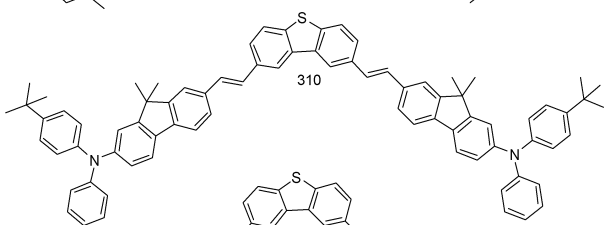
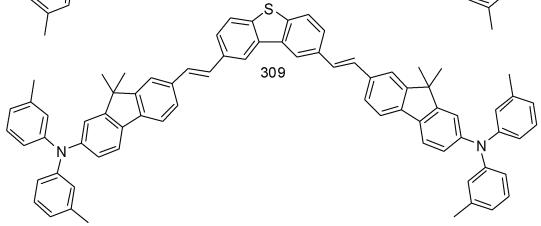
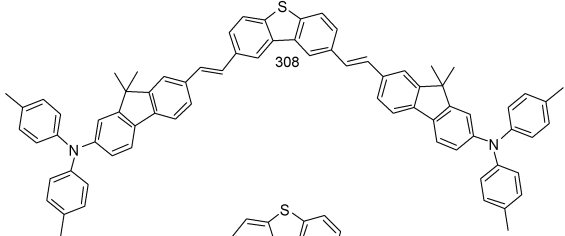
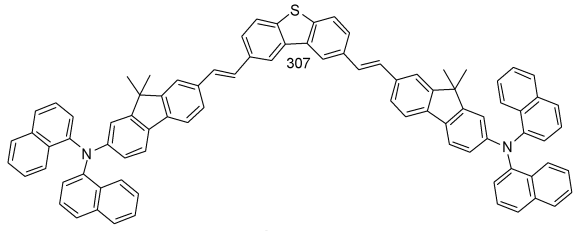
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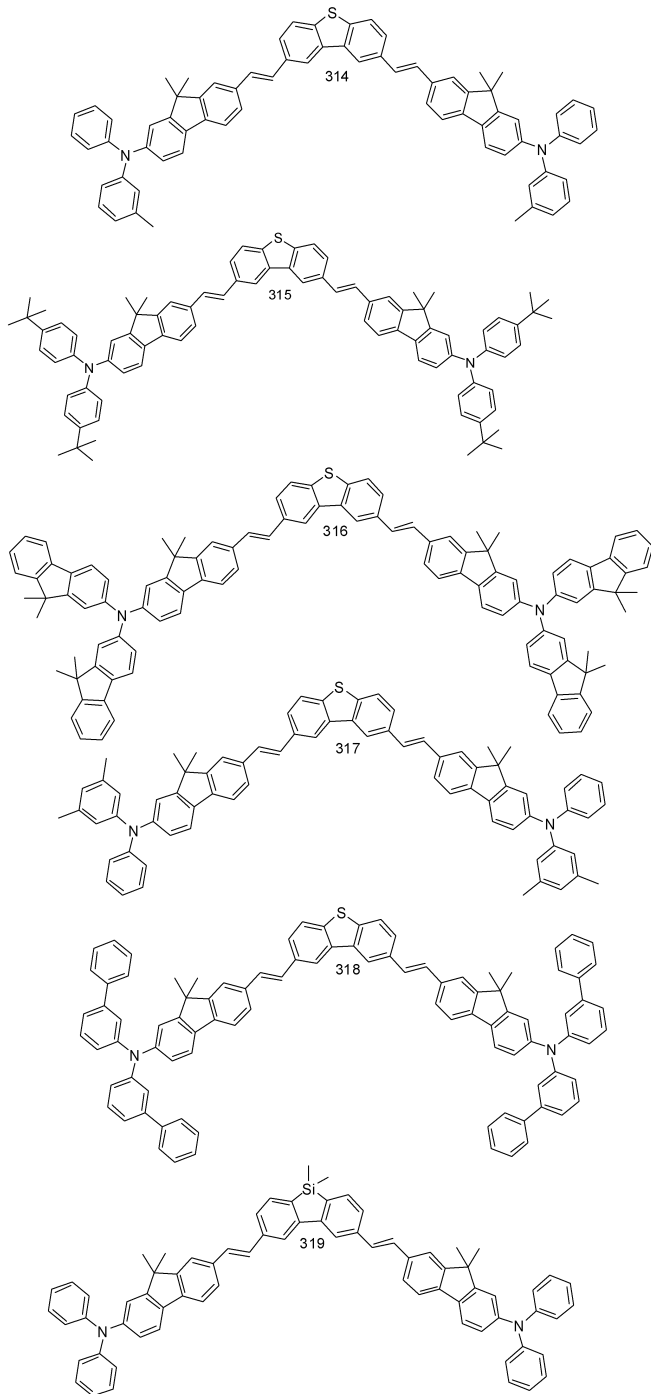
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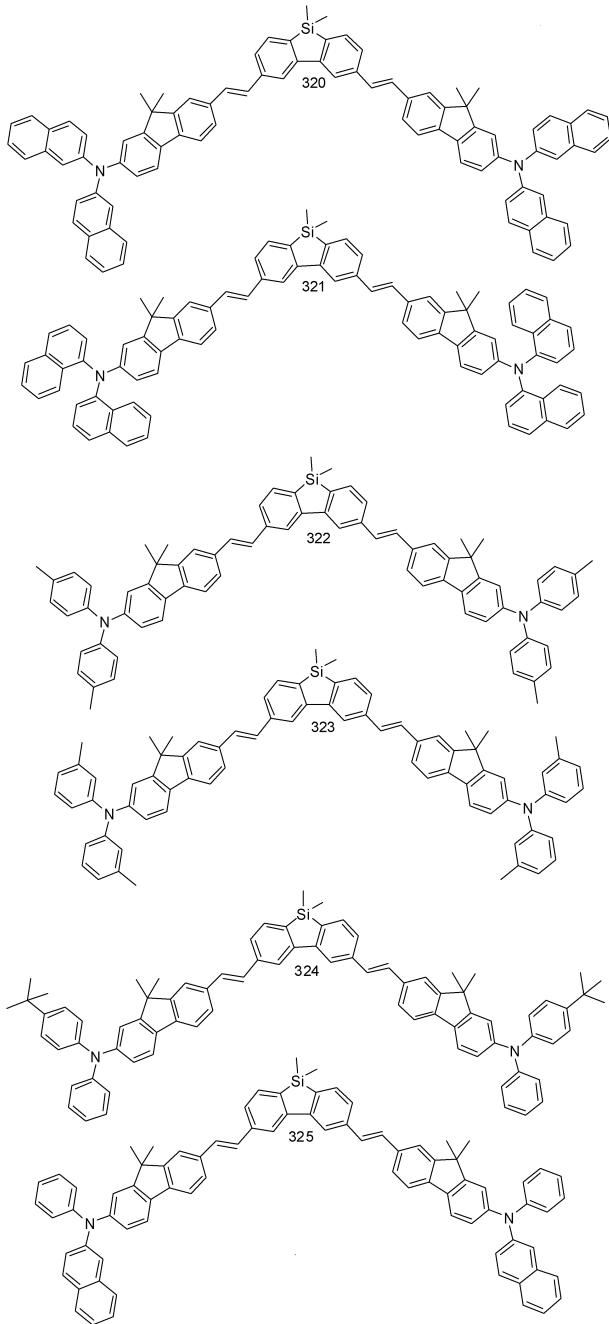
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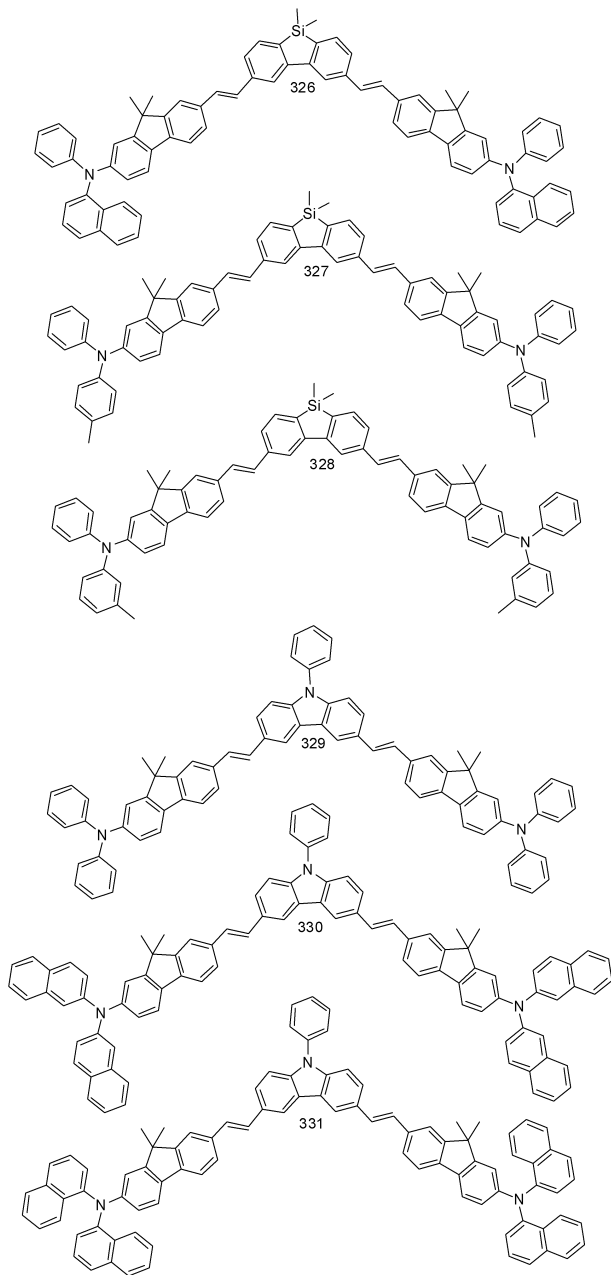
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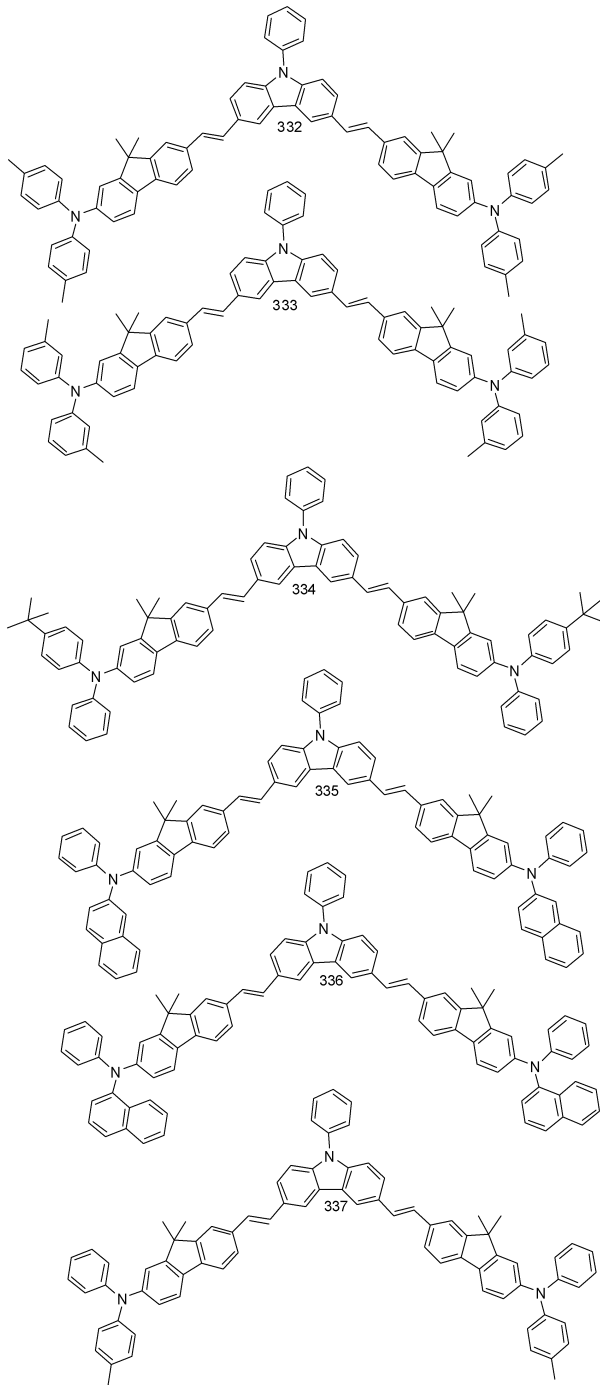
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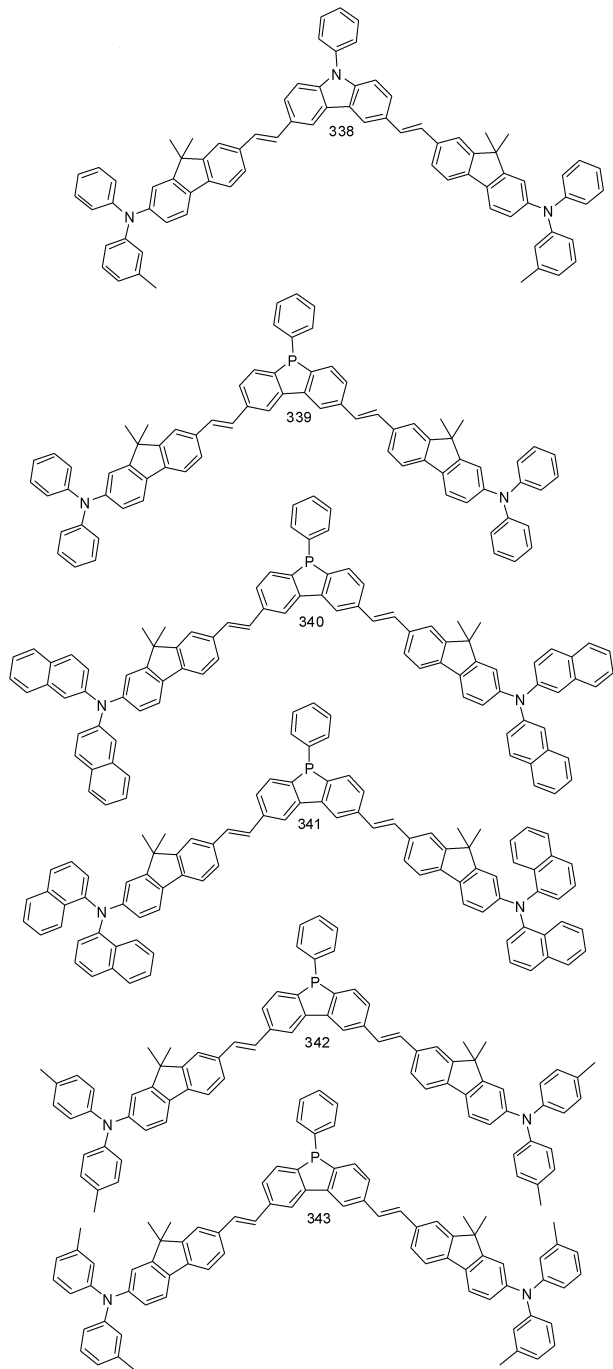
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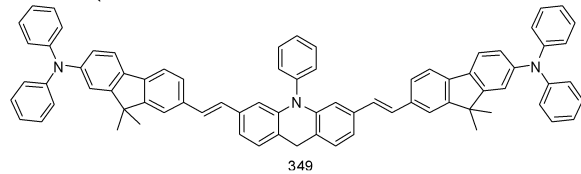
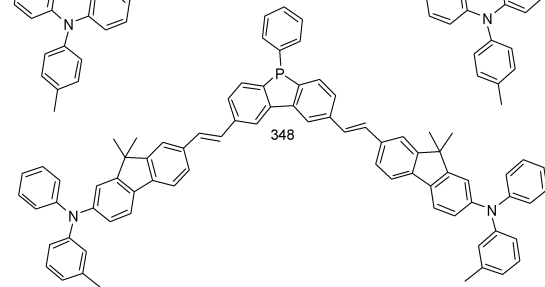
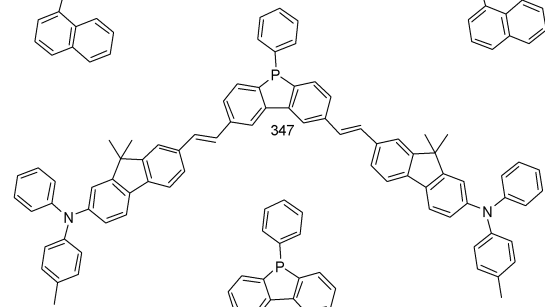
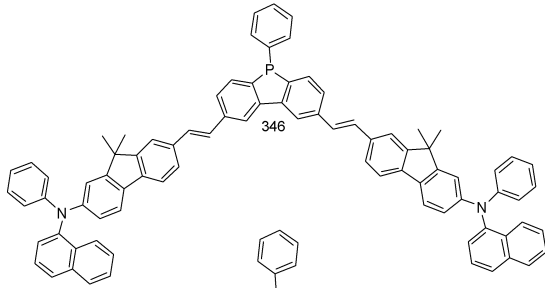
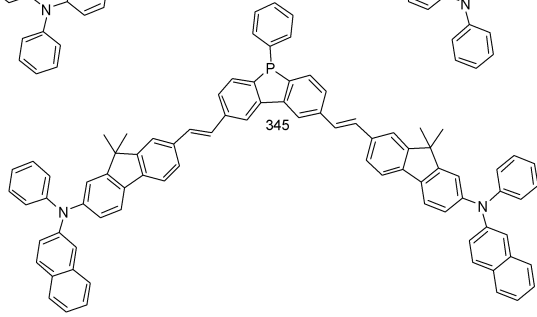
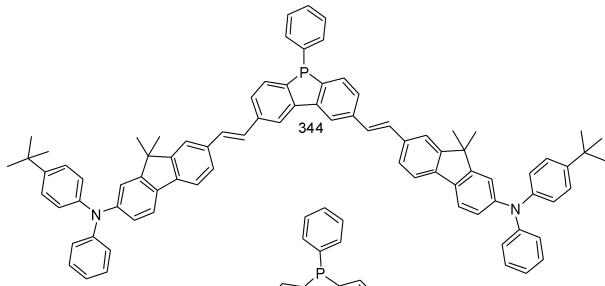
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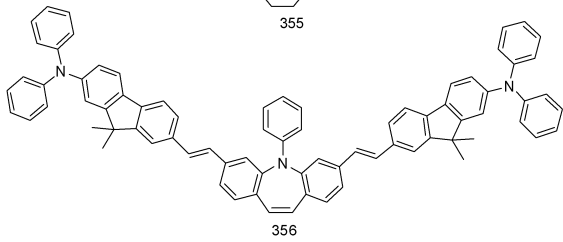
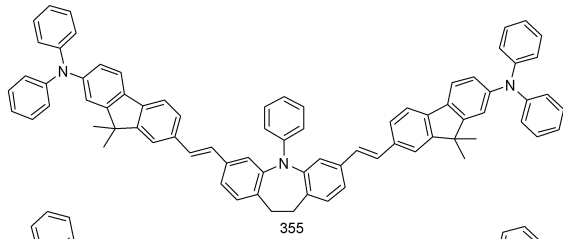
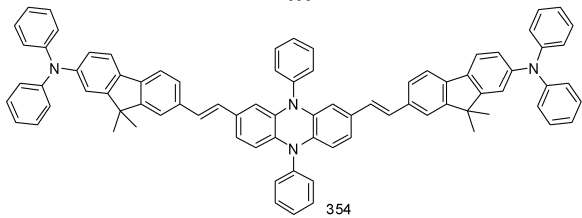
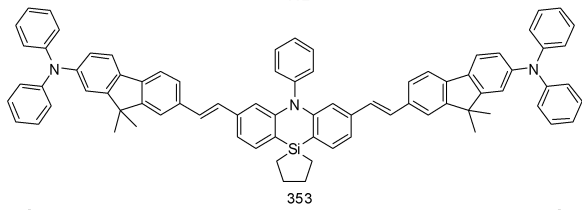
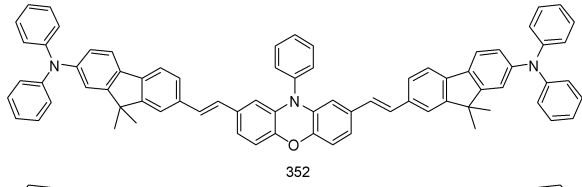
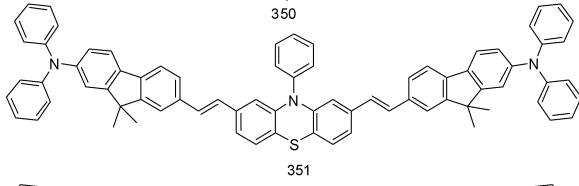
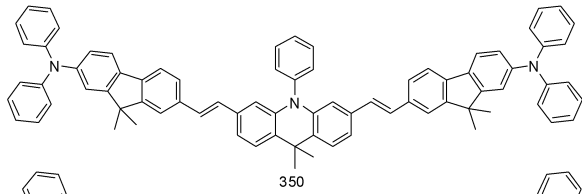
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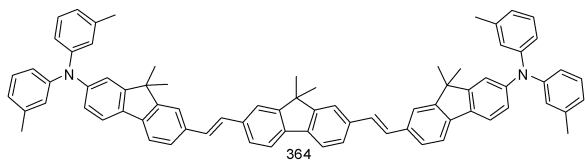
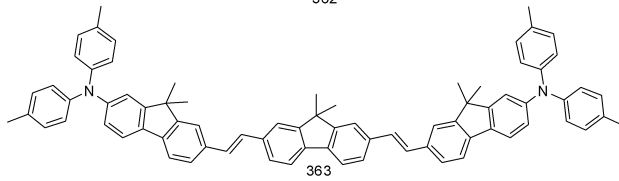
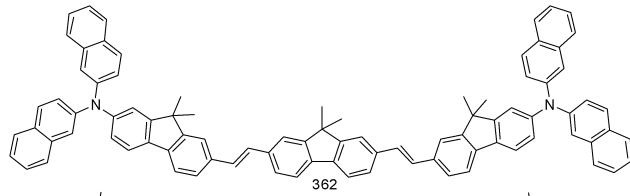
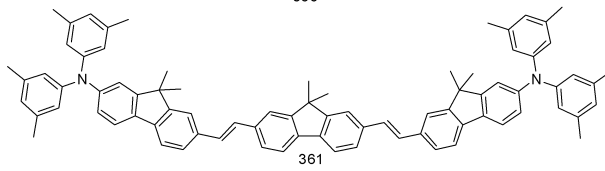
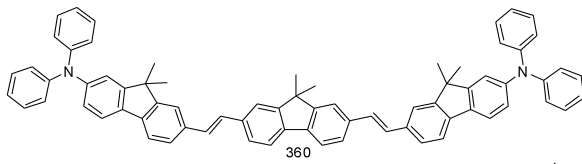
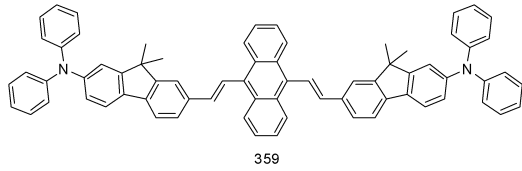
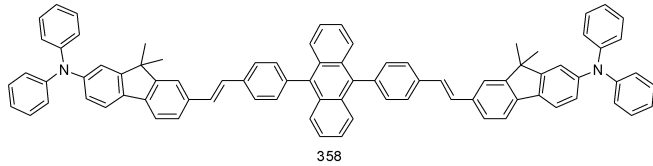
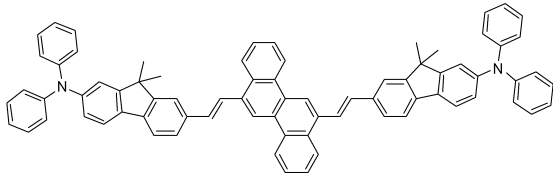
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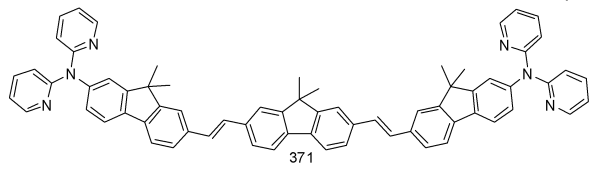
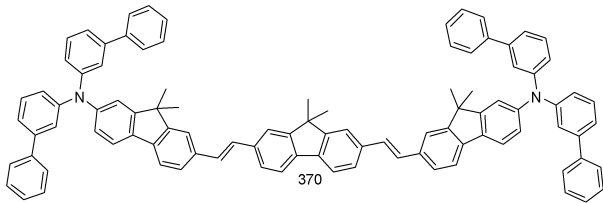
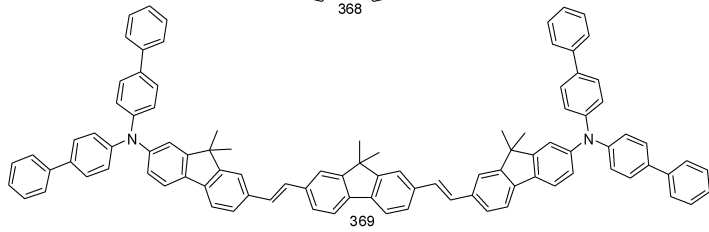
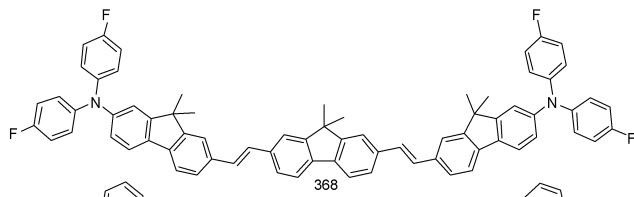
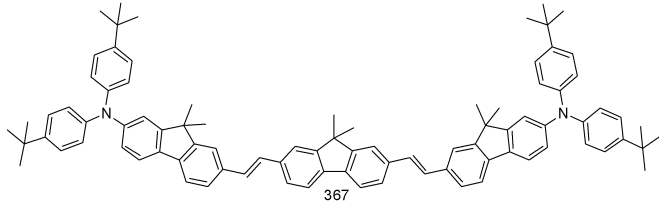
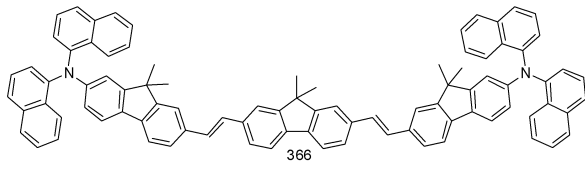
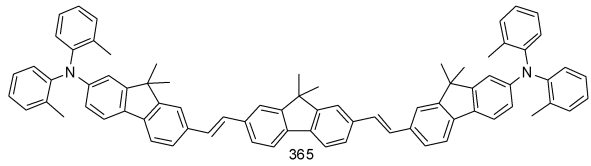
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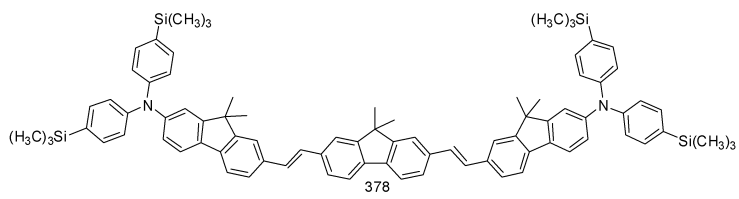
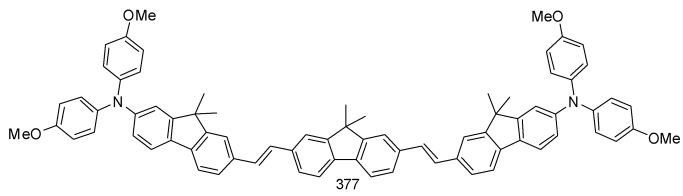
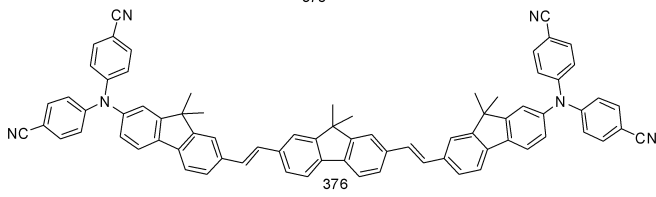
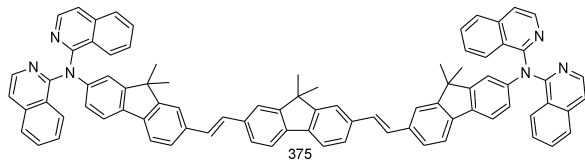
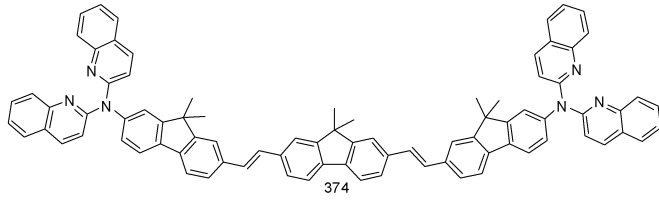
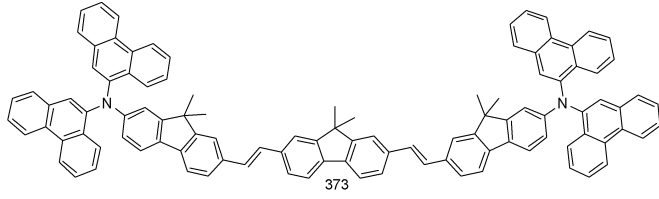
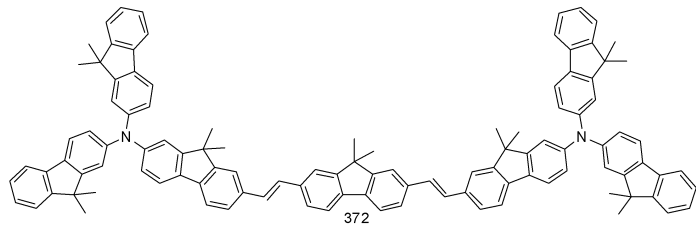
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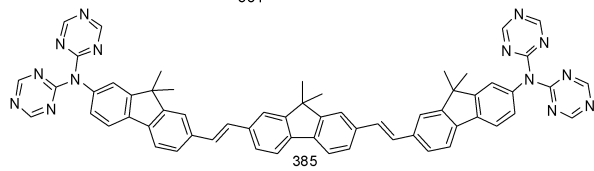
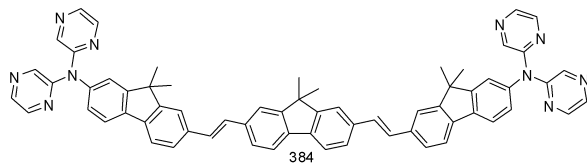
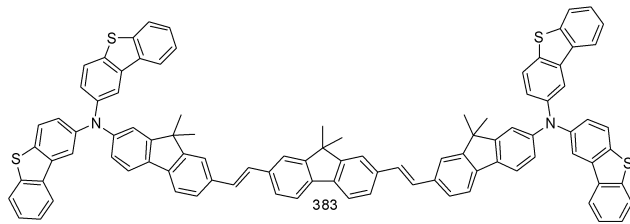
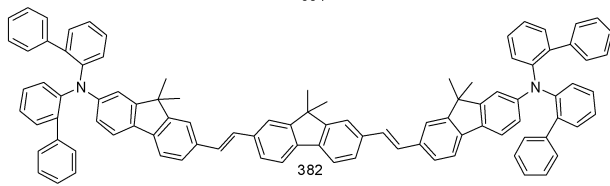
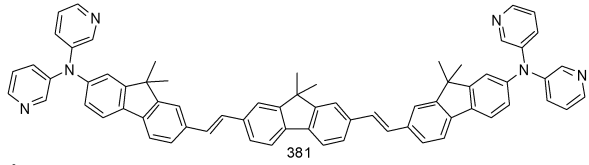
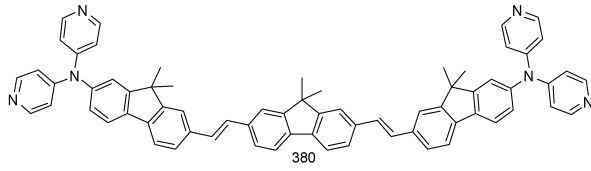
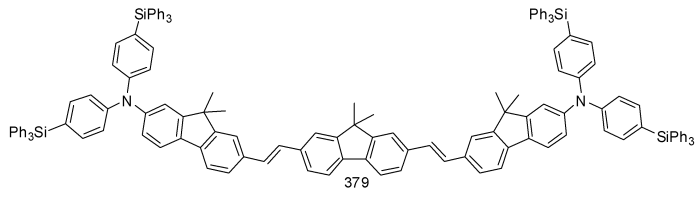
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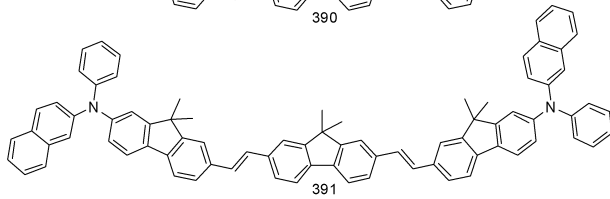
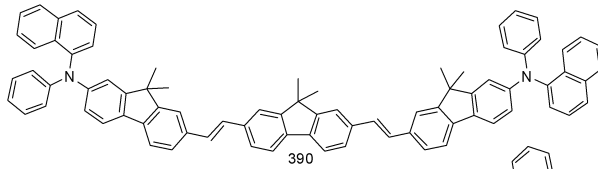
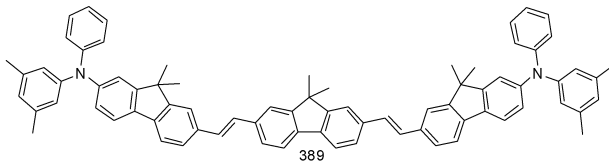
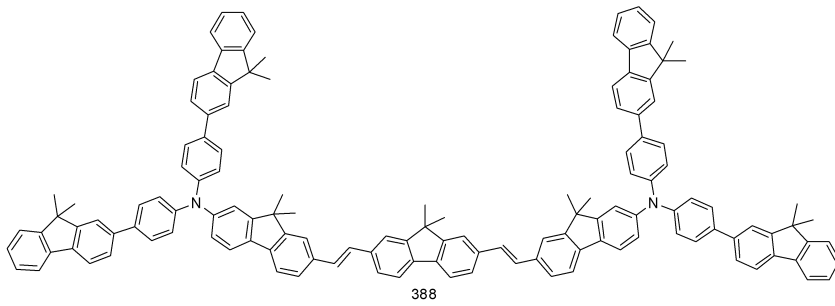
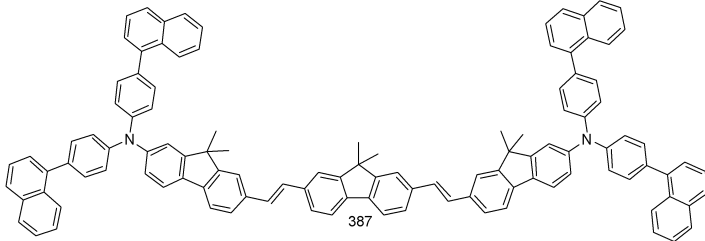
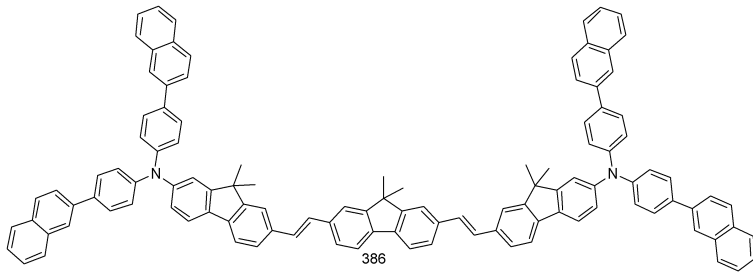
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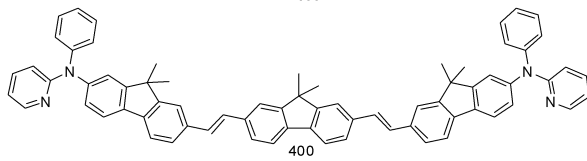
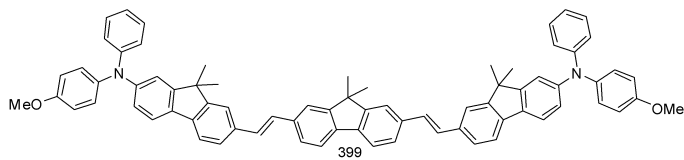
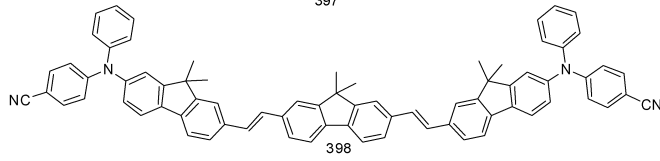
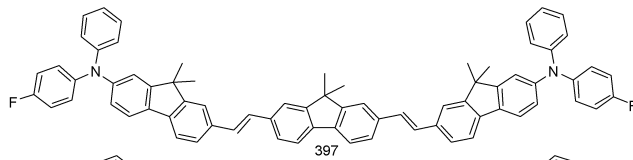
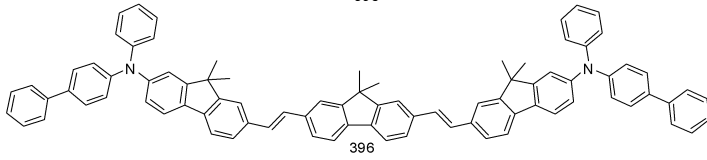
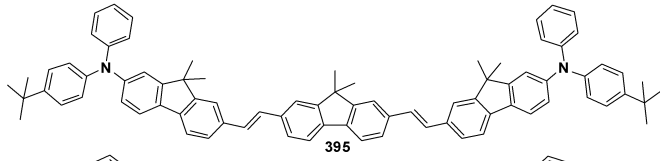
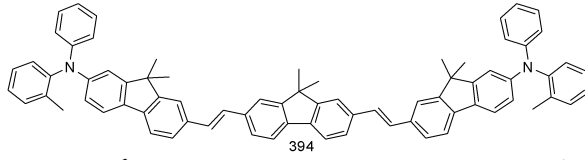
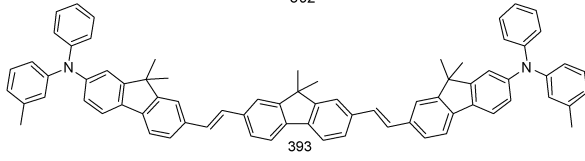
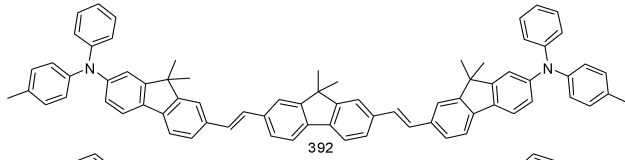
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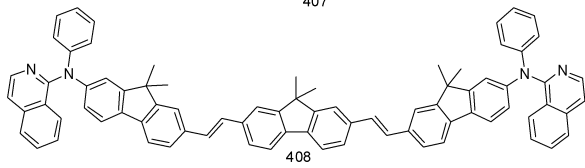
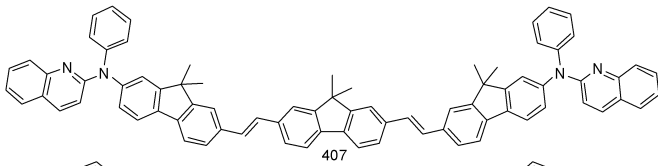
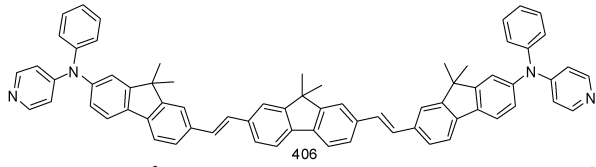
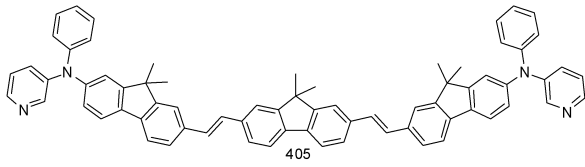
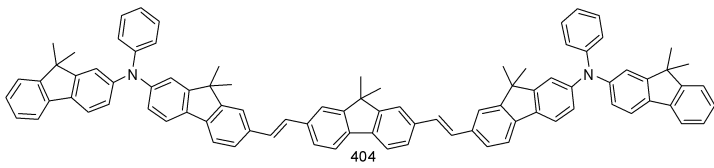
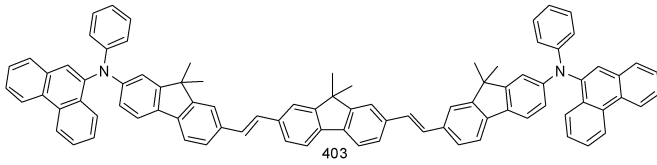
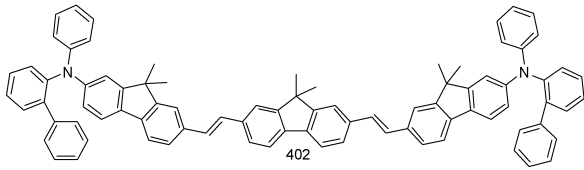
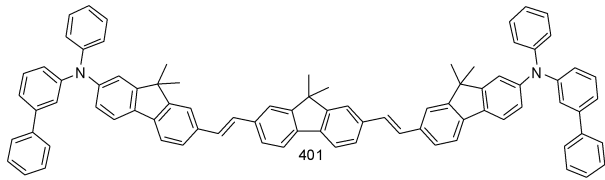
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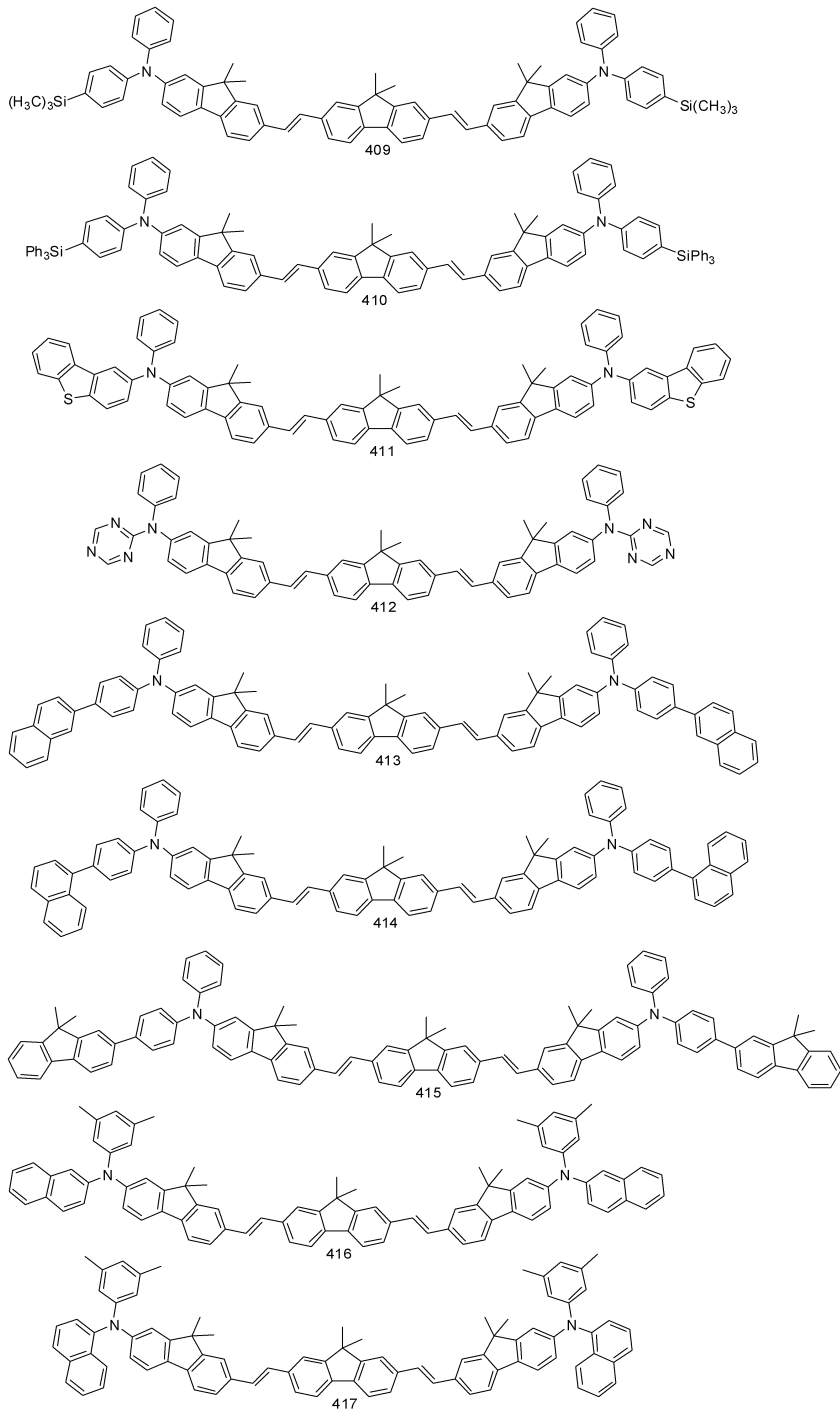
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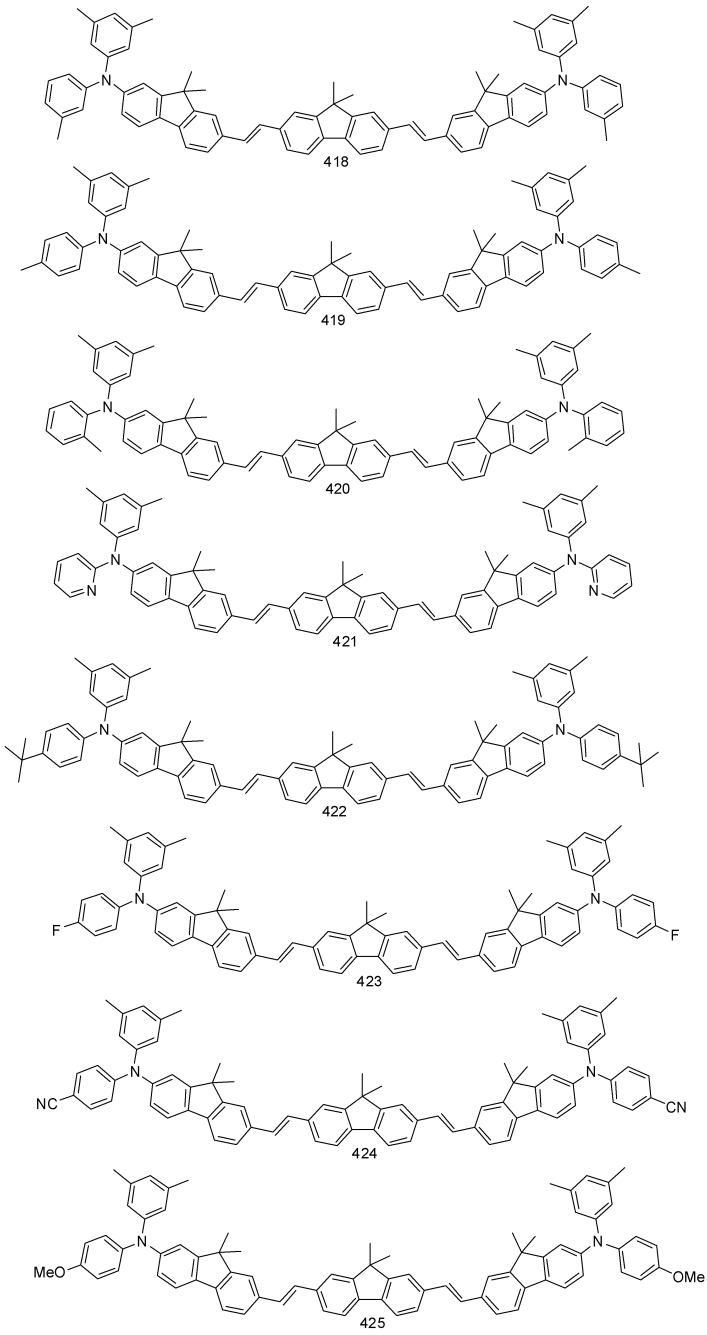
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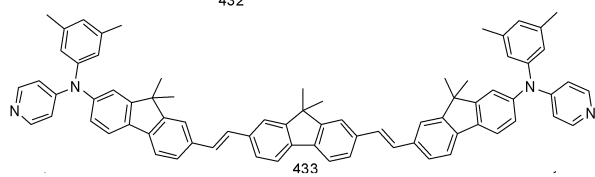
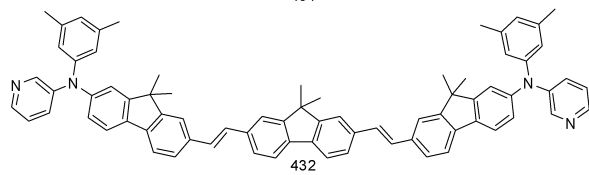
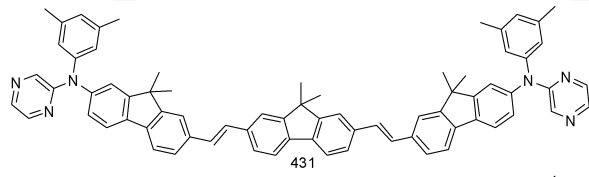
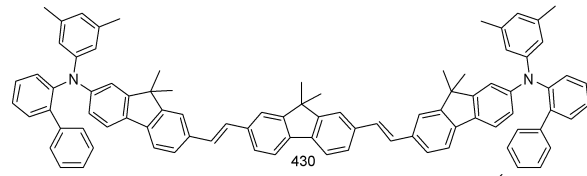
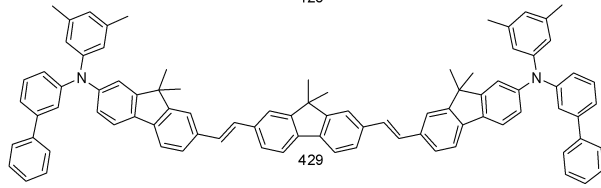
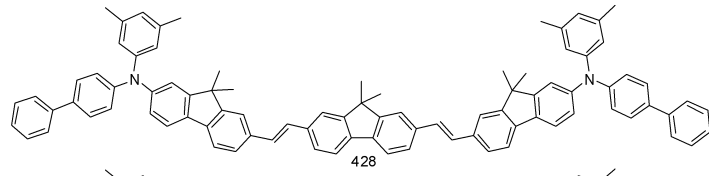
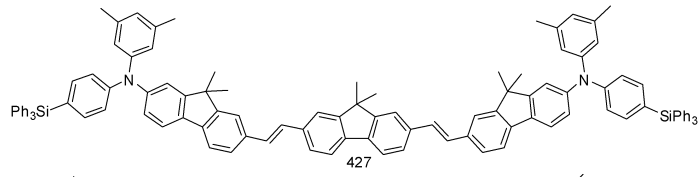
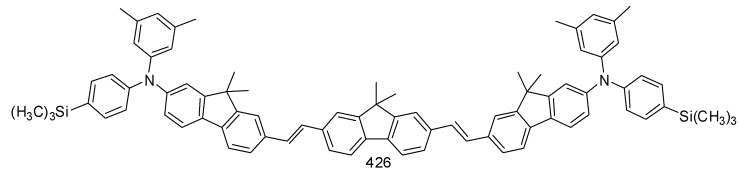
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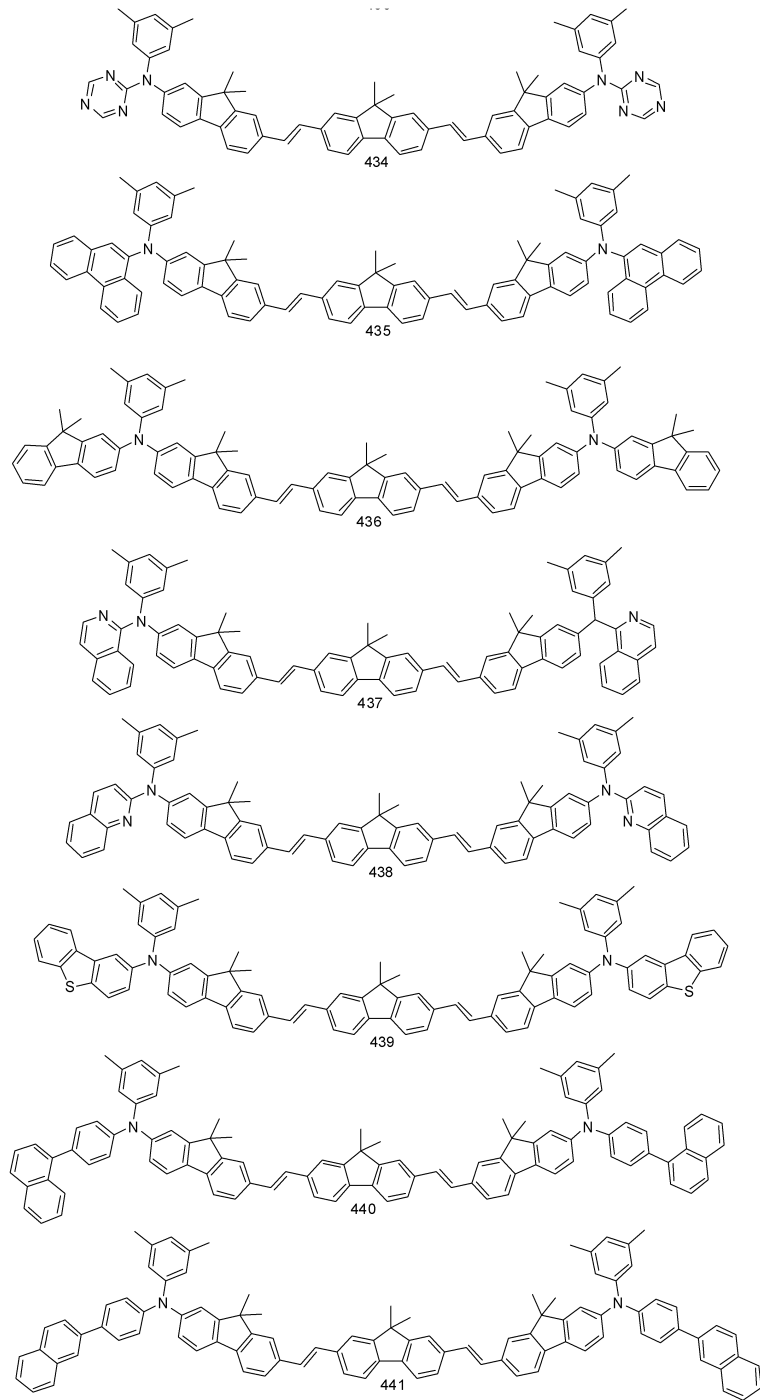
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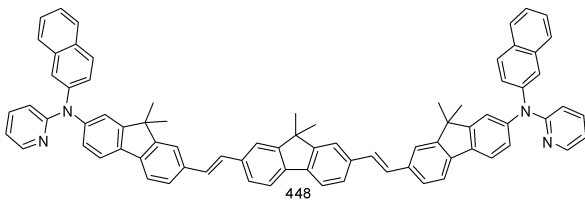
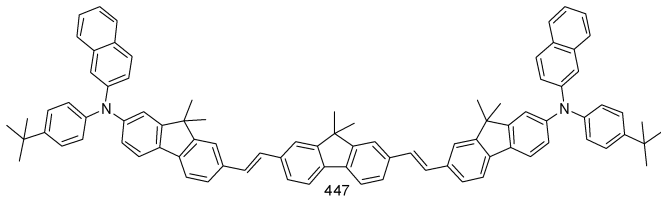
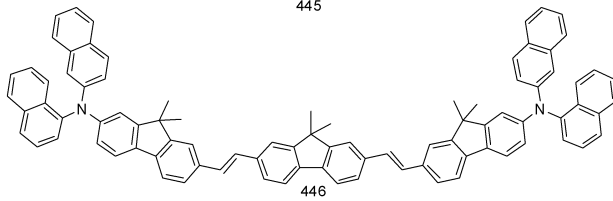
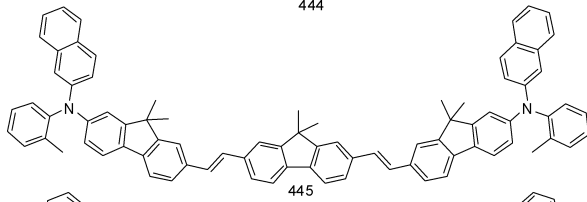
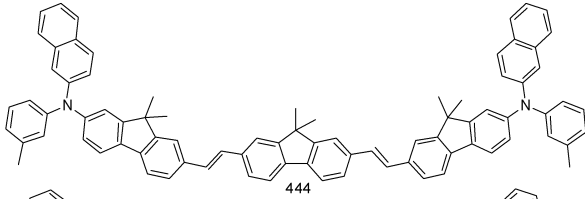
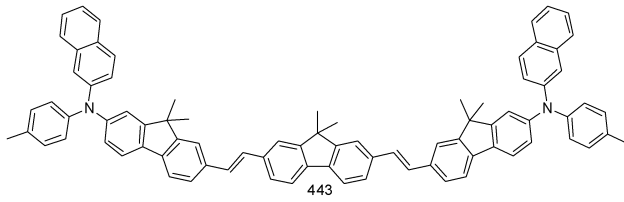
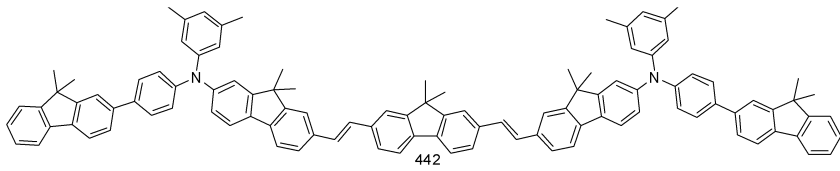
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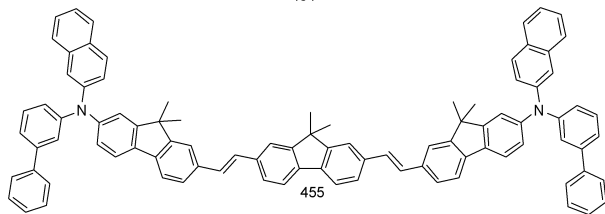
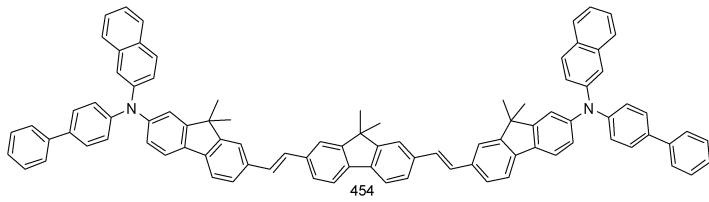
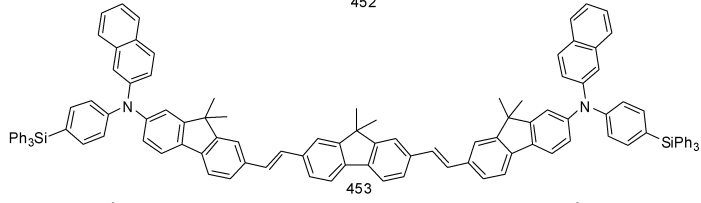
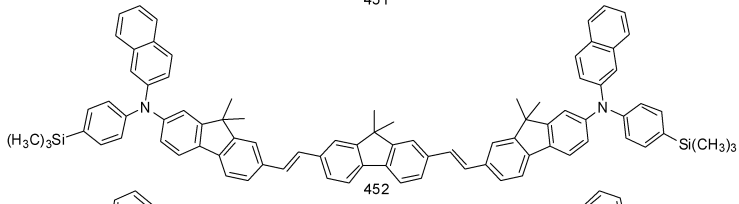
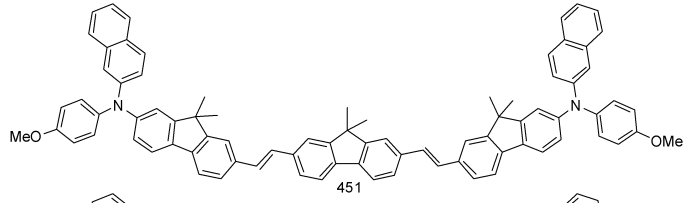
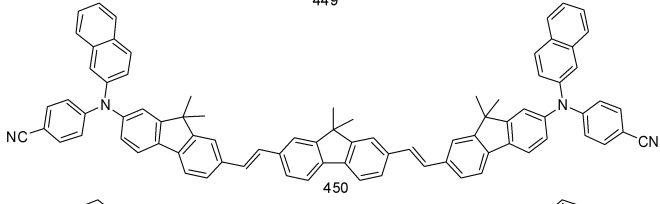
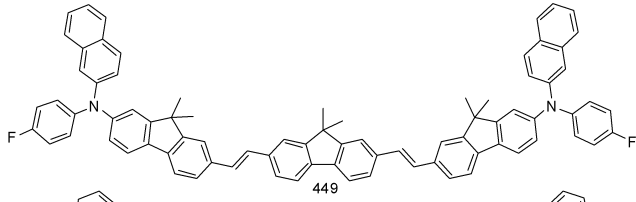
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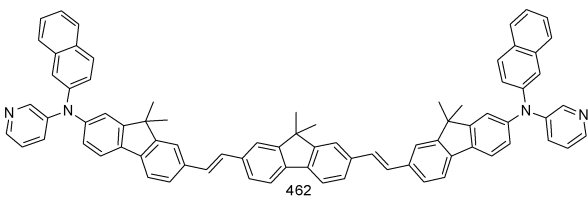
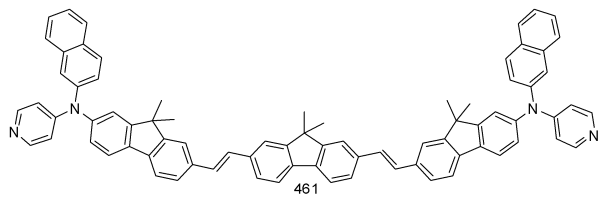
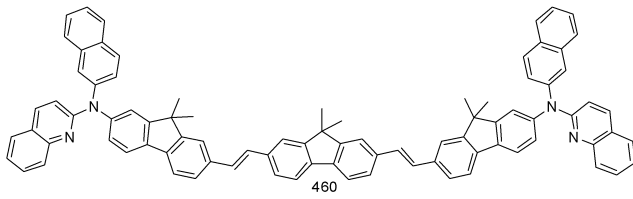
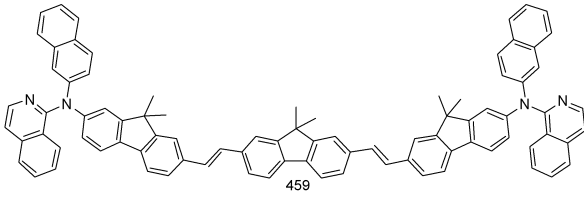
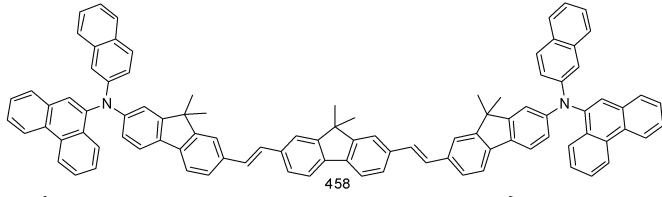
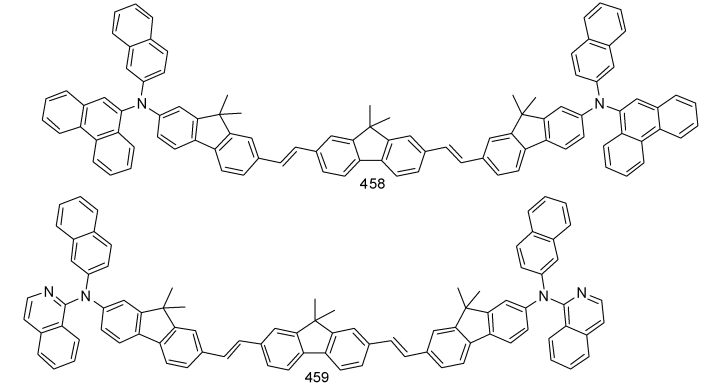
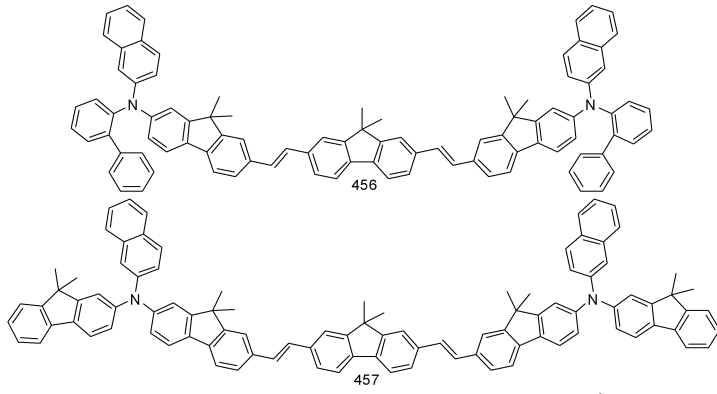
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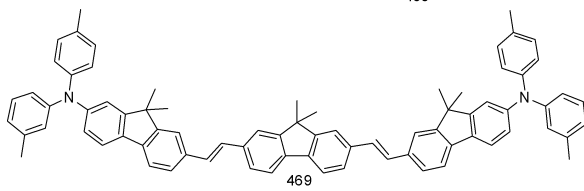
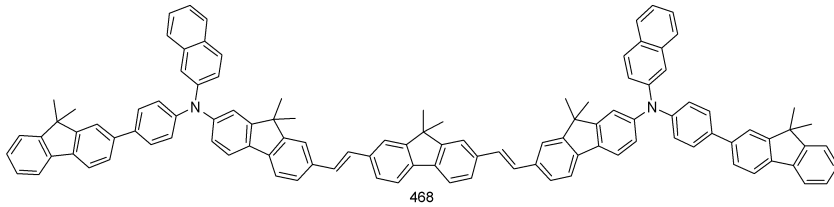
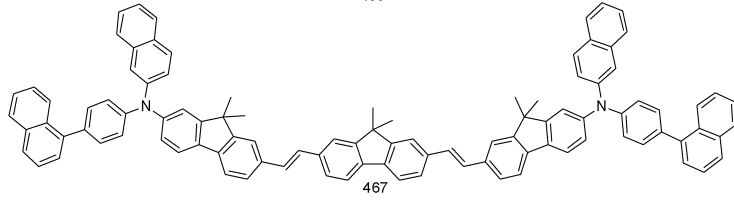
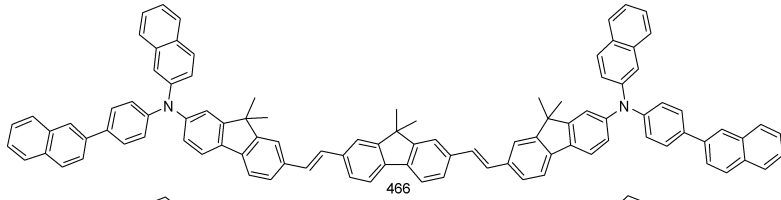
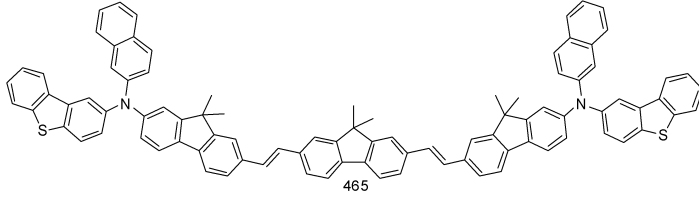
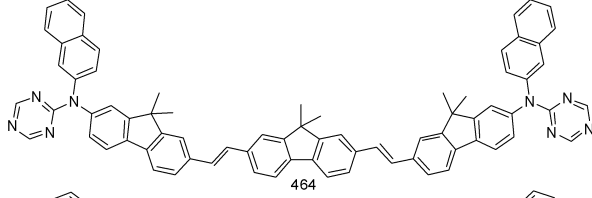
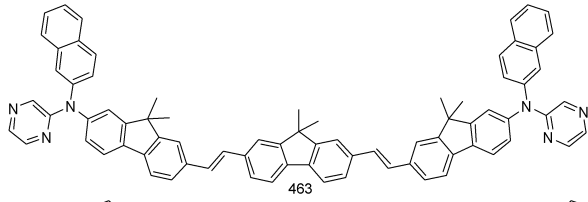
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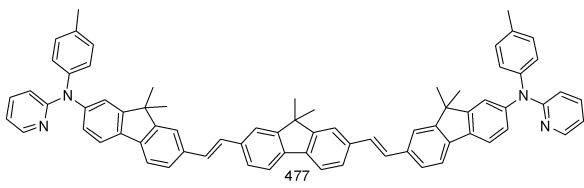
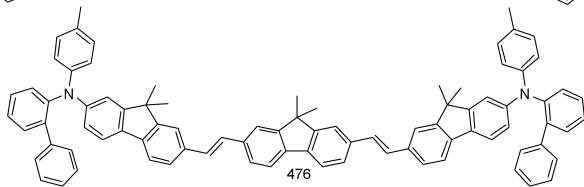
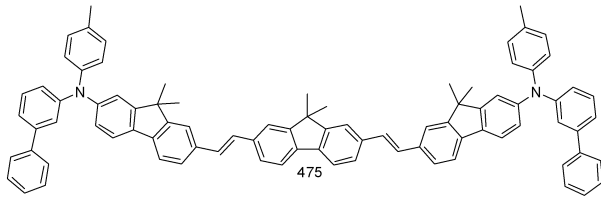
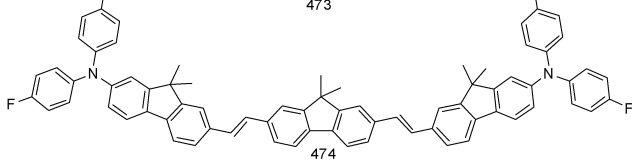
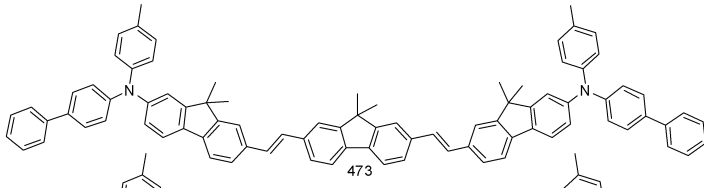
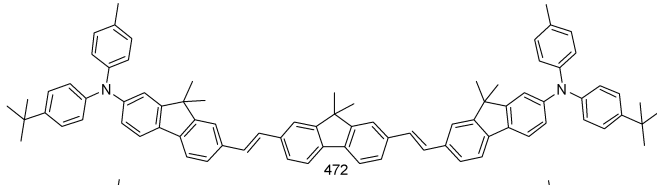
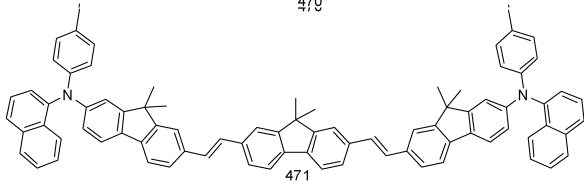
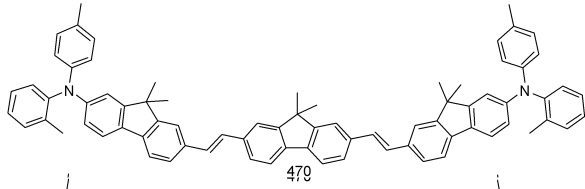
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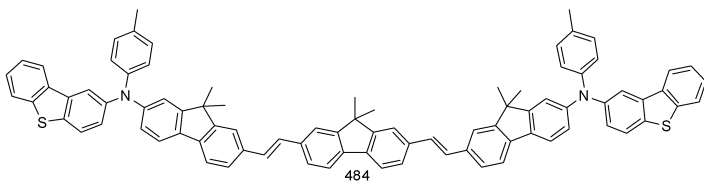
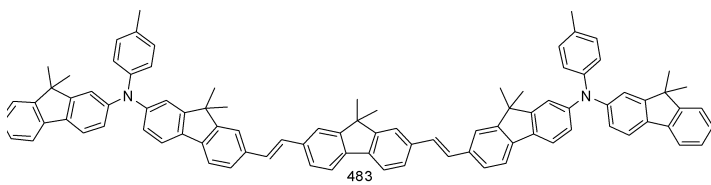
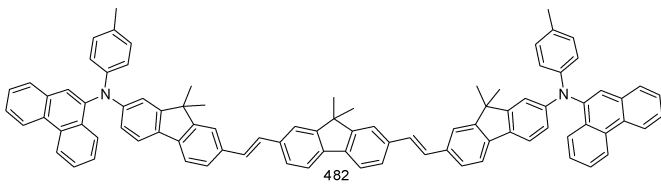
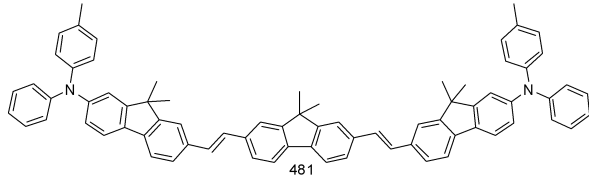
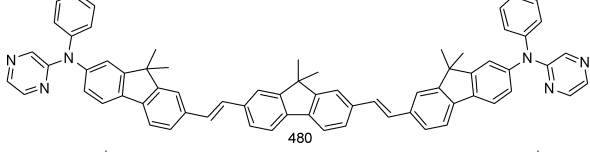
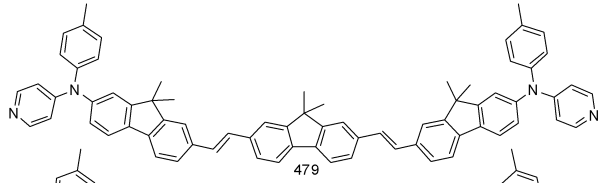
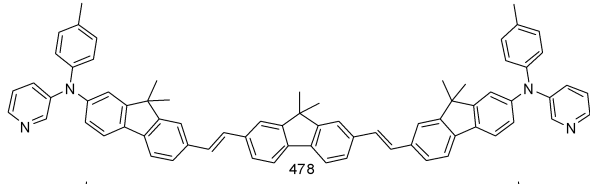
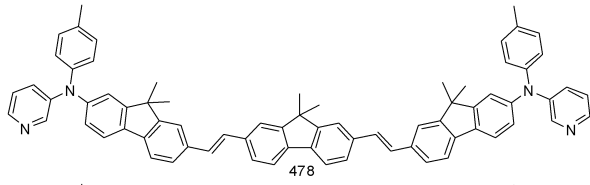
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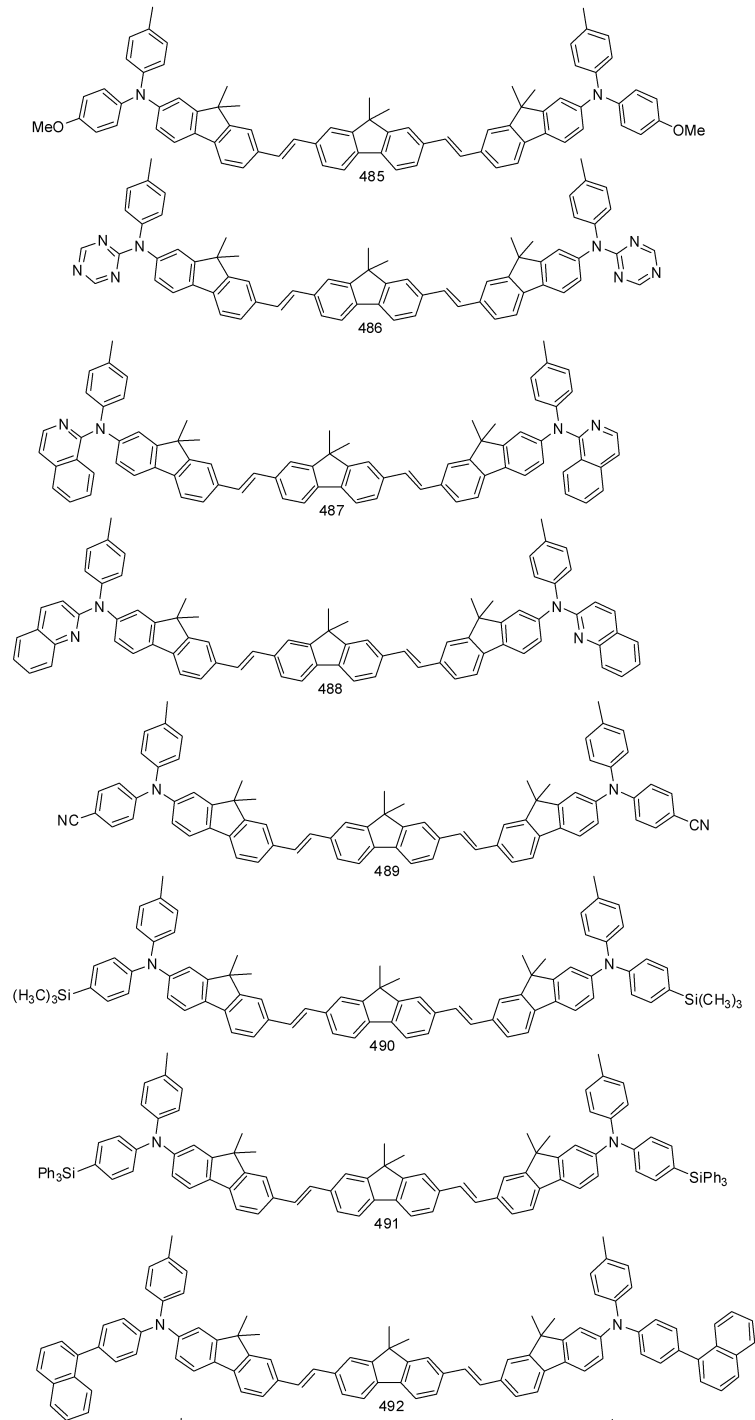
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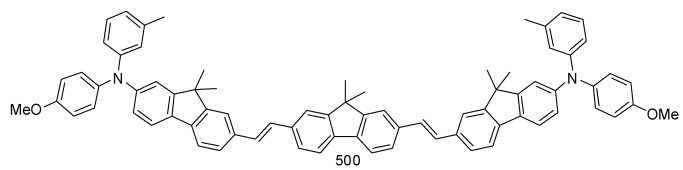
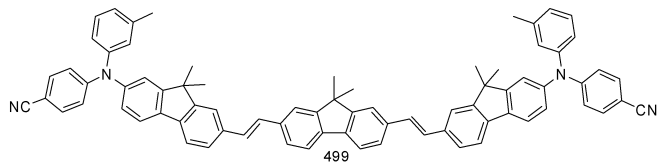
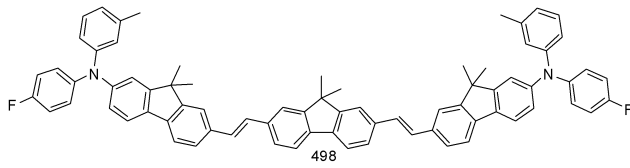
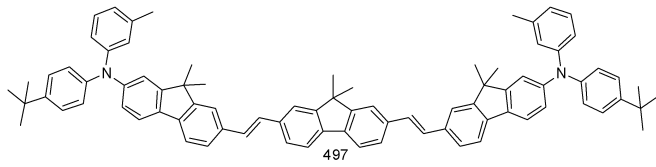
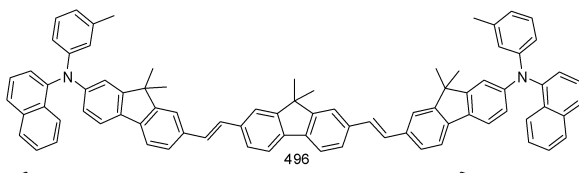
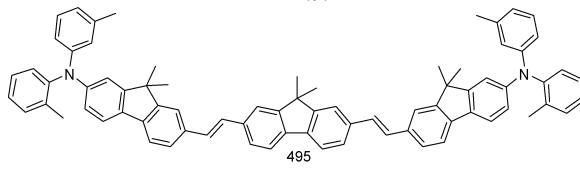
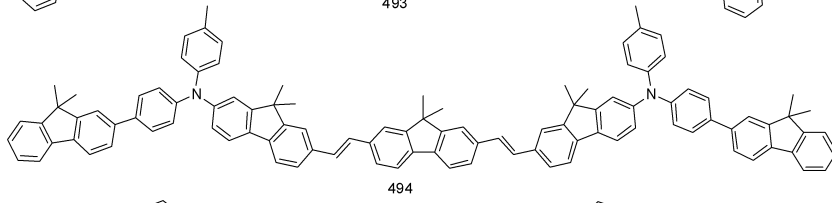
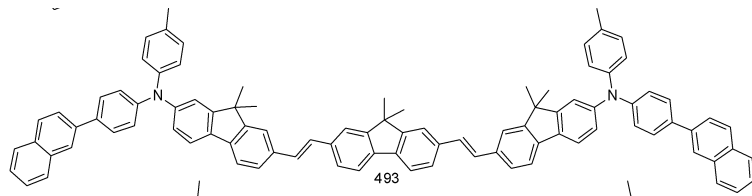
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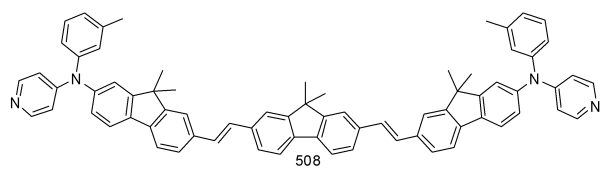
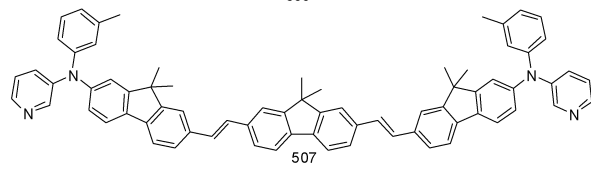
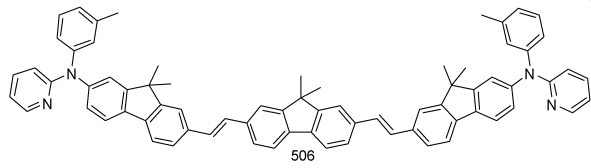
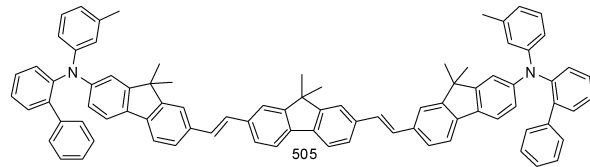
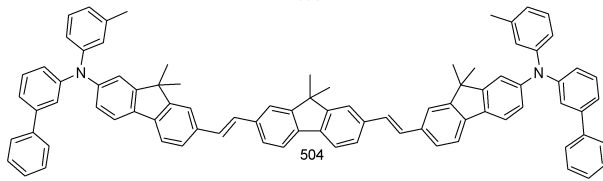
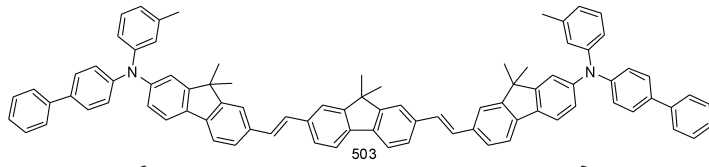
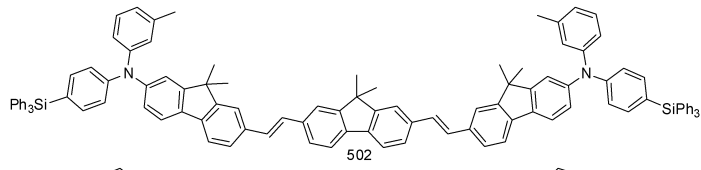
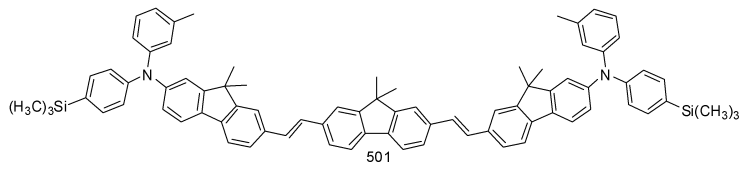
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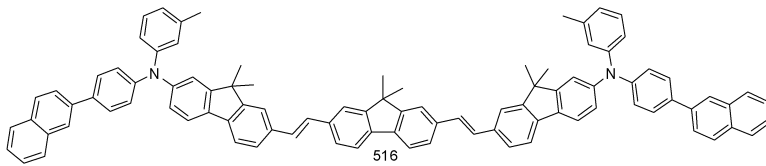
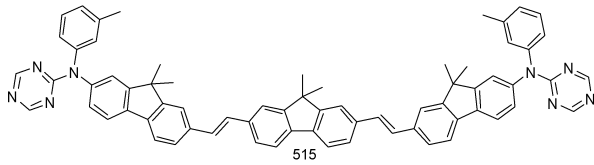
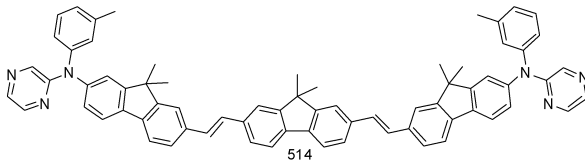
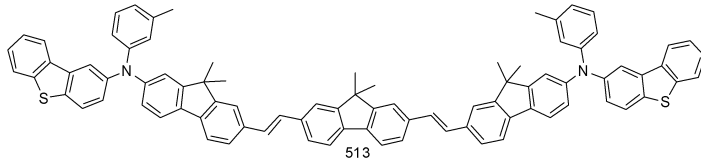
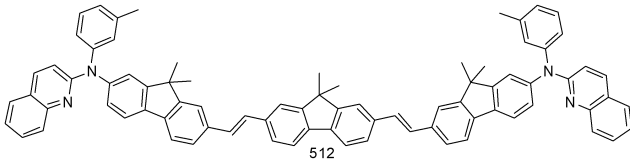
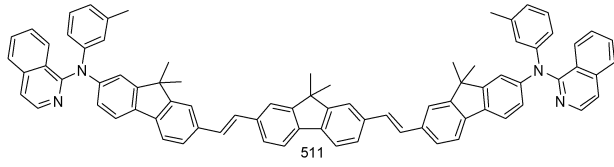
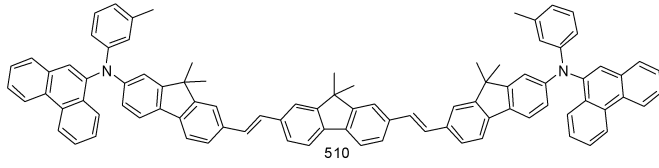
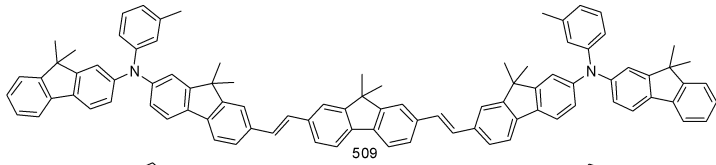
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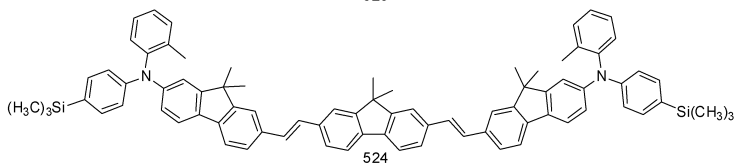
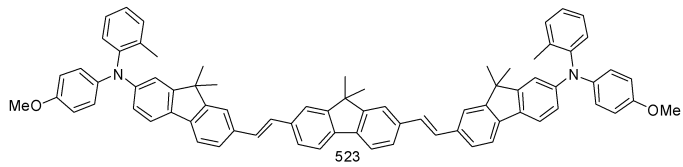
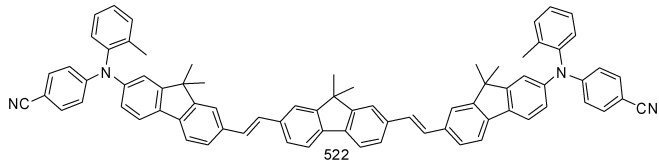
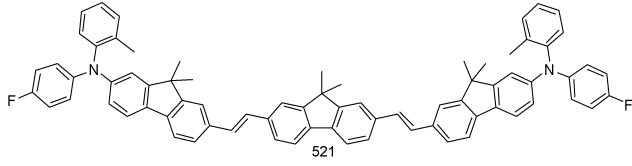
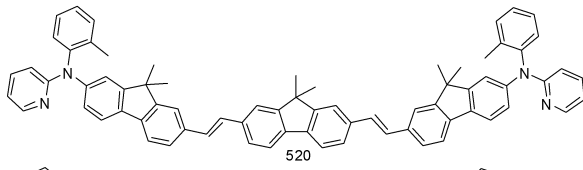
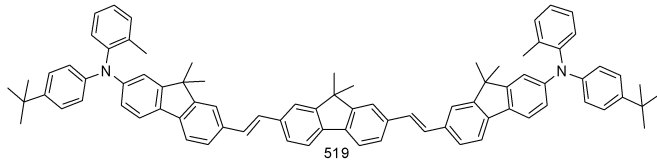
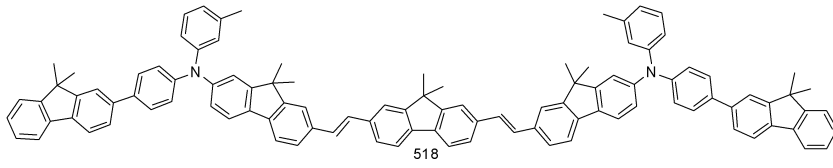
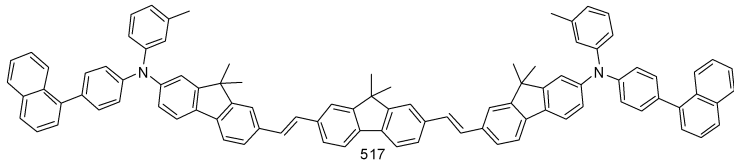
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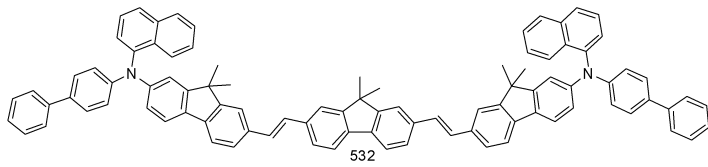
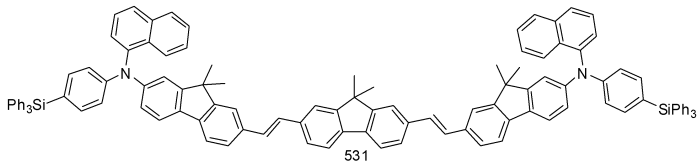
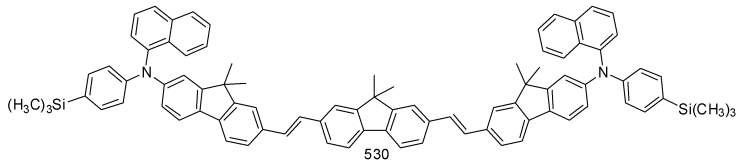
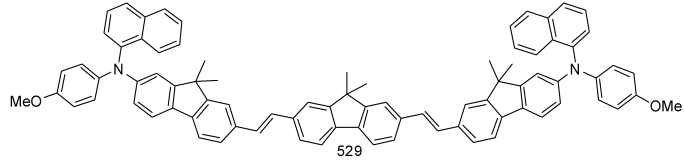
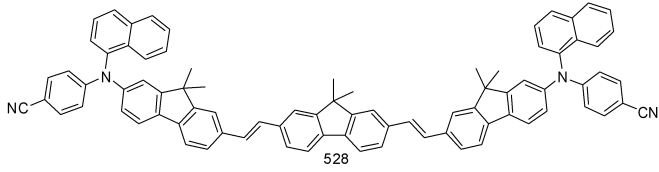
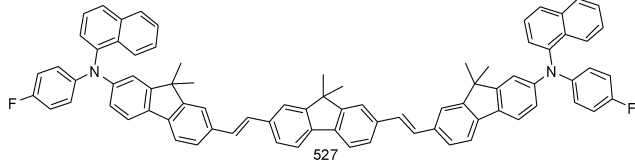
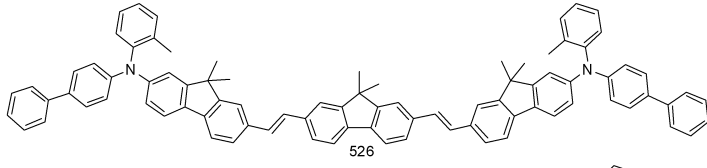
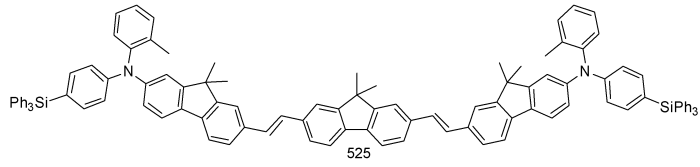
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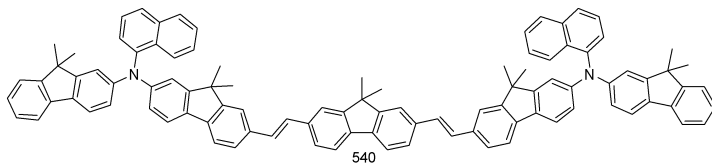
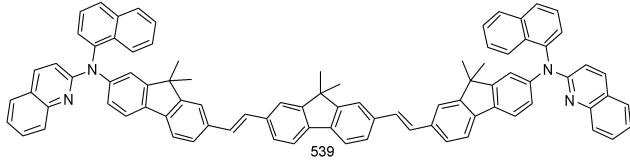
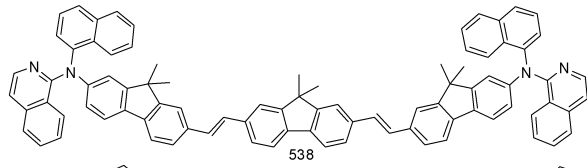
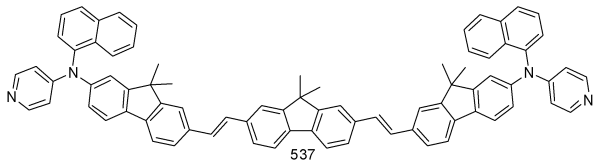
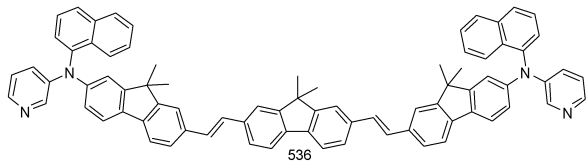
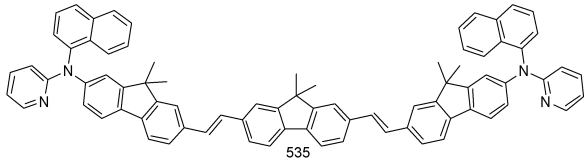
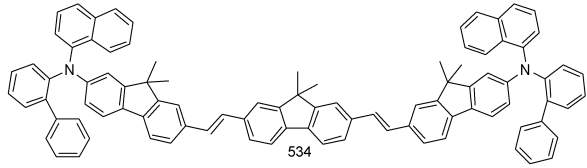
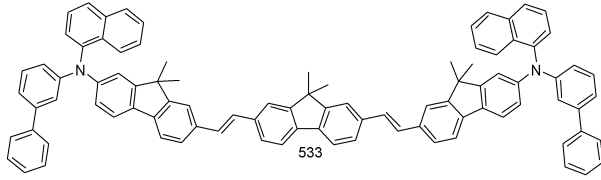
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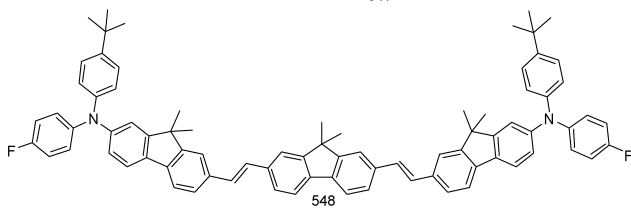
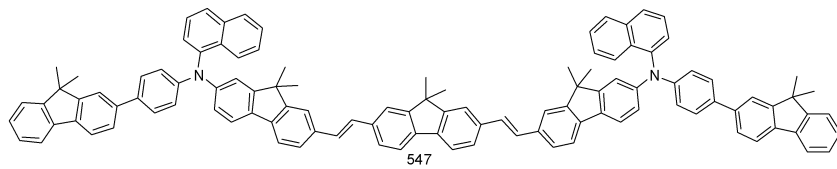
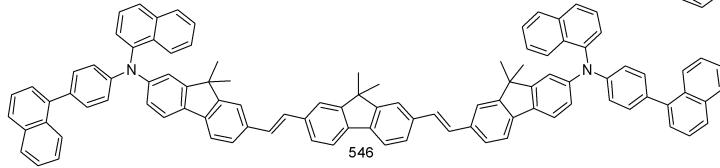
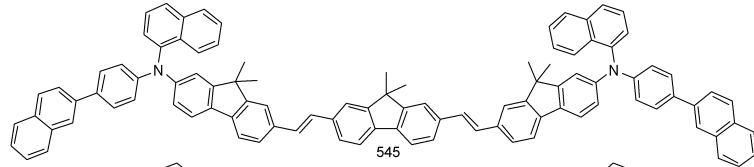
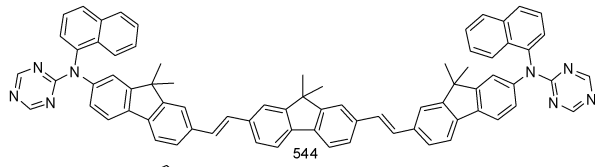
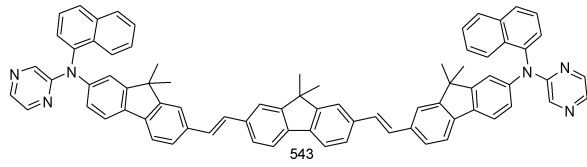
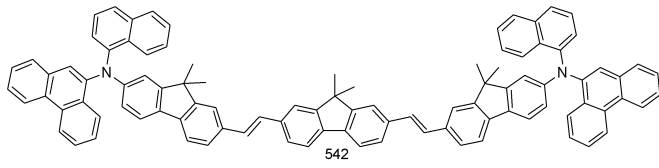
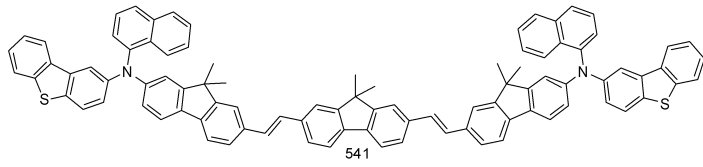
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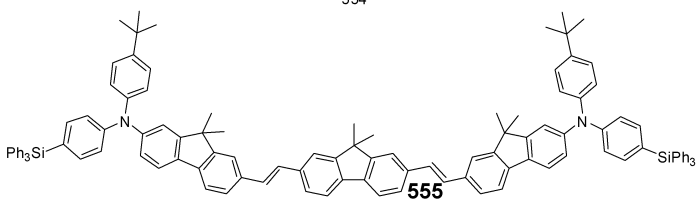
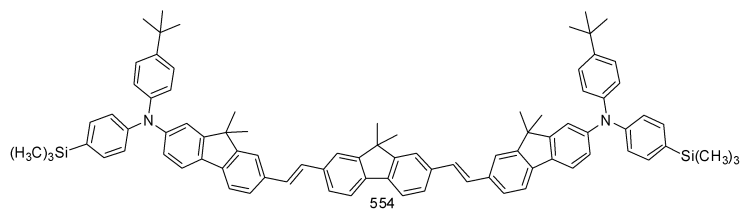
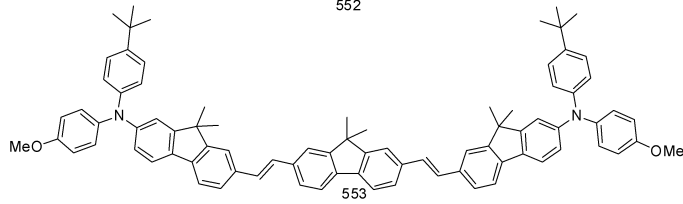
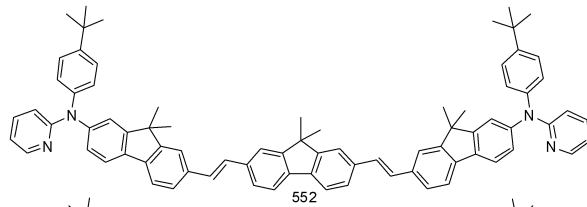
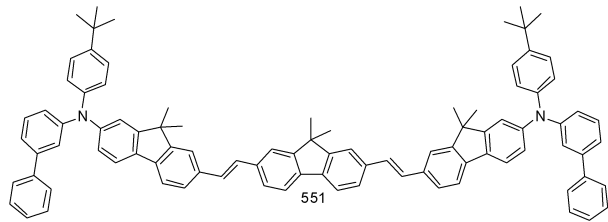
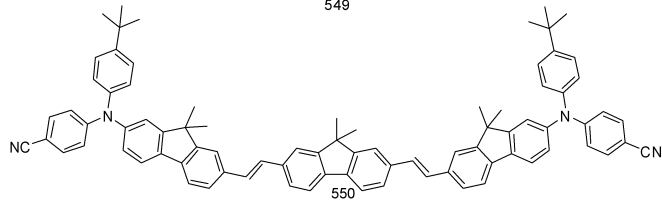
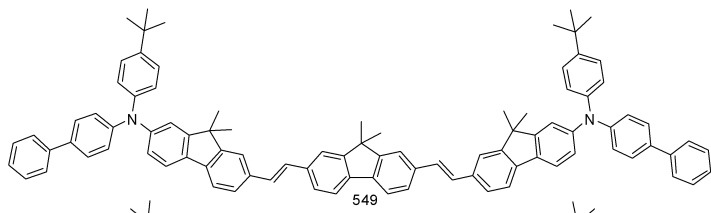
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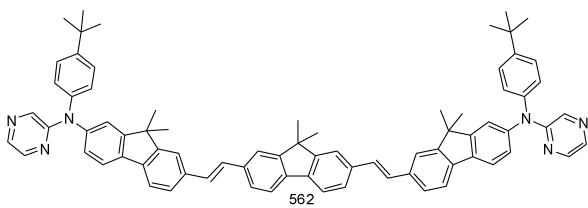
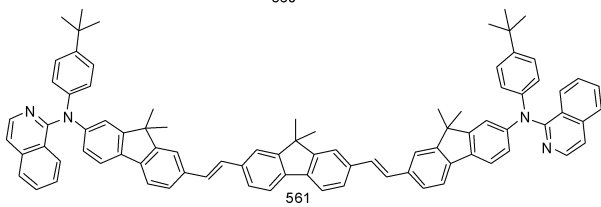
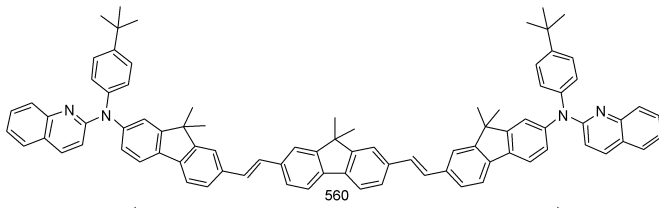
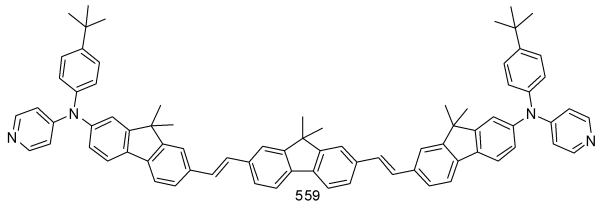
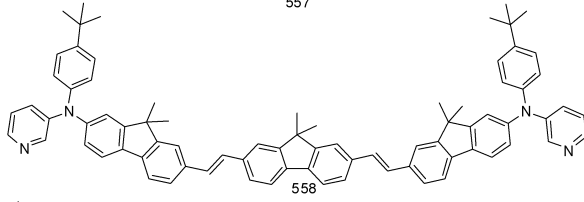
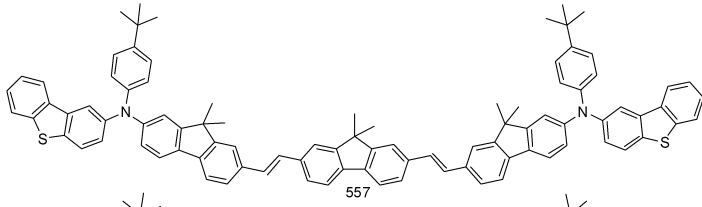
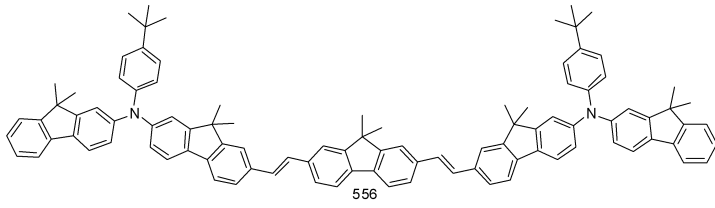
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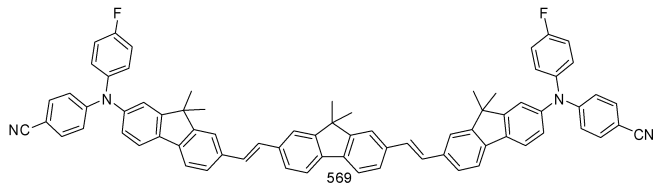
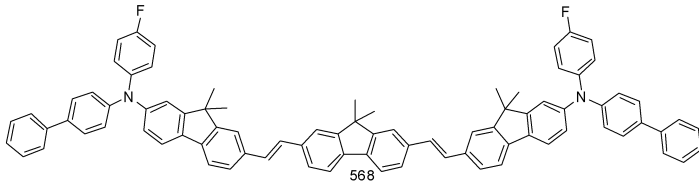
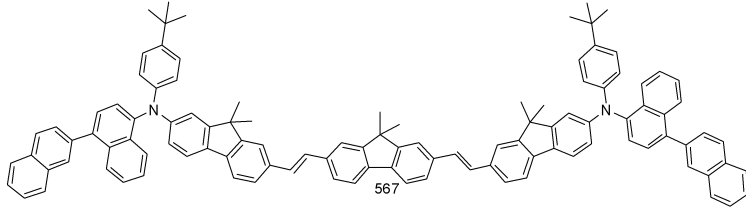
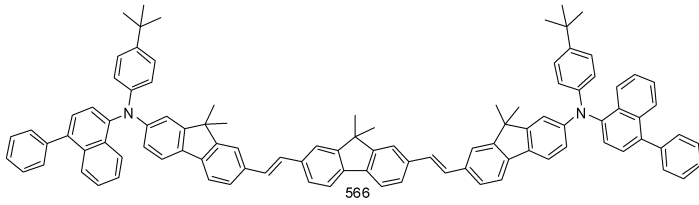
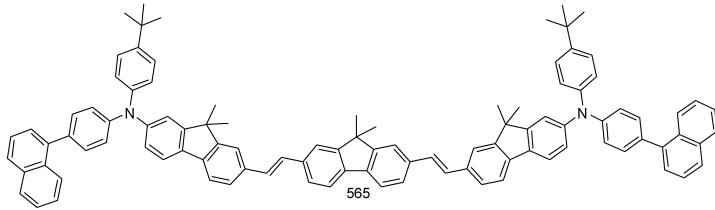
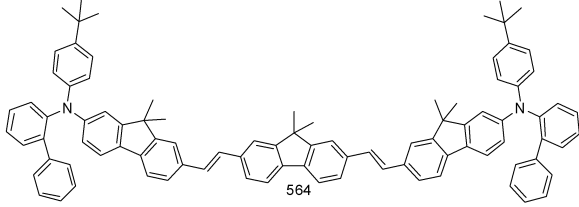
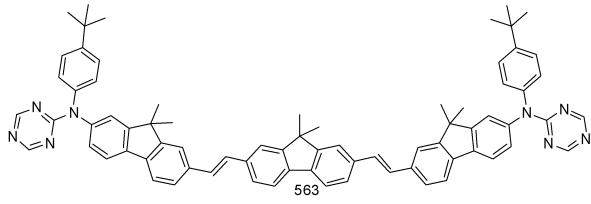
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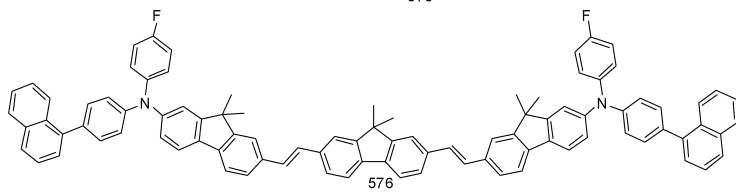
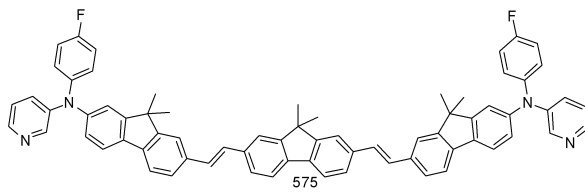
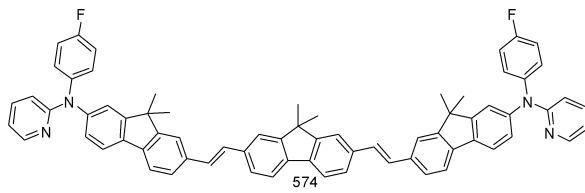
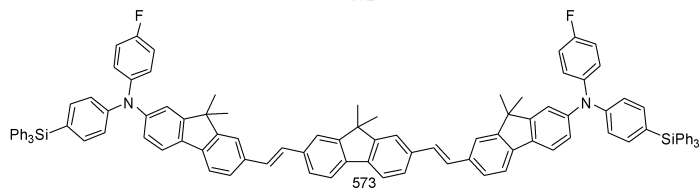
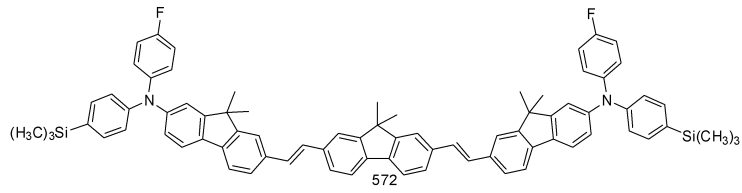
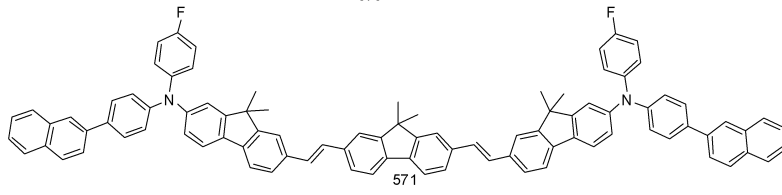
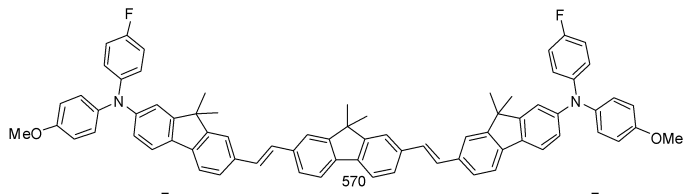
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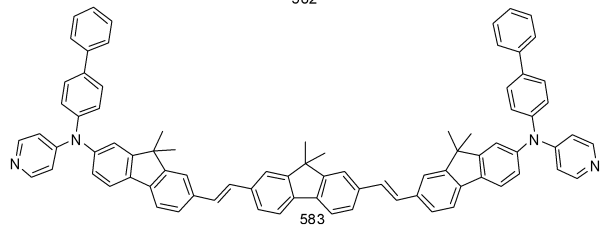
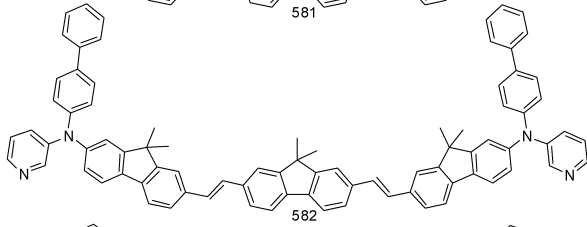
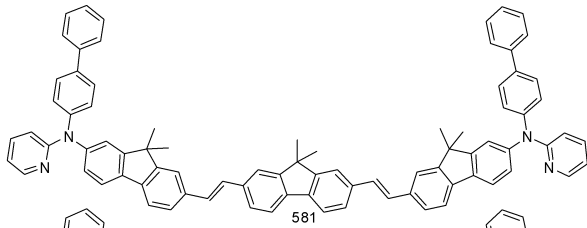
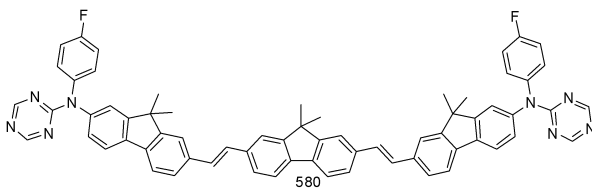
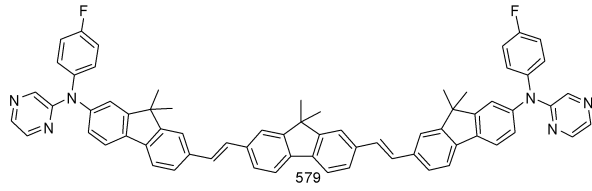
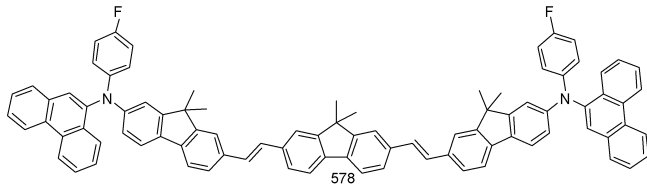
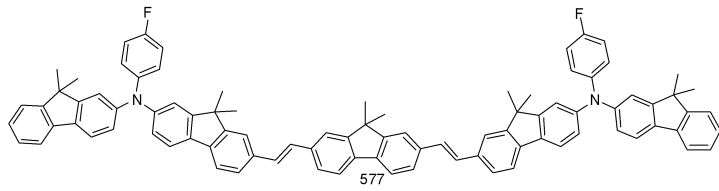
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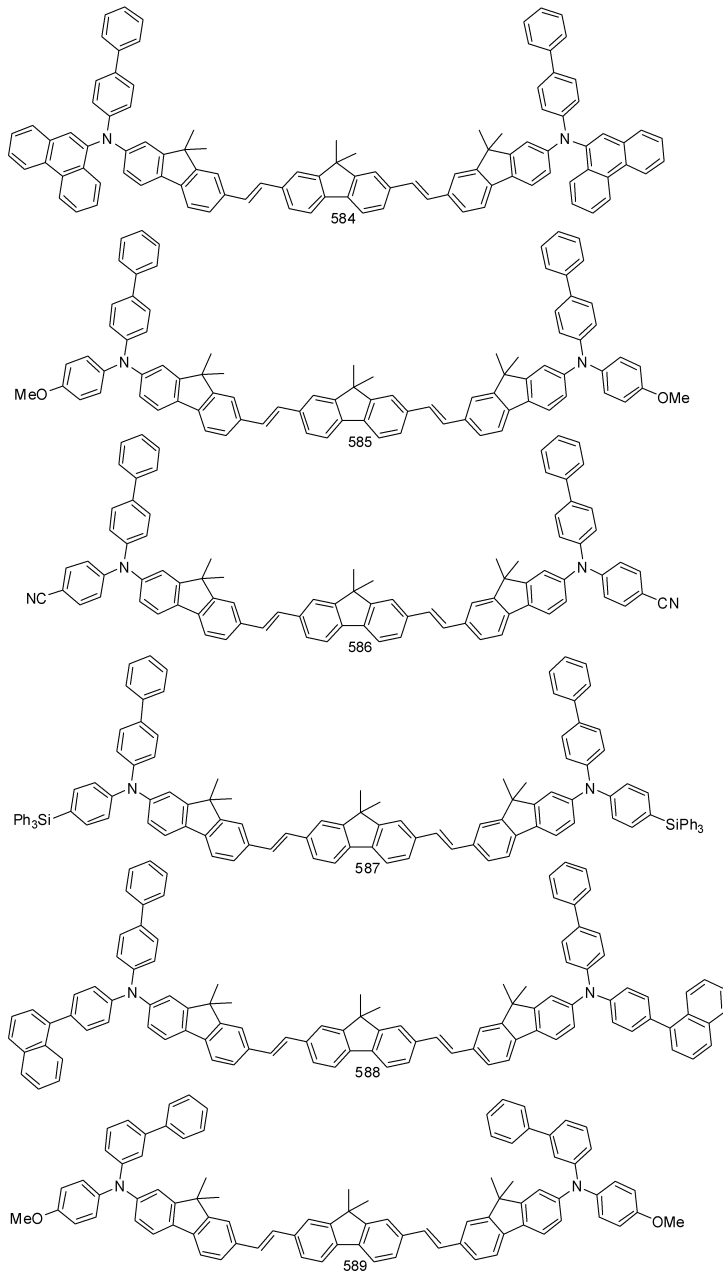
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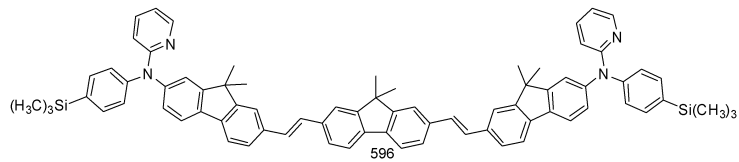
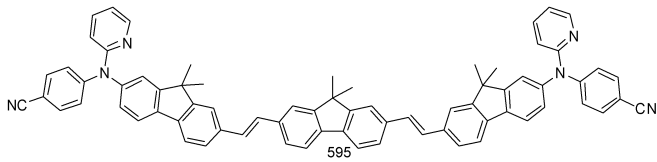
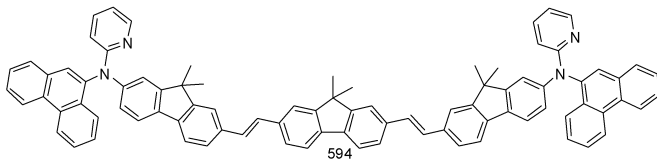
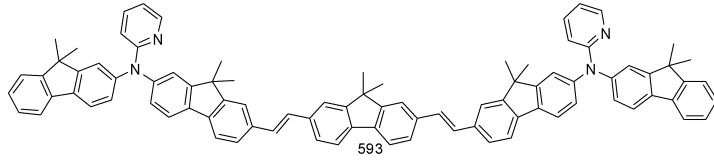
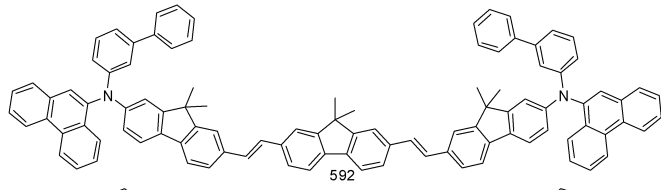
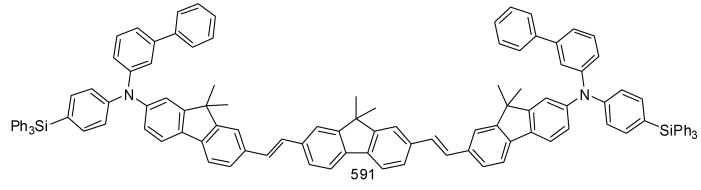
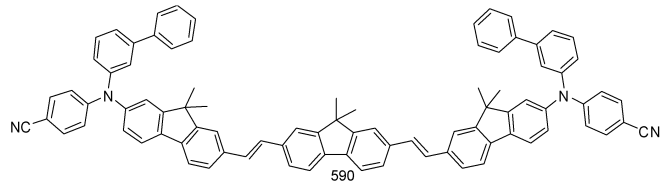
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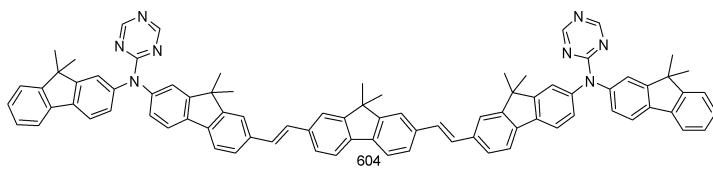
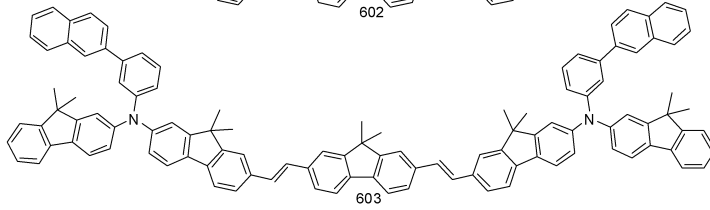
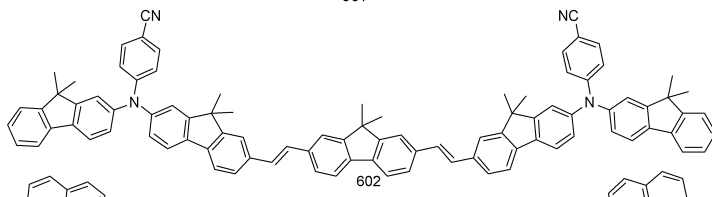
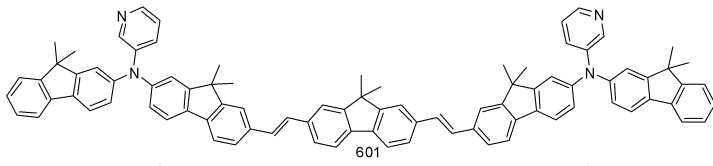
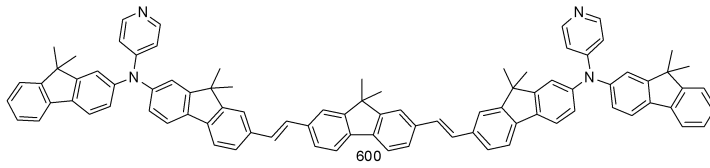
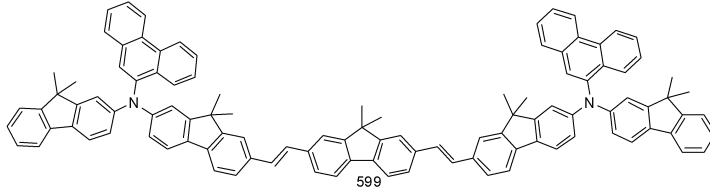
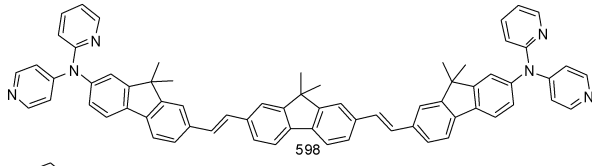
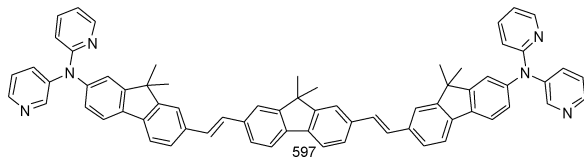
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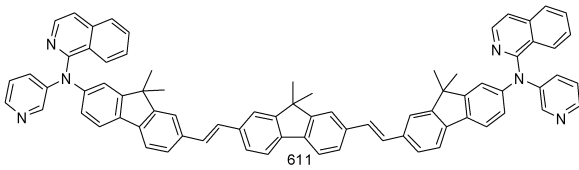
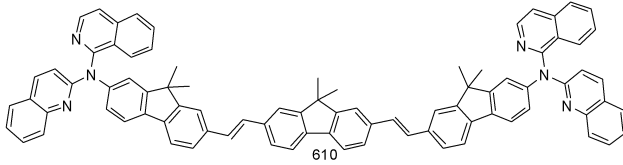
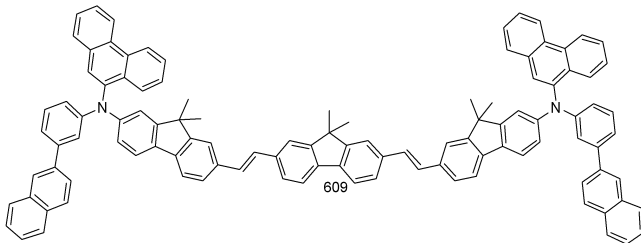
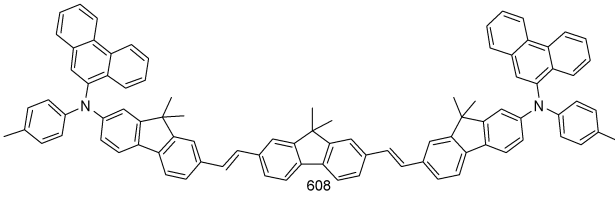
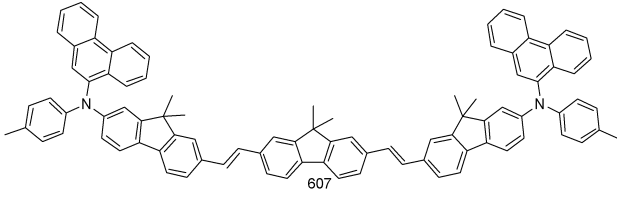
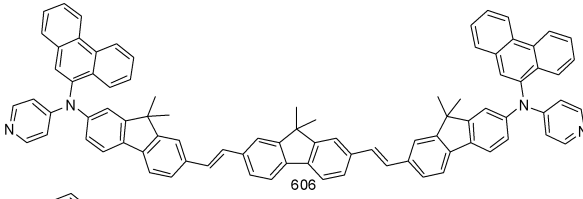
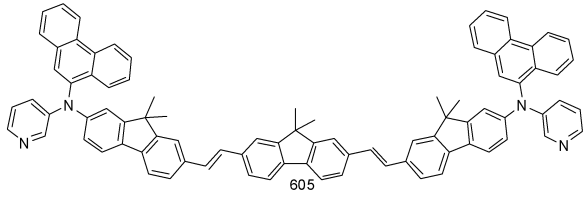
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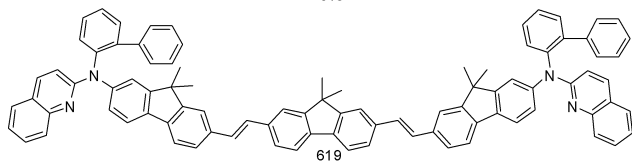
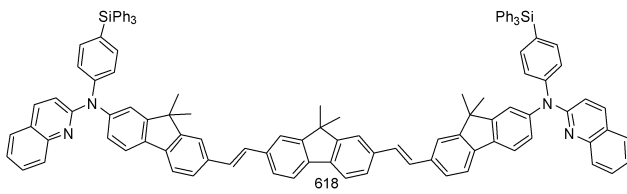
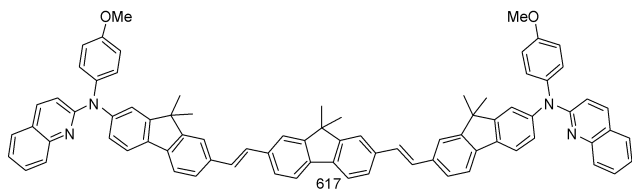
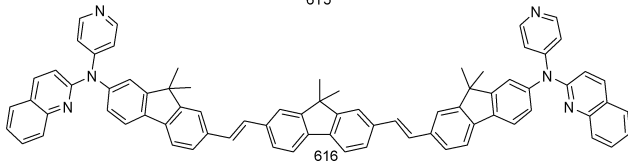
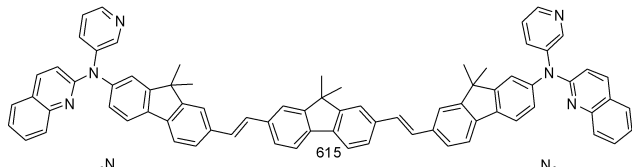
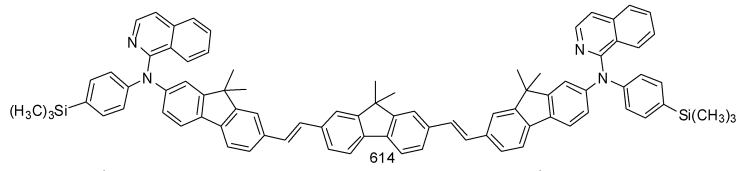
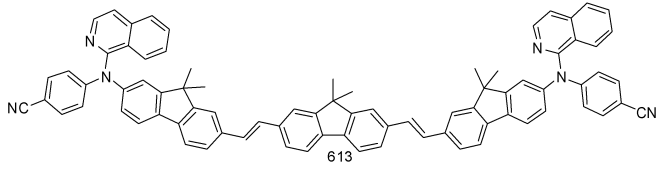
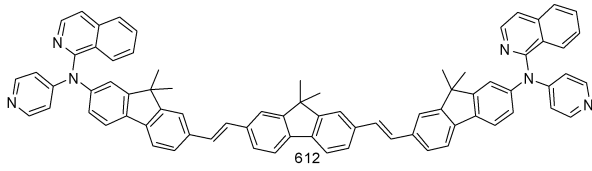
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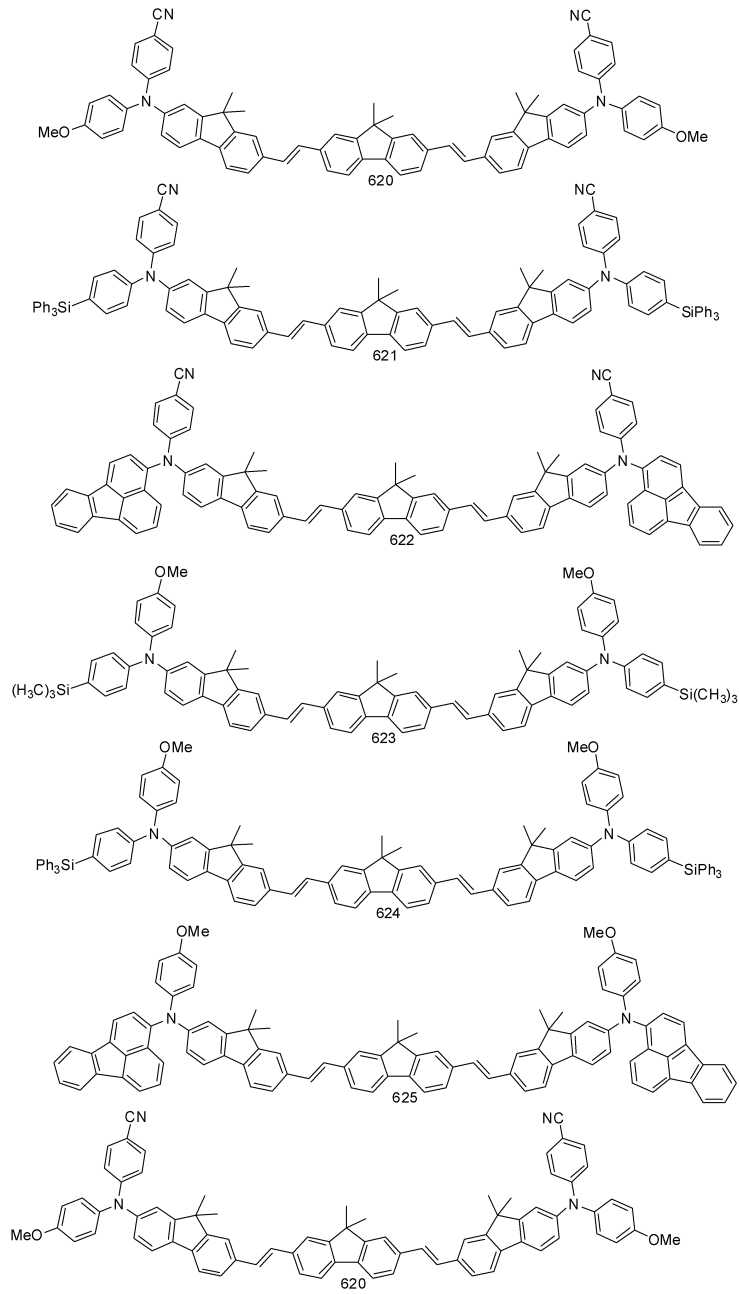
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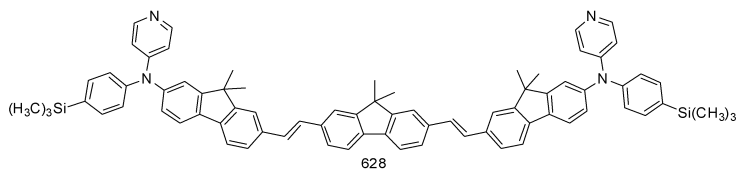
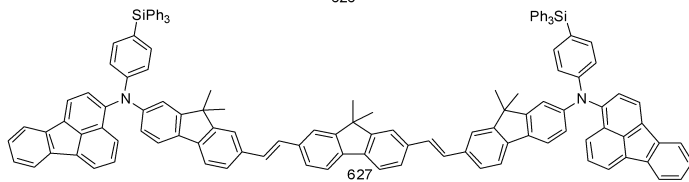
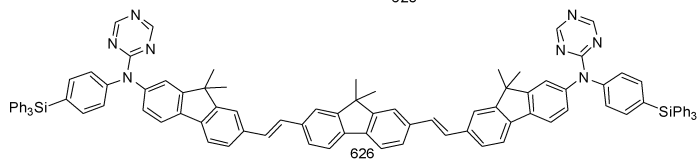
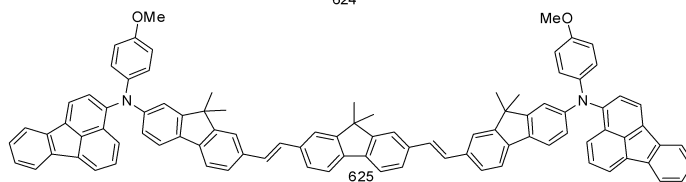
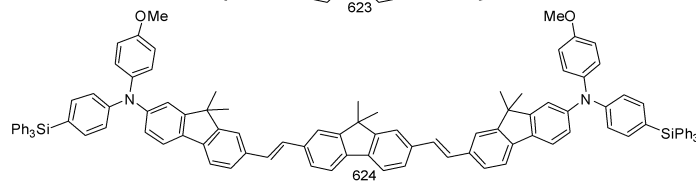
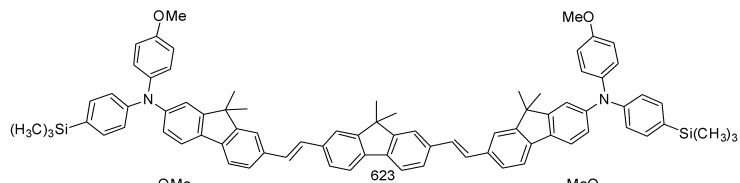
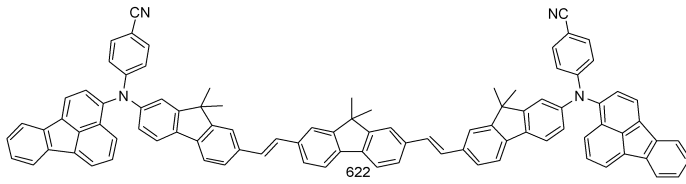
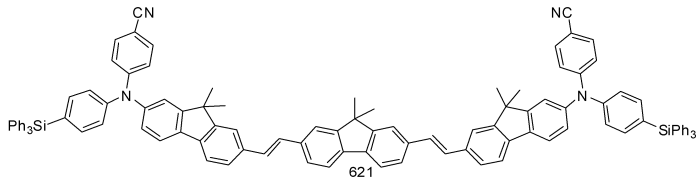
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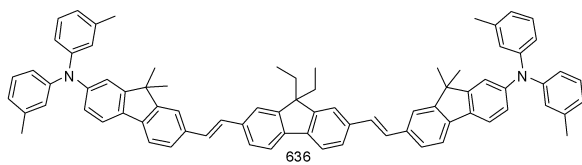
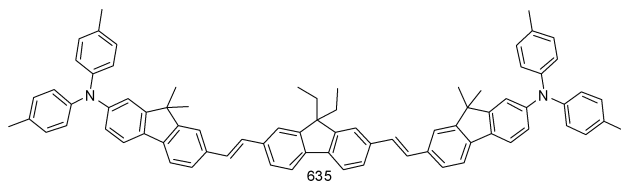
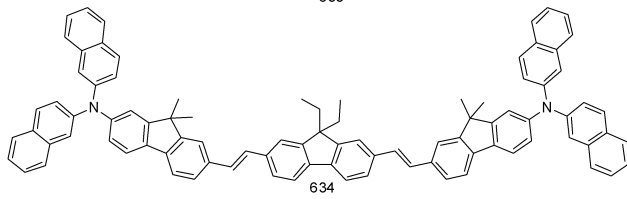
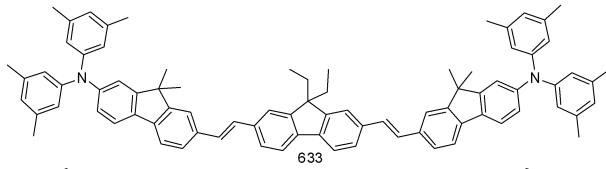
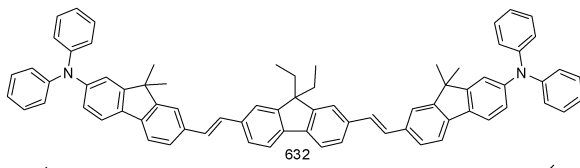
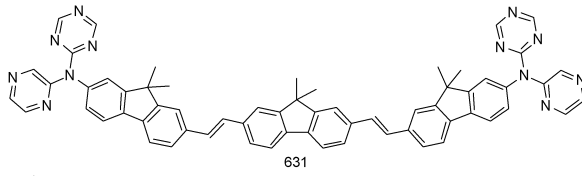
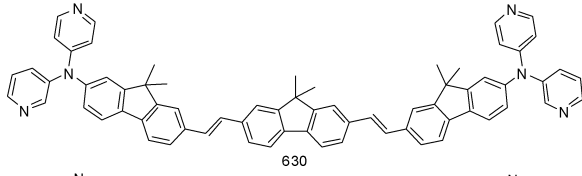
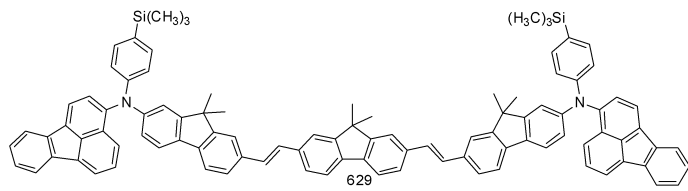
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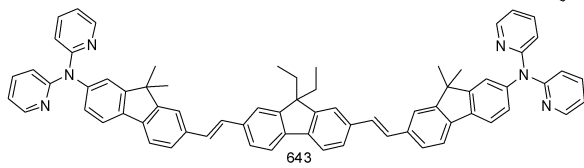
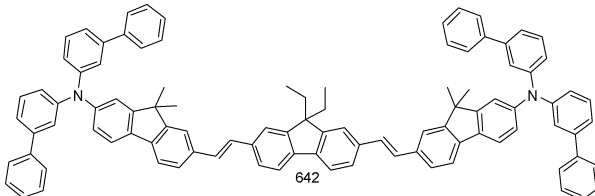
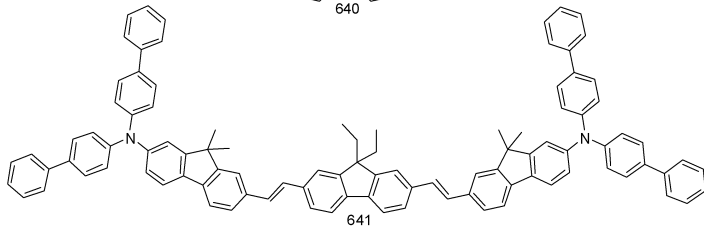
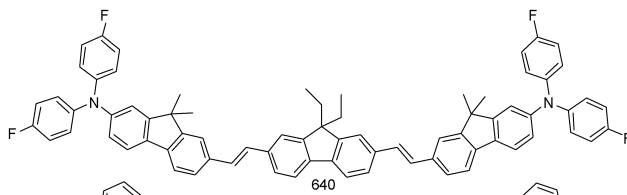
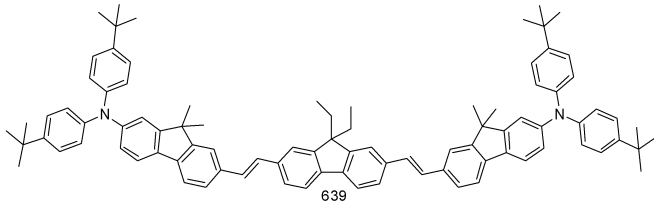
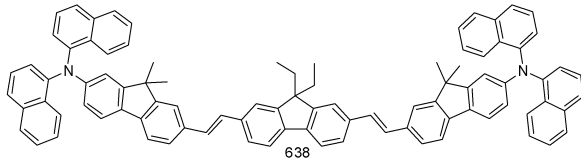
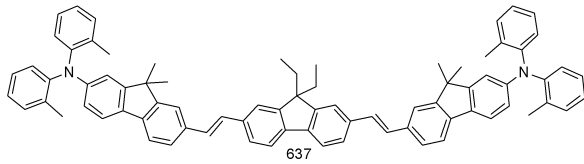
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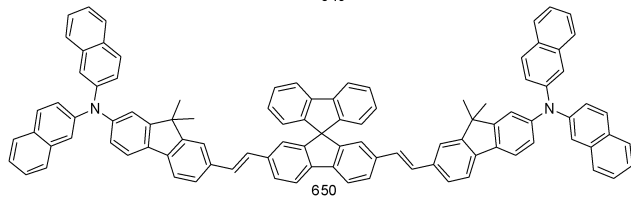
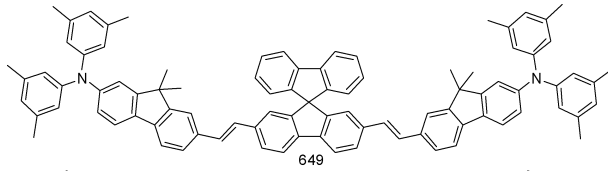
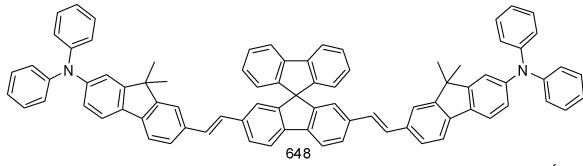
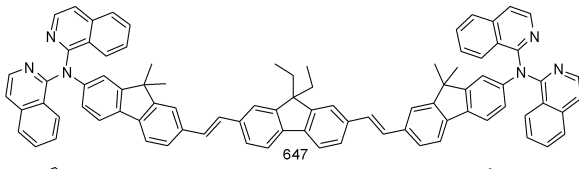
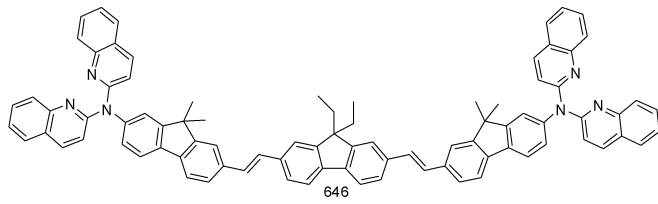
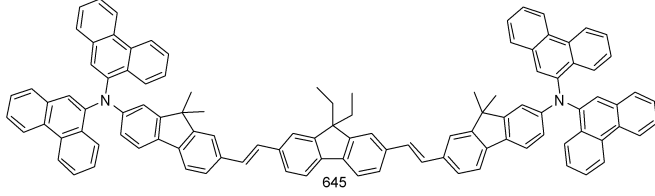
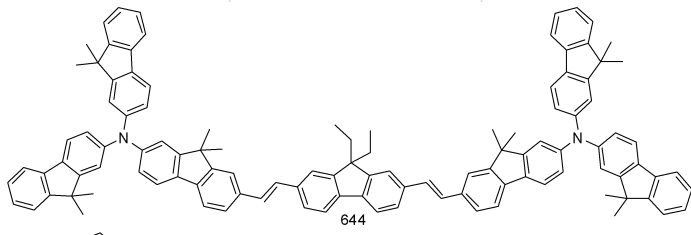
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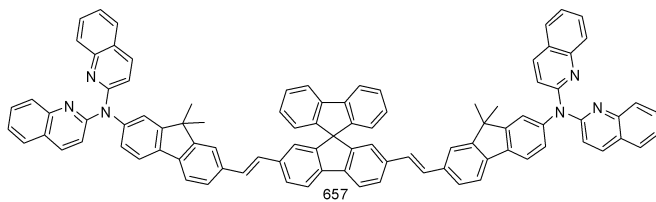
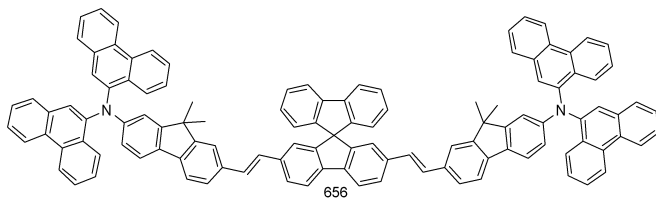
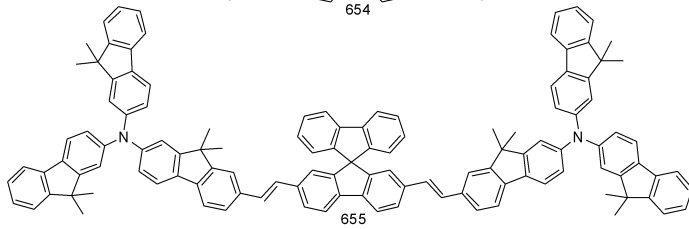
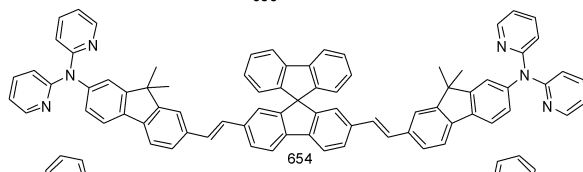
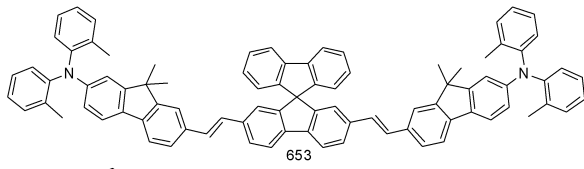
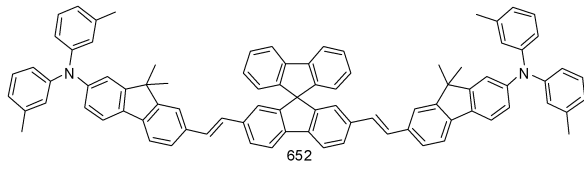
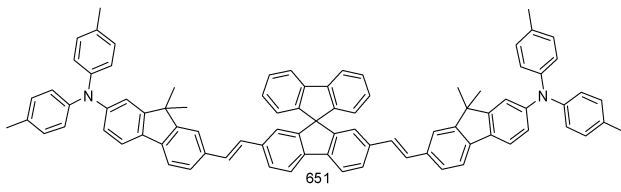
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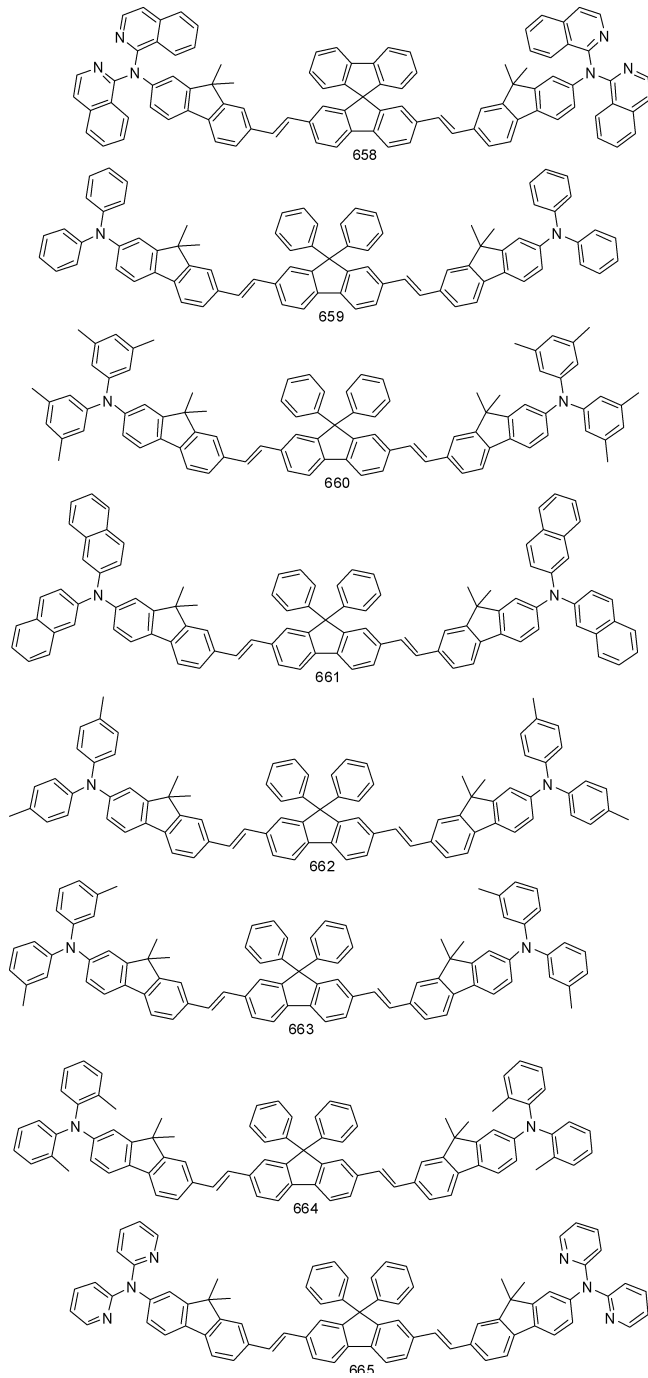
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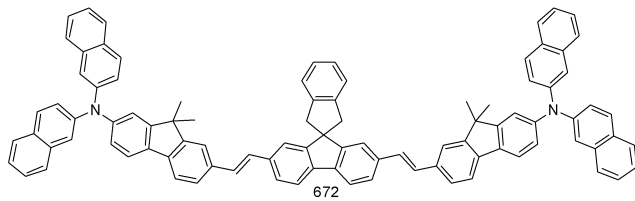
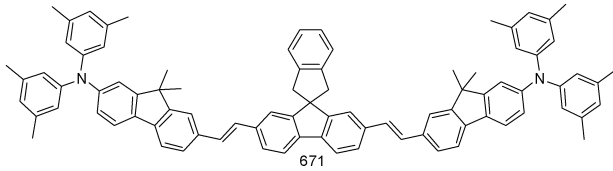
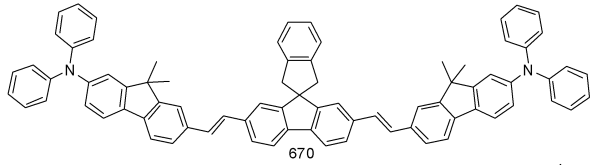
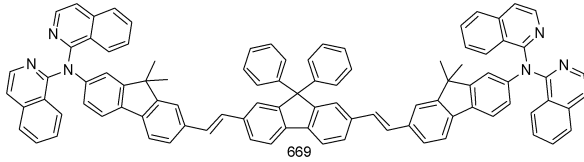
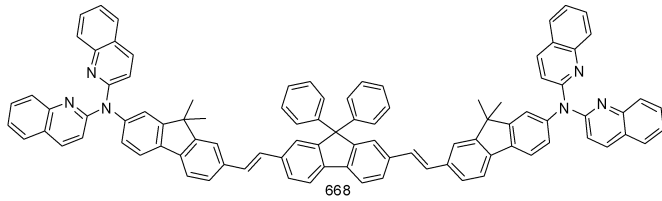
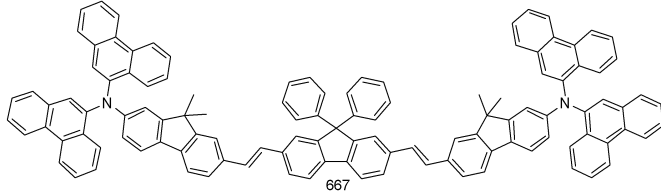
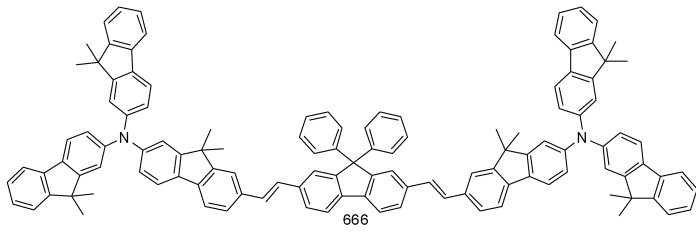
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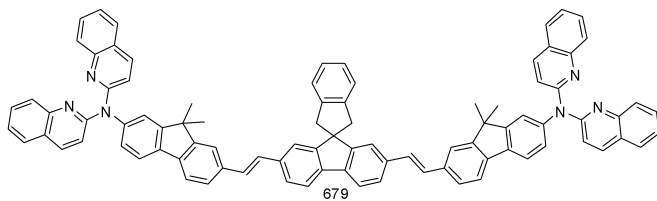
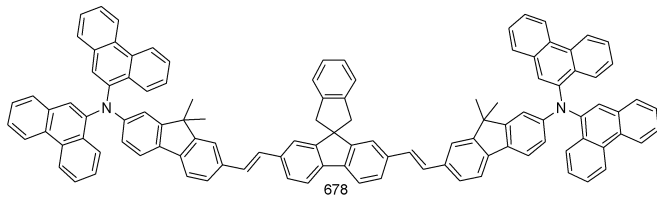
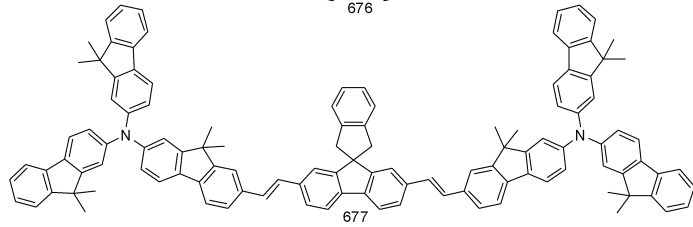
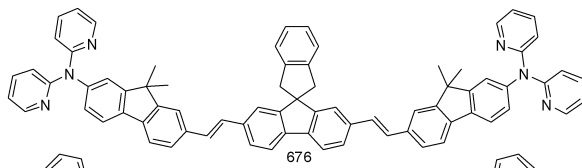
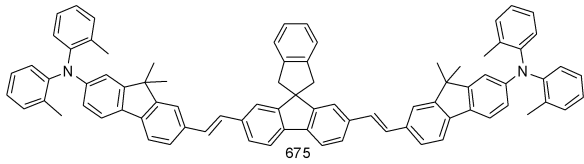
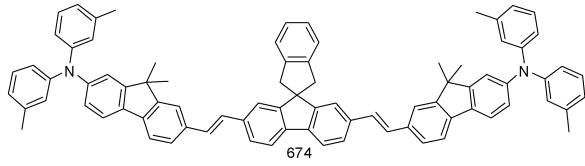
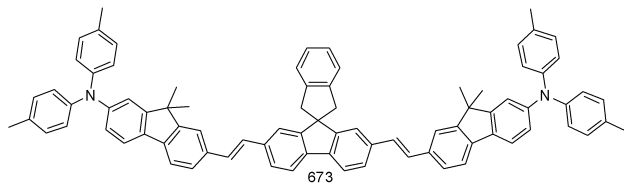
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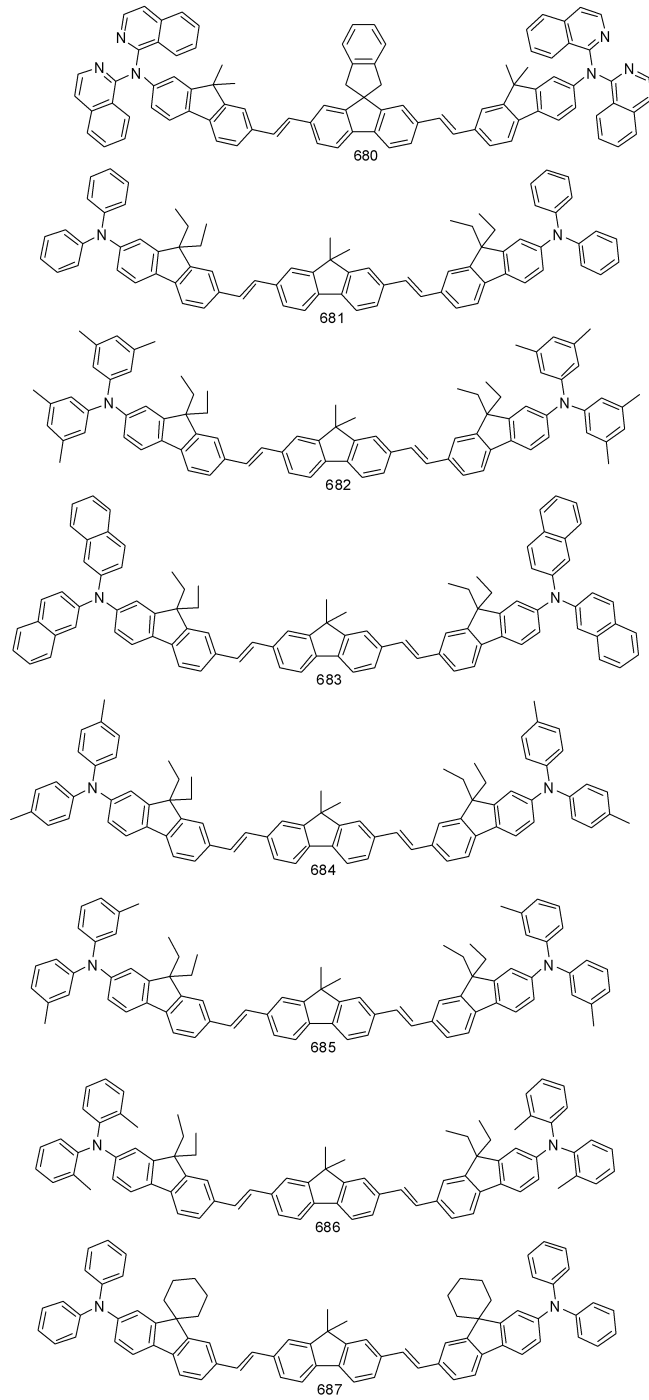
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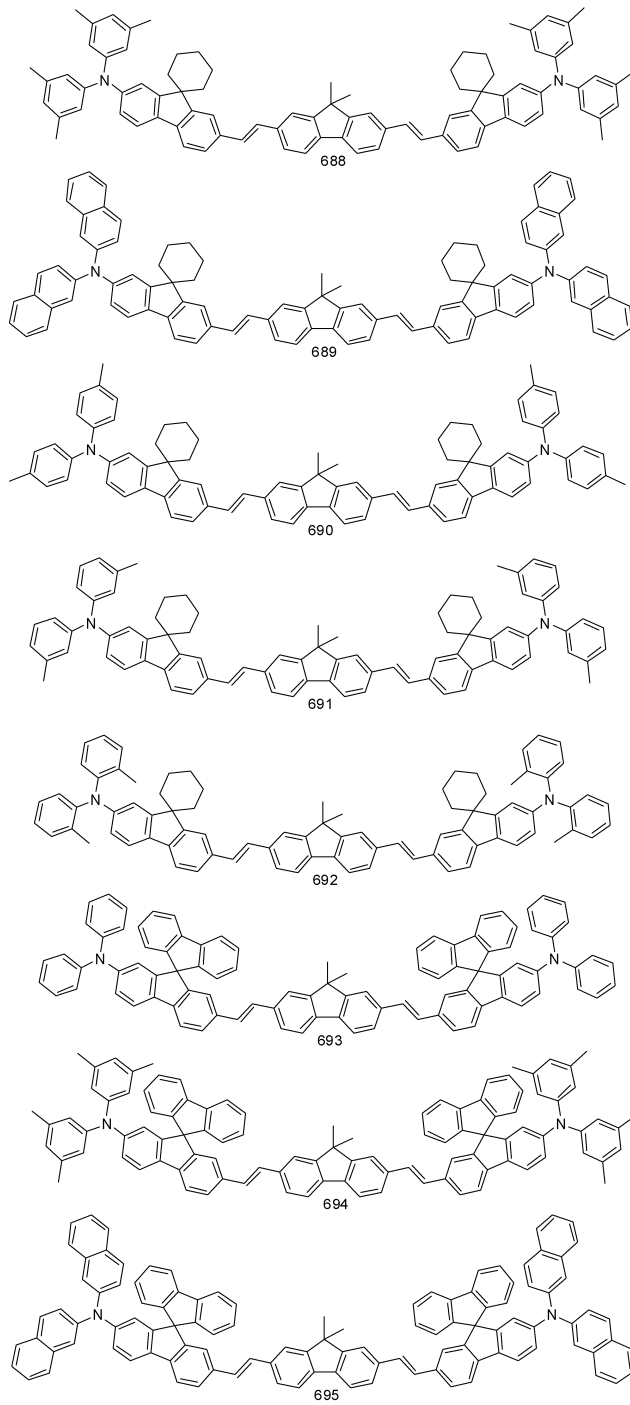
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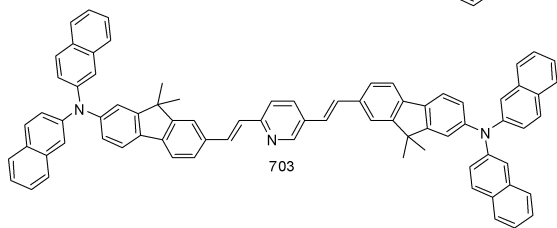
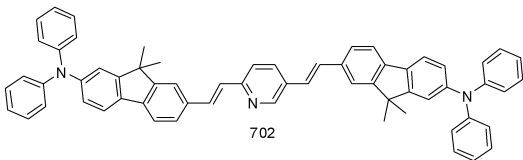
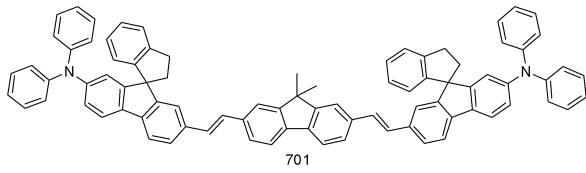
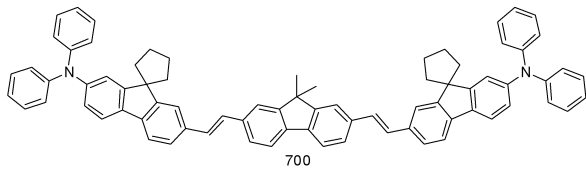
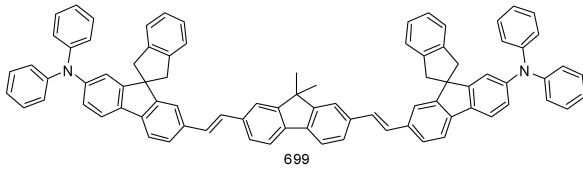
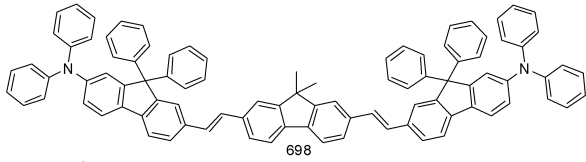
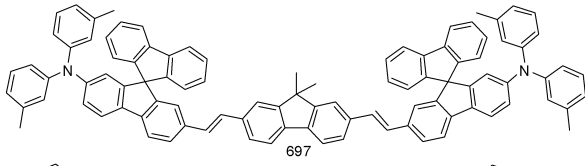
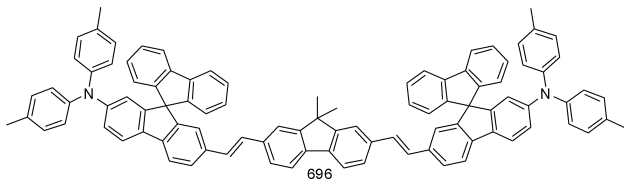
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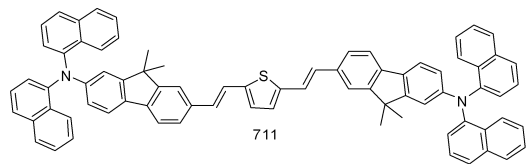
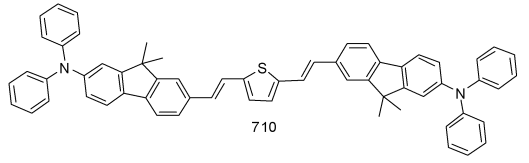
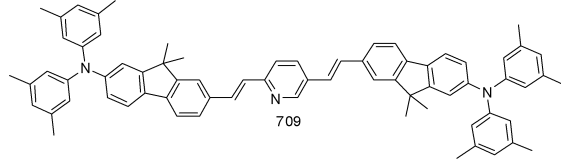
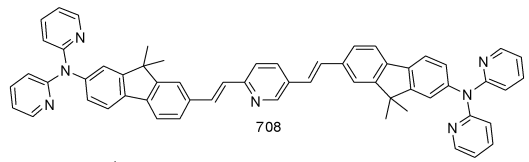
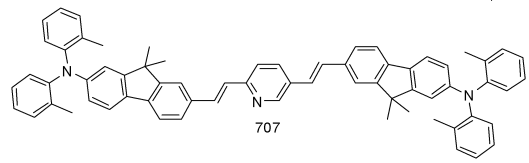
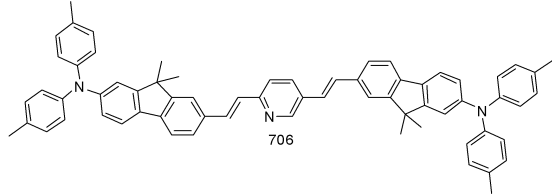
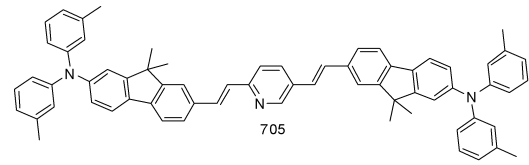
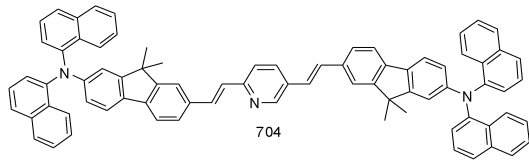
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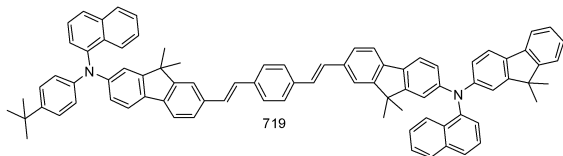
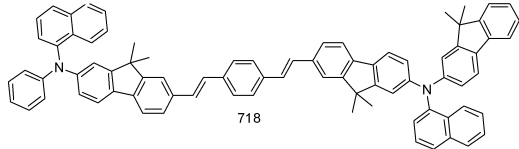
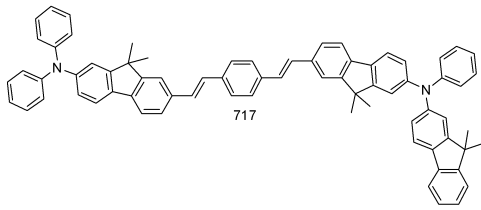
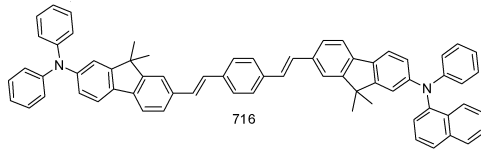
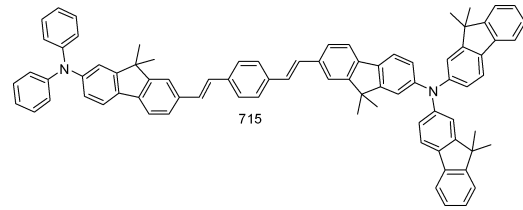
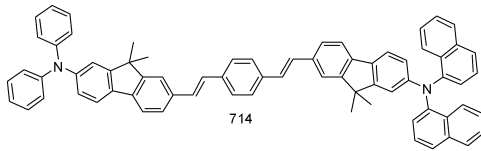
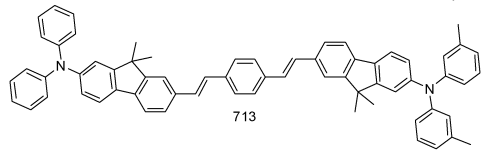
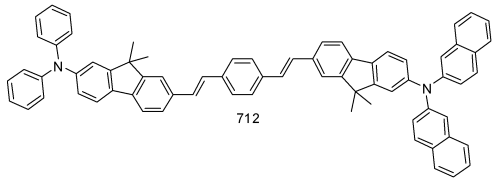
[0140]



[0141]



[0142]

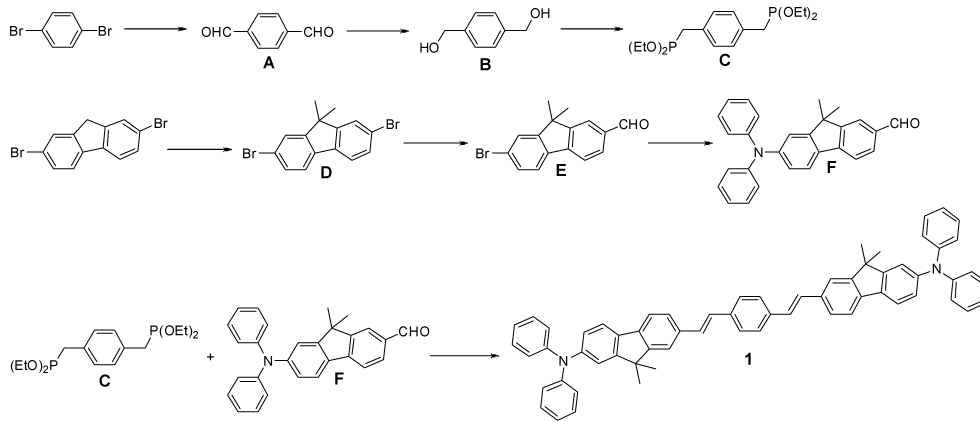


[0143]

[0144]

본 발명에 따른 유기 발광 화합물은 예를 들어 하기 반응식 1에 나타난 바와 같이, 제조될 수 있으며, 하기 반응식으로만 한정되는 것은 아니다.

[0145] [반응식 1]



[0146]

[0147] 또한 본 발명은 유기 태양 전지를 제공하며, 본 발명에 따른 유기 태양 전지는 상기 화학식 1의 유기 발광 화합물을 하나 이상 포함하는 것을 특징으로 한다.

[0148] 또한 본 발명은 유기 발광 소자를 제공하며, 본 발명에 따른 유기 발광 소자는 제1전극; 제2전극; 및 상기 제1전극 및 제2전극 사이에 개재되는 1층 이상의 유기물층으로 이루어진 유기 발광 소자에 있어서, 상기 유기물층은 상기 화학식 1의 유기 발광 화합물을 하나 이상 포함하는 것을 특징으로 한다.

[0149] 본 발명에 따른 유기 발광 소자는 상기 유기물층이 발광층을 포함하며, 상기 발광층은 상기 화학식 1의 하나 이상의 유기 발광 화합물을 발광 도판트로 하여 하나 이상의 호스트를 포함하는 것을 특징으로 하며, 본 발명의 유기 발광 소자에 적용되는 호스트는 특별히 제한되지 않으나, 하기 화학식 2 및 화학식 3으로 표시되는 화합물에서 선택되는 것이 바람직하다.

[0150] [화학식 2]

[0151] $(Ar_{11})_a-X-(Ar_{12})_b$

[0152] [화학식 3]

[0153] $(Ar_{13})_c-Y-(Ar_{14})_d$

[0154] [상기 화학식 2 및 화학식 3에서,

[0155] X는 (C6-C60)아틸렌 또는 (C4-C60)헤테로아틸렌이고;

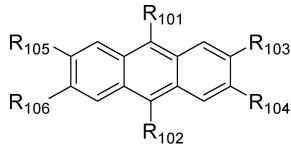
[0156] Y는 안트라세닐렌이며;

[0157] Ar_{11} 내지 Ar_{14} 는 서로 독립적으로 수소, 중수소이거나, (C1-C60)알킬, (C1-C60)알콕시, 할로젠, (C4-C60)헤테로아틸, (C5-C60)시클로알킬 또는 (C6-C60)아릴로부터 선택되고, 상기 Ar_{11} 내지 Ar_{14} 의 시클로알킬, 아틸 또는 헤테로아틸은 중수소, 할로젠이 치환되거나 치환되지 않은 (C1-C60)알킬, (C1-C60)알콕시, (C3-C60)시클로알킬, 할로젠, 시아노, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴 또는 트리(C6-C60)아릴실릴로 이루어진 군으로부터 선택된 하나 이상이 치환되거나 치환되지 않은 (C6-C60)아틸 또는 (C4-C60)헤테로아틸, 할로젠이 치환되거나 치환되지 않은 (C1-C60)알킬, (C1-C60)알콕시, (C3-C60)시클로알킬, 중수소, 할로젠, 시아노, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴 또는 트리(C6-C60)아릴실릴로 이루어지는 군에서 선택되는 하나 이상의 치환기가 더 치환될 수 있고;

[0158] a, b, c, 및 d는 독립적으로 0 내지 4의 정수이다.]

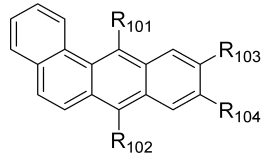
[0159] 상기 화학식 2 및 화학식 3의 호스트는 화학식 4 내지 화학식 7로 표시되는 안트라센 유도체 또는 벤즈[a]안트라센 유도체로 예시될 수 있다.

[0160] [화학식 4]



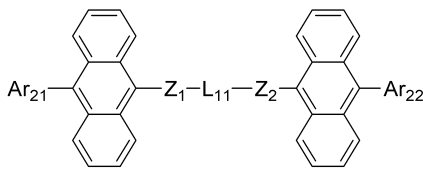
[0161]

[0162] [화학식 5]



[0163]

[0164] [화학식 6]



[0165]

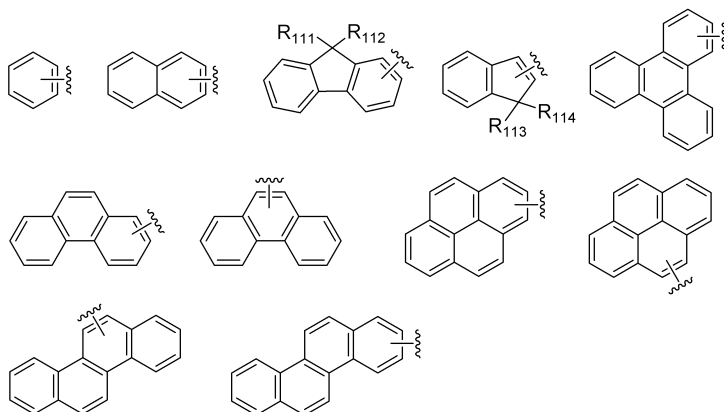
[0166] [상기 화학식 4 내지 화학식 6에서,

[0167] R₁₀₁ 및 R₁₀₂는 서로 독립적으로 수소, 중수소, (C1-C60)알킬, 할로젠, (C6-C60)아릴, (C4-C60)헤테로아릴, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬 또는 (C3-C60)시클로알킬이며, 상기 R₁₀₁ 및 R₁₀₂의 아릴 또는 헤테로아릴은 중수소, (C1-C60)알킬, 할로(C1-C60)알킬, (C1-C60)알콕시, (C3-C60)시클로알킬, (C6-C60)아릴, (C4-C60)헤테로아릴, 할로젠, 시아노, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴 또는 트리(C6-C60)아릴실릴로 이루어지는 군에서 선택되는 하나 이상의 치환기가 더 치환될 수 있으며;

[0168] R₁₀₃ 내지 R₁₀₆는 서로 독립적으로 수소, 중수소, (C1-C60)알킬, (C1-C60)알콕시, 할로젠, (C4-C60)헤테로아릴, (C5-C60)시클로알킬 또는 (C6-C60)아릴이며, 상기 R₁₀₃ 내지 R₁₀₆의 헤테로아릴, 시클로알킬 또는 아릴은 중수소, 할로젠이 치환되거나 치환되지 않은 (C1-C60)알킬, (C1-C60)알콕시, (C3-C60)시클로알킬, 할로젠, 시아노, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴 또는 트리(C6-C60)아릴실릴로 이루어지는 군에서 선택되는 하나 이상의 치환기가 더 치환될 수 있고;

[0169] Z₁ 및 Z₂는 서로 독립적으로 화합결합이거나 (C1-C60)알킬, (C1-C60)알콕시, (C6-C60)아릴, (C4-C60)헤테로아릴 또는 할로젠으로부터 선택된 하나 이상이 치환되거나 치환되지 않은 (C6-C60)아릴렌이며, ;

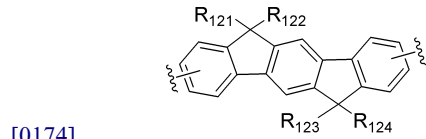
[0170] Ar₂₁ 및 Ar₂₂는 하기 구조에서 선택되는 아릴 또는 (C4-C60)헤테로아릴이며,



[0171]

[0172] 상기 Ar₂₁ 및 Ar₂₂의 아릴 또는 헤테로아릴은 (C1-C60)알킬, (C1-C60)알콕시, (C6-C60)아릴 또는 (C4-C60)헤테로아릴로부터 선택된 치환기가 하나이상 치환될 수 있고;

[0173] L₁₁는 (C6-C60)아릴렌, (C4-C60)헤테로아릴렌 또는 하기 구조의 화합물이며,

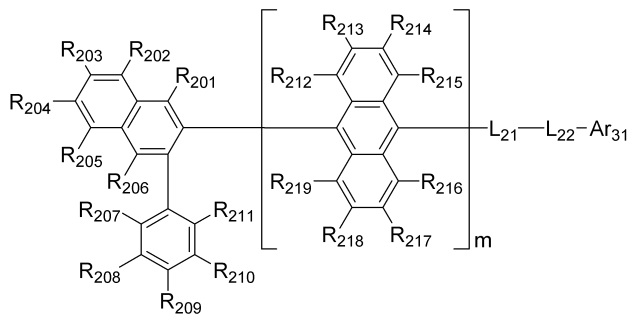


[0174] 상기 L₁₁의 아릴렌 또는 헤테로아릴렌은 (C1-C60)알킬, (C1-C60)알콕시, (C6-C60)아릴, (C4-C60)헤테로아릴 또는 할로젠으로부터 선택된 하나 이상이 치환될 수 있으며;

[0176] R₁₁₁, R₁₁₂, R₁₁₃ 및 R₁₁₄는 서로 독립적으로 수소, 중수소, (C1-C60)알킬 또는 (C6-C60)아릴이거나, 인접한 치환체와 융합고리를 포함하거나 포함하지 않는 (C3-C60)알킬렌 또는 (C3-C60)알케닐렌으로 연결되어 지환족 고리 및 단일환 또는 다환의 방향족 고리를 형성할 수 있으며,

[0177] R₁₂₁, R₁₂₂, R₁₂₃ 및 R₁₂₄는 서로 독립적으로 수소, 중수소, (C1-C60)알킬, (C1-C60)알콕시, (C6-C60)아릴, (C4-C60)헤테로아릴 또는 할로젠이거나, 인접한 치환체와 융합고리를 포함하거나 포함하지 않는 (C3-C60)알킬렌 또는 (C3-C60)알케닐렌으로 연결되어 지환족 고리 및 단일환 또는 다환의 방향족 고리를 형성할 수 있다.]

[0178] [화학식 7]

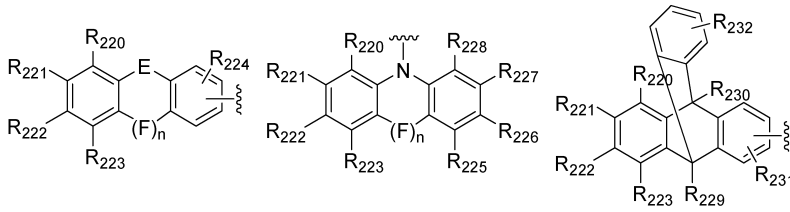


[0179] [상기 화학식 7에서,

[0180] L₂₁ 및 L₂₂는 서로 독립적으로 화학결합이거나, (C6-C60)아릴렌 또는 (C3-C60)헤테로아릴렌이고, 상기 L₂₁ 및 L₂₂의 아릴렌 또는 헤테로아릴렌은 중수소, (C1-C60)알킬, 할로젠, 시아노, (C1-C60)알콕시, (C3-C60)시클로알킬, (C6-C60)아릴, (C3-C60)헤테로아릴, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴 또는 트리(C6-C30)아릴실릴로부터 선택된 하나 이상이 더 치환될 수 있으며;

[0182] R₂₀₁ 내지 R₂₁₉는 서로 독립적으로 수소, 중수소, 할로젠, (C1-C60)알킬, (C6-C60)아릴, (C4-C60)헤테로아릴, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴, 트리(C6-C60)아릴실릴, 아다만틸, (C7-C60)바이시클로알킬, (C2-C60)알케닐, (C2-C60)알키닐, (C1-C60)알콕시, 시아노, (C1-C60)알킬아미노, (C6-C60)아릴아미노, (C6-C60)아르(C1-C60)알킬, (C6-C60)아릴옥시, (C6-C60)아릴티오, (C1-C60)알콕시카보닐, 카르복실, 나이트로 또는 하이드록시이거나, R₂₀₁ 내지 R₂₁₉는 인접한 치환체와 융합고리를 포함하거나 포함하지 않는 (C3-C60)알킬렌 또는 (C3-C60)알케닐렌으로 연결되어 지환족 고리 및 단일환 또는 다환의 방향족 고리를 형성할 수 있고,

[0183] Ar₃₁은 (C6-C60)아릴, (C4-C60)헤테로아릴, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 아다만틸, (C7-C60)바이시클로알킬이거나, 하기 구조에서 선택되는 치환기이고,



[0184]

[0185]

상기 R₂₂₀ 내지 R₂₃₂는 서로 독립적으로 수소, 중수소, 할로젠, (C1-C60)알킬, (C6-C60)아릴, (C4-C60)헤테로아릴, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴, 트리(C6-C60)아릴실릴, 아다만틸, (C7-C60)바이시클로알킬, (C2-C60)알케닐, (C2-C60)알키닐, (C1-C60)알콕시, 시아노, (C1-C60)알킬아미노, (C6-C60)아릴아미노, (C6-C60)아르(C1-C60)알킬, (C6-C60)아릴옥시, (C6-C60)아릴티오, (C1-C60)알콕시카보닐, 카르복실, 나이트로 또는 하이드록시이고;

[0186]

E 및 F는 서로 독립적으로 화학결합이거나, CR₂₃₃R₂₃₄, NR₂₃₅, S, O, SiR₂₃₆R₂₃₇, PR₃₈, CO, BR₂₃₉, InR₂₄₀, Se, GeR₂₄₁R₂₄₂, SnR₂₄₃R₂₄₄, GaR₂₄₅이며;

[0187]

R₂₃₃ 내지 R₂₄₅는 서로 독립적으로 수소, 중수소, 할로젠, (C1-C60)알킬, (C6-C60)아릴, (C4-C60)헤테로아릴, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴, 트리(C6-C60)아릴실릴, 아다만틸, (C7-C60)바이시클로알킬, (C2-C60)알케닐, (C2-C60)알키닐, (C1-C60)알콕시, 시아노, (C1-C60)알킬아미노, (C6-C60)아릴아미노, (C6-C60)아르(C1-C60)알킬, (C6-C60)아릴옥시, (C6-C60)아릴티오, (C1-C60)알콕시카보닐, 카르복실, 나이트로 또는 하이드록시이거나, R₂₃₃ 내지 R₂₄₅는 인접한 치환체와 융합고리를 포함하거나 포함하지 않는 (C3-C60)알킬렌 또는 (C3-C60)알케닐렌으로 연결되어 치환체 고리 및 단일환 또는 다환의 방향족 고리를 형성할 수 있으며;

[0188]

상기 Ar₃₁의 아릴, 헤테로아릴, 헤테로시클로알킬, 아다만틸, 바이시클로알킬 또는 R₂₀₁ 내지 R₂₃₂의 알킬, 알케닐, 알키닐, 시클로알킬, 헤테로시클로알킬, 아릴, 헤테로아릴, 아릴실릴, 알킬실릴, 알킬아미노 및 아릴아미노는 중수소, 할로젠, (C1-C60)알킬, (C6-C60)아릴, (C4-C60)헤테로아릴, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴, 트리(C6-C60)아릴실릴, 아다만틸, (C7-C60)바이시클로알킬, (C2-C60)알케닐, (C2-C60)알키닐, (C1-C60)알콕시, 시아노, (C1-C60)알킬아미노, (C6-C60)아릴아미노, (C6-C60)아르(C1-C60)알킬, (C6-C60)아릴옥시, (C6-C60)아릴티오, (C1-C60)알콕시카보닐, 카르복실, 나이트로 또는 하이드록시로부터 선택된 하나 이상이 더 치환될 수 있으며;

[0189]

m은 1 내지 4의 정수이고;

[0190]

n은 0 내지 4의 정수이다.]

[0191]

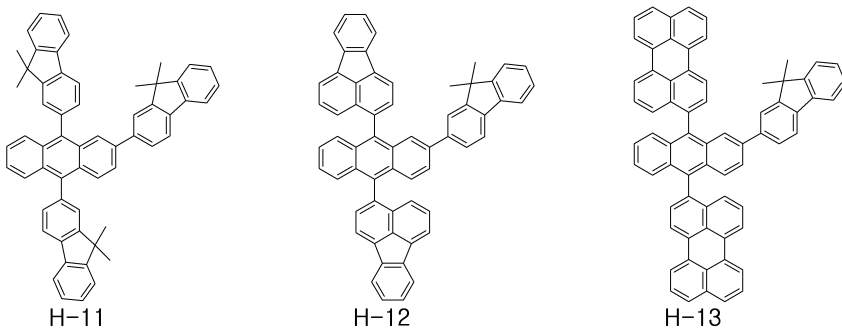
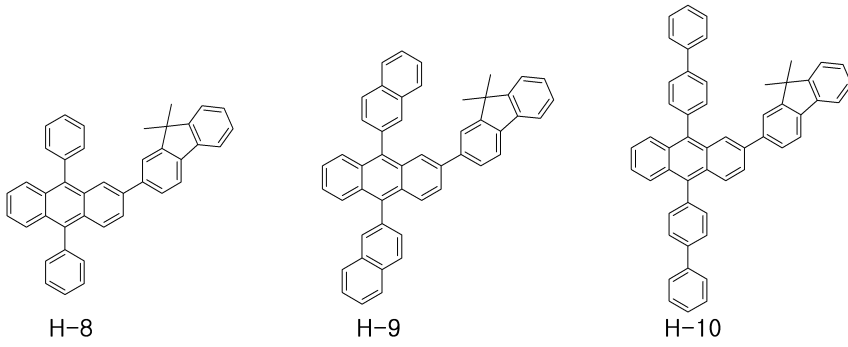
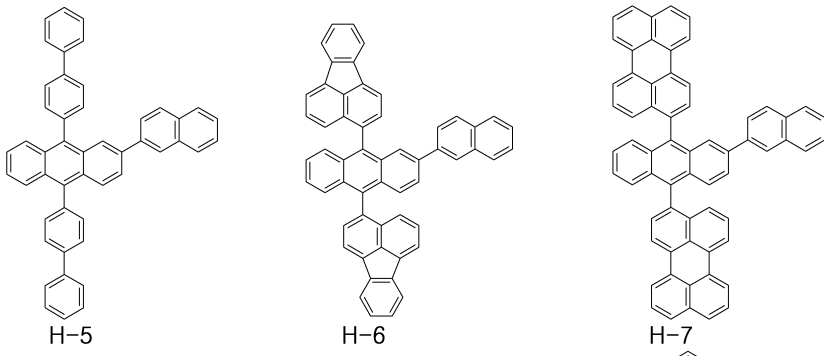
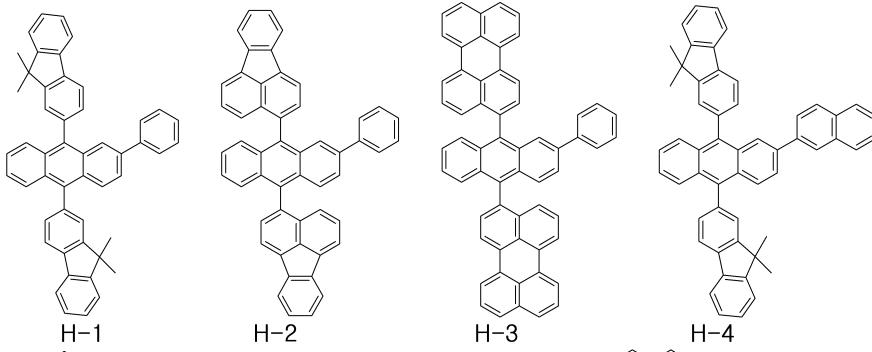
상기 발광층의 의미는 발광이 이루어지는 층으로서 단일 층일 수 있으며, 또한 2개 이상의 층이 적층된 복수의 층일 수 있다. 본 발명의 구성에서의 호스트-도판트를 혼합하여 사용하는 경우, 본 발명의 발광 호스트에 의한 발광 효율의 현저한 개선을 확인할 수 있었다. 이는 0.5 내지 10중량%의 도핑 농도로 구성할 수 있는데, 기존의 다른 호스트 재료에 비하여 정공, 전자에 대한 전도성이 매우 뛰어나며, 물질 안정성을 매우 우수하여 발광효율 뿐만 아니라, 수명도 현저히 개선시키는 특성을 보여 주고 있다.

[0192]

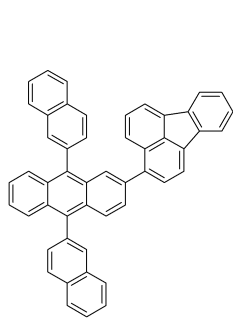
따라서, 상기 화학식 4 내지 화학식 7로부터 선택되는 화합물을 발광 호스트로 채택하는 경우, 본 발명의 화학식 1의 유기 발광 화합물의 전기적 단점을 상당히 보완해 주는 역할을 하고 있다고 설명할 수 있다.

[0193]

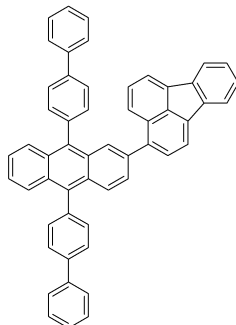
상기 화학식 4 내지 화학식 7의 호스트 화합물은 하기 구조의 화합물로 예시될 수 있으나, 이에 한정되는 것은 아니다.



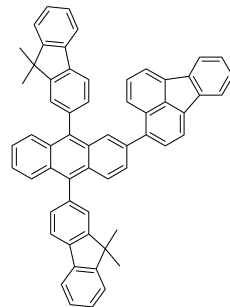
[0194]



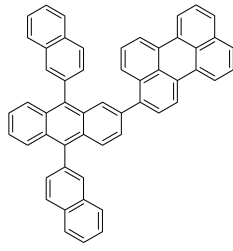
H-14



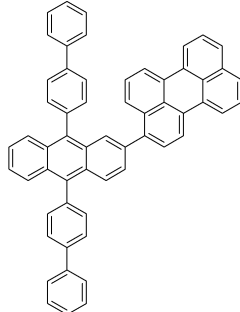
H-15



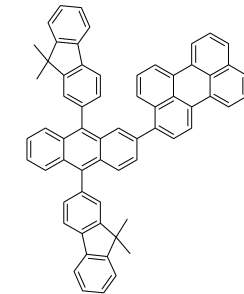
H-16



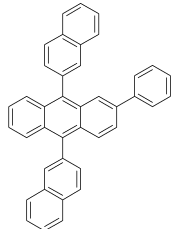
H-17



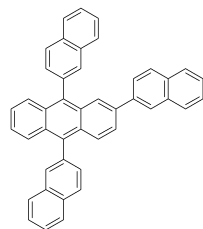
H-18



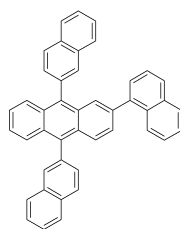
H-19



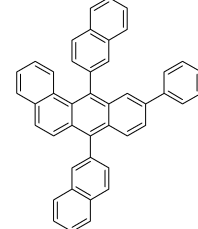
H-20



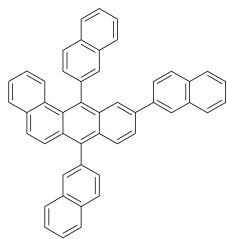
H-21



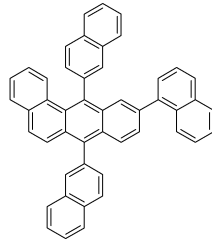
H-22



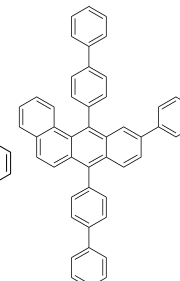
H-23



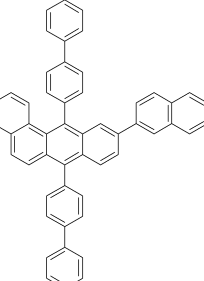
H-24



H-25

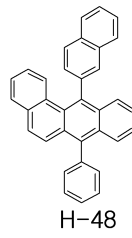
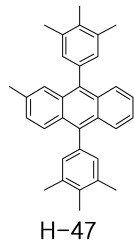
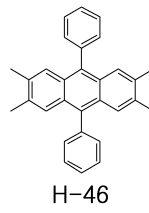
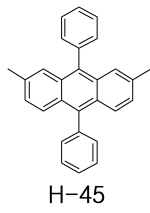
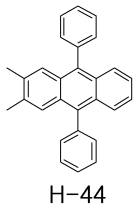
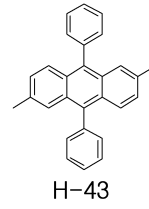
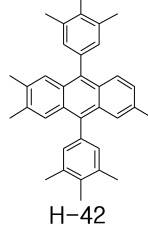
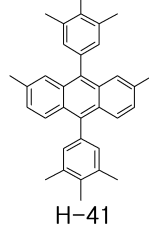
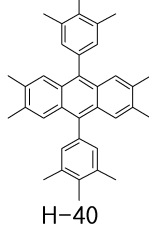
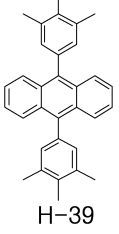
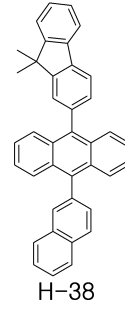
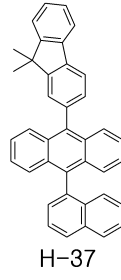
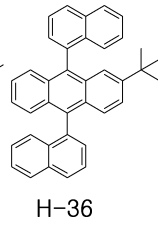
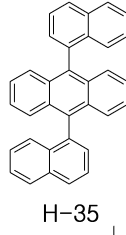
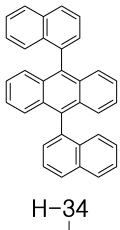
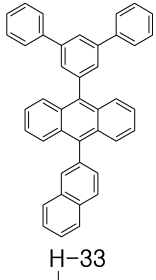
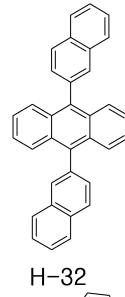
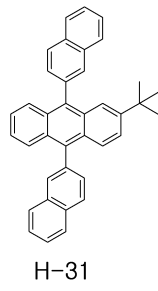
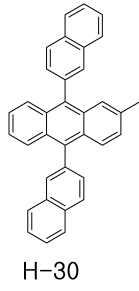
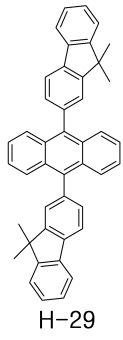
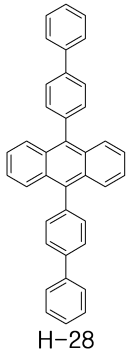


H-26

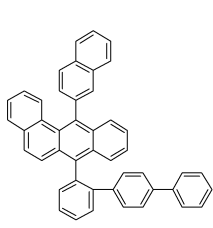


H-27

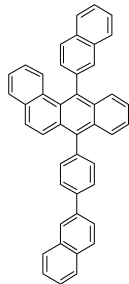
[0195]



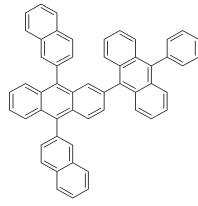
[0196]



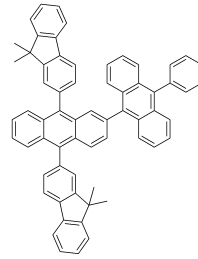
H-49



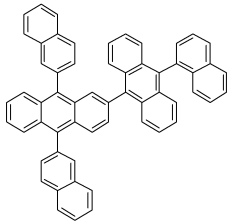
H-50



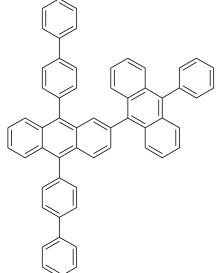
H-51



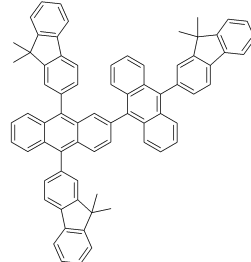
H-52



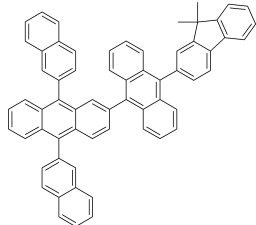
H-53



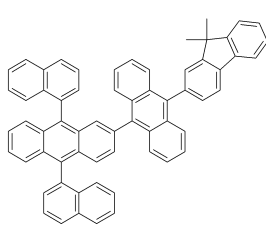
H-54



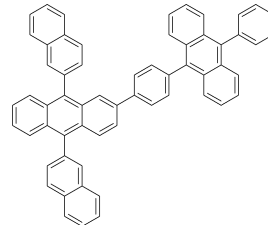
H-55



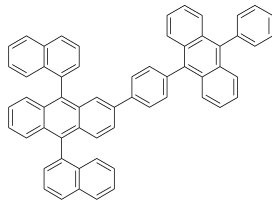
H-56



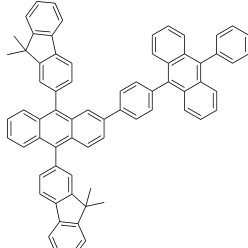
H-57



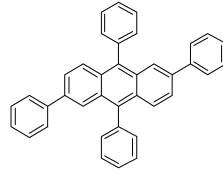
H-58



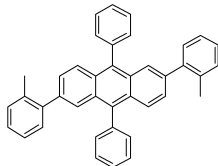
H-59



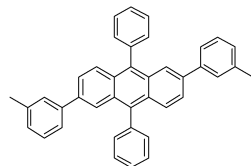
H-60



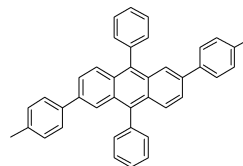
H-61



H-62

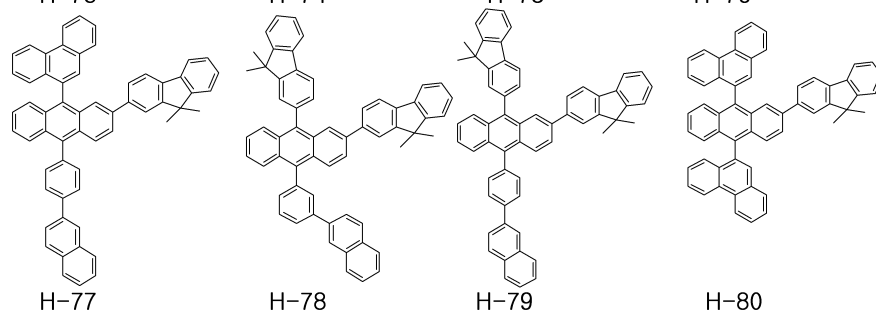
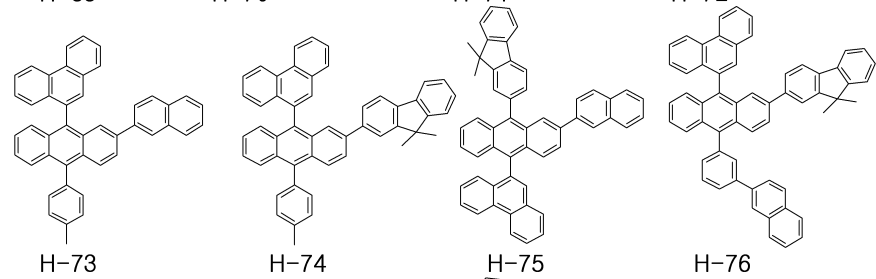
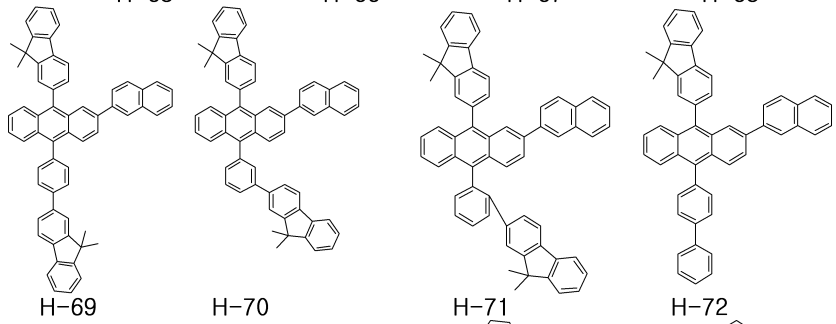
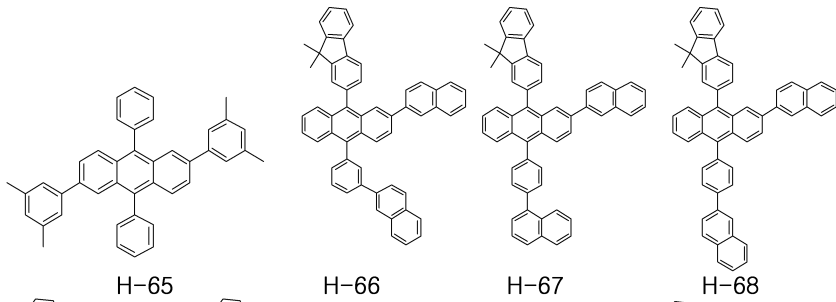


H-63

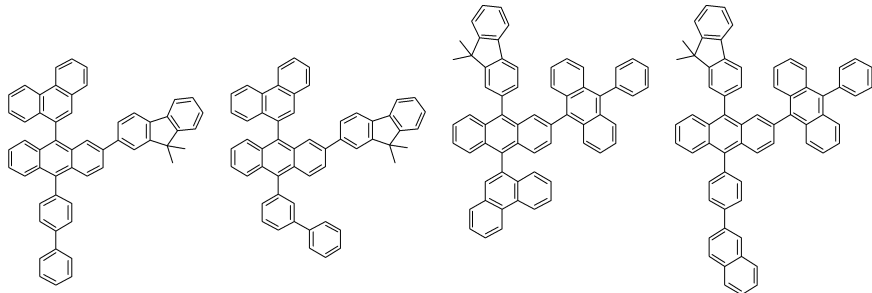


H-64

[0197]



[0198]

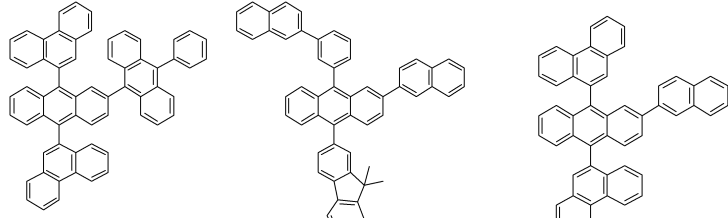


H-81

H-82

H-83

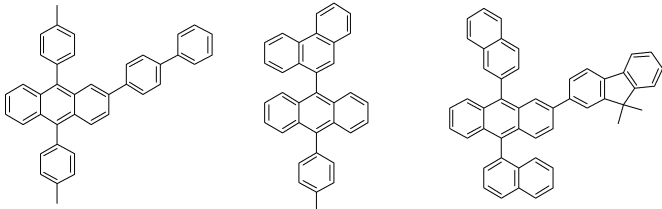
H-84



H-85

H-86

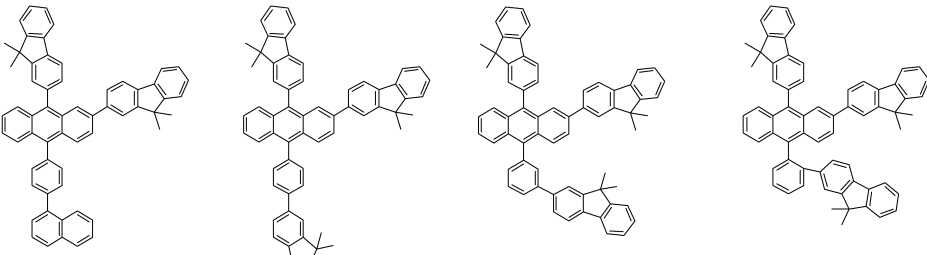
H-87



H-88

H-89

H-90



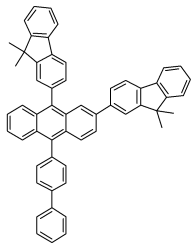
H-91

H-92

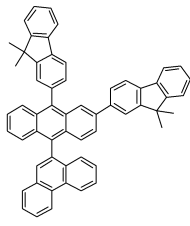
H-93

H-94

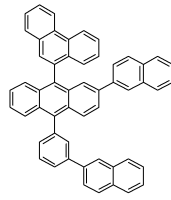
[0199]



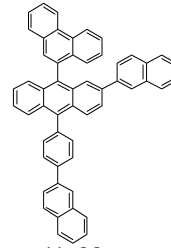
H-95



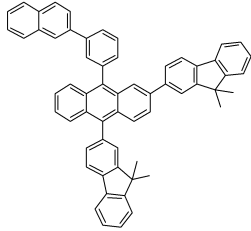
H-96



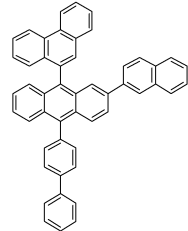
H-97



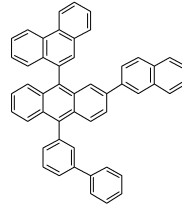
H-98



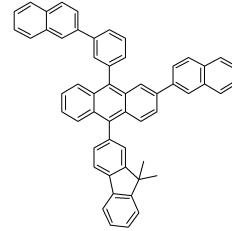
H-99



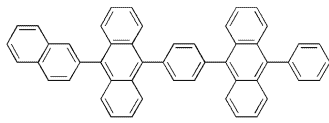
H-100



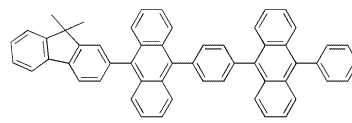
H-101



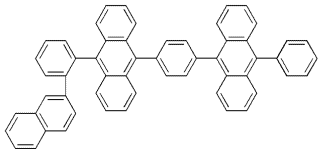
H-102



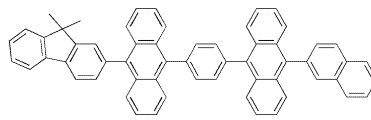
H-103



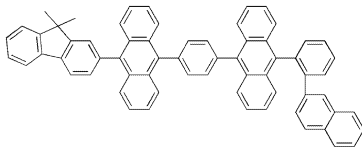
H-104



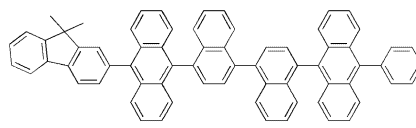
H-105



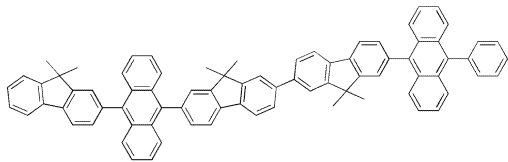
H-106



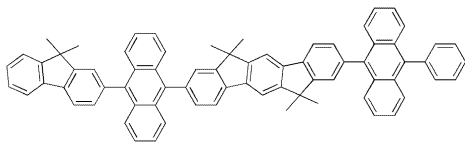
H-107



H-108

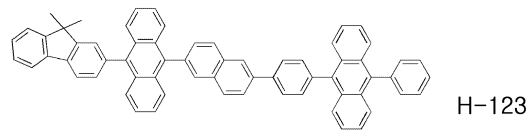
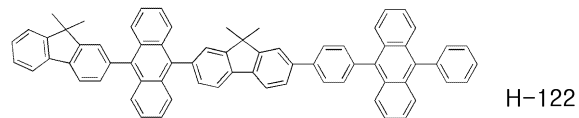
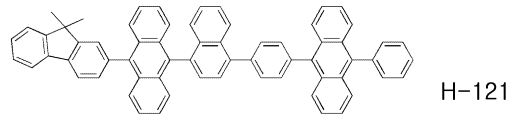
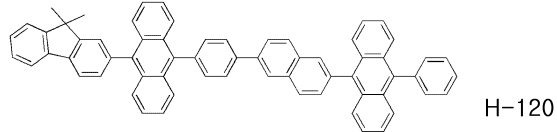
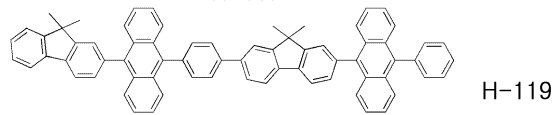
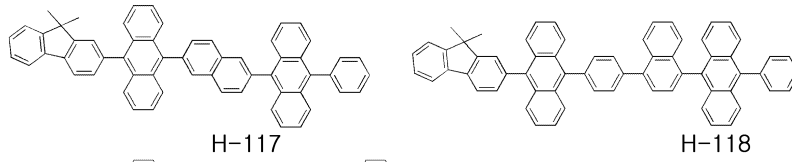
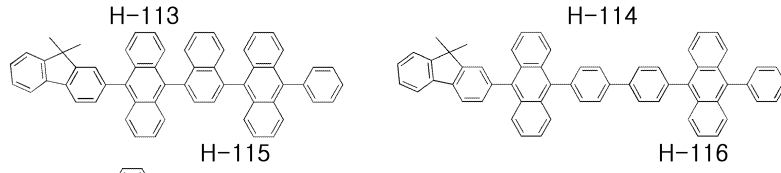
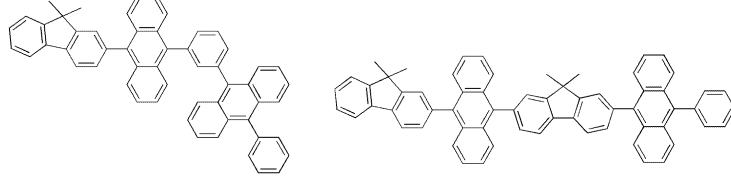
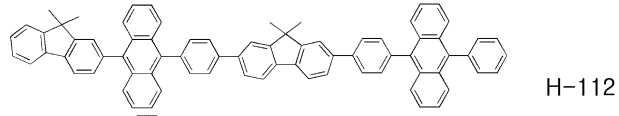
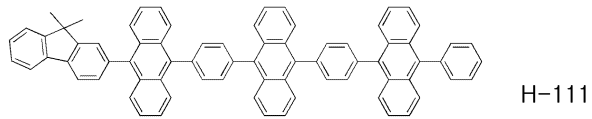


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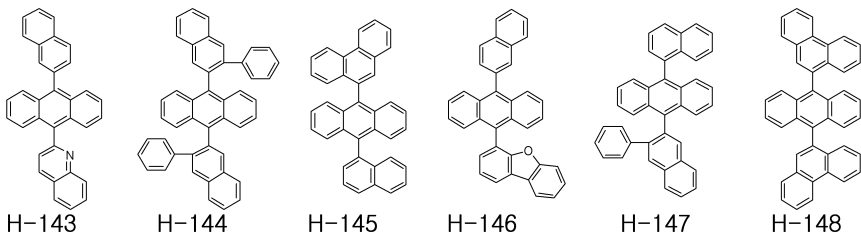
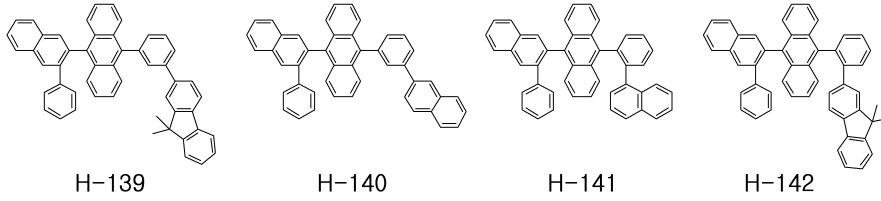
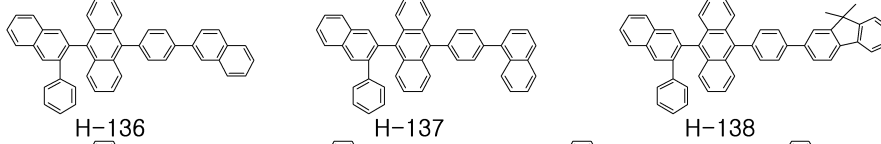
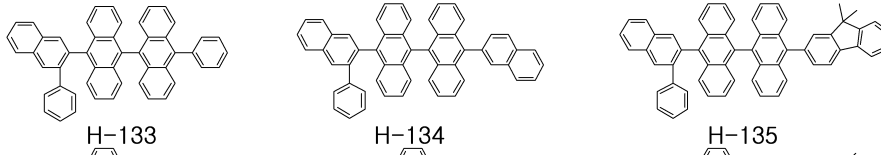
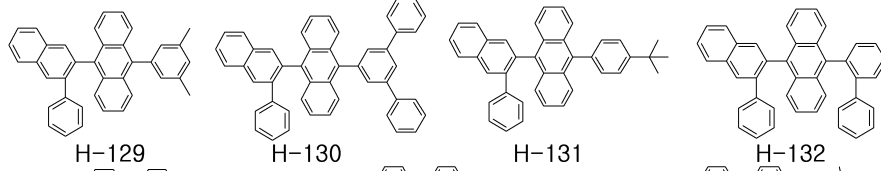
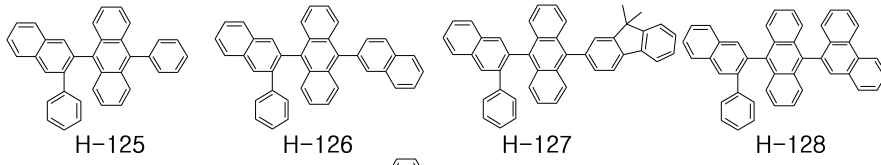
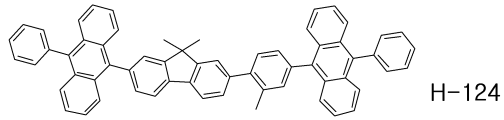


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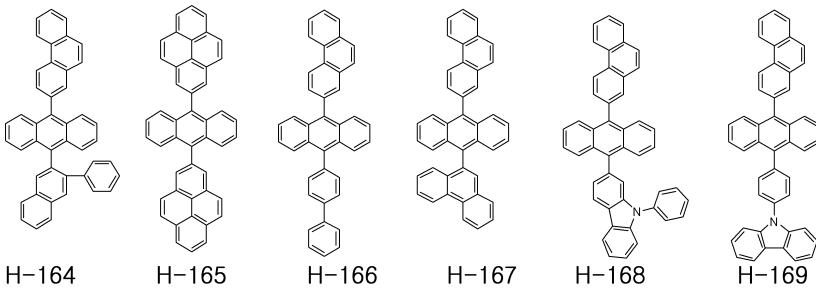
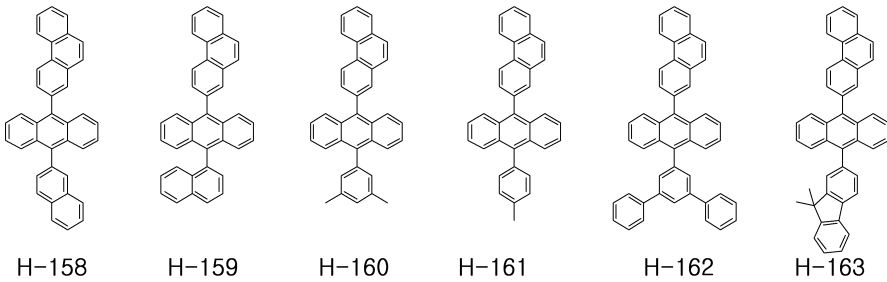
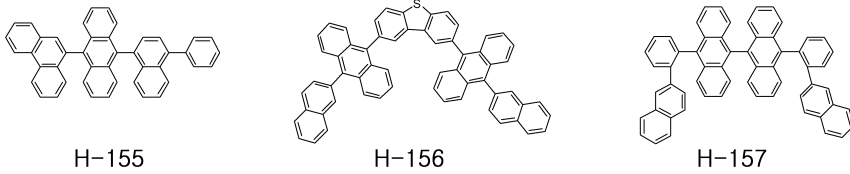
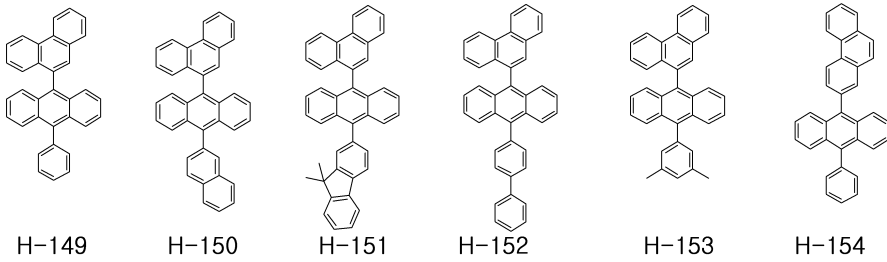
[0200]



[0201]



[0202]



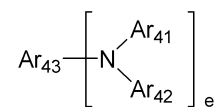
[0203]

[0204]

본 발명의 유기 발광 소자에 있어서, 화학식 1의 유기 발광 화합물을 포함하고, 동시에 아릴아민계 화합물 또는 스티릴아릴아민계 화합물로 이루어진 군으로부터 선택된 하나 이상의 화합물을 포함할 수 있으며, 아릴아민계 화합물 또는 스티릴아릴아민계 화합물의 예로 하기의 화학식 8의 화합물이 있으나, 이에 한정되는 것을 아니다.

[0205]

[화학식 8]



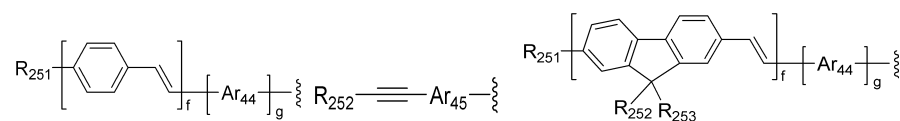
[0206]

[0207]

[상기 화학식 8에서, Ar₄₁ 및 Ar₄₂는 서로 독립적으로 (C1-C60)알킬, (C6-C60)아릴, (C4-C60)헤테로아릴, (C6-C60)아릴아미노, (C1-C60)알킬아미노, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬 또는 (C3-C60)시클로알킬이고, Ar₄₁ 및 Ar₄₂는 융합고리를 포함하거나 포함하지 않는 (C3-C60)알킬렌 또는 (C3-C60)알케닐렌으로 연결되어 지환족 고리 및 단일환 또는 다환의 방향족 고리를 형성하고;

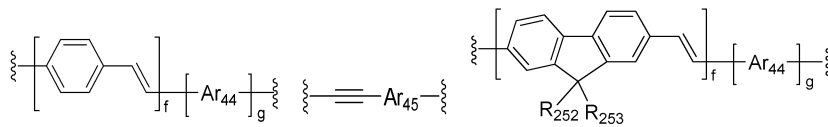
[0208]

e가 1인 경우 Ar₄₃은 (C6-C60)아릴 또는 (C4-C60)헤테로아릴 또는 하기 구조의 아릴이고;



[0209]

[0210] e가 2인 경우 Ar₄₃는 (C6-C60)아릴렌, (C4-C60)헤테로아릴렌 또는 하기 구조의 아릴렌이고;



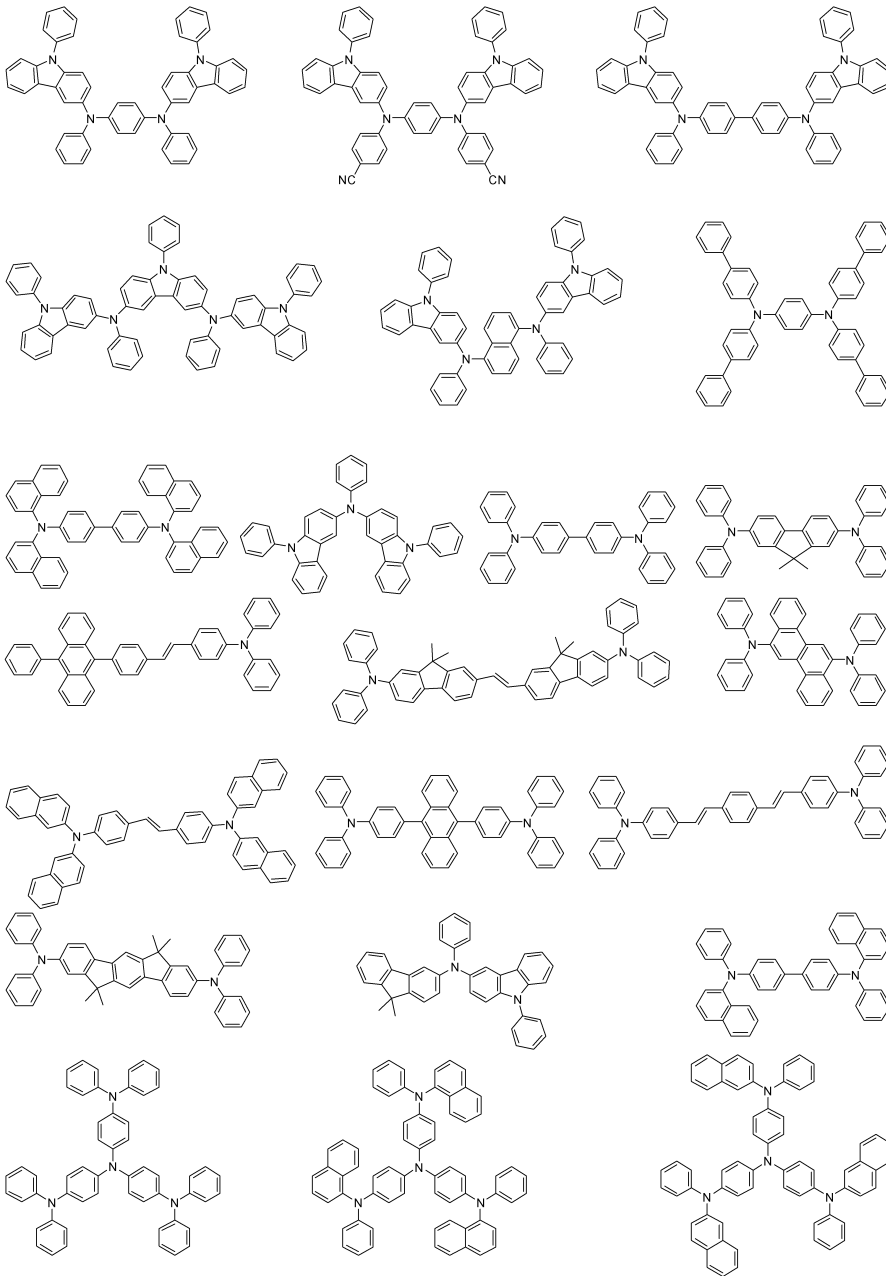
[0211] Ar₄₄ 및 Ar₄₅은 서로 독립적으로 (C6-C60)아릴렌 또는 (C4-C60)헤테로아릴렌이고;

[0212] R₂₅₁, R₂₅₂ 및 R₂₅₃는 서로 독립적으로 수소, 중수소, (C1-C60)알킬 또는 (C6-C60)아릴이고;

[0213] f는 1 내지 4의 정수이며, g는 0 또는 1의 정수이고,

[0214] 상기 Ar₄₁ 및 Ar₄₂의 알킬, 아릴, 헤테로아릴, 아릴아미노, 알킬아미노, 시클로알킬 또는 헤테로시클로알킬, 또는 상기 Ar₄₃의 아릴, 헤테로아릴, 아릴렌 또는 헤테로아릴렌, 또는 상기 Ar₄₄ 및 Ar₄₅의 아릴렌 및 헤테로아릴렌, 또는 R₂₅₁ 내지 R₂₅₃의 알킬 또는 아릴은 중수소, 할로젠, (C1-C60)알킬, (C6-C60)아릴, (C4-C60)헤테로아릴, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴, 트리(C6-C60)아릴실릴, 아다만틸, (C7-C60)바이시클로알킬, (C2-C60)알케닐, (C2-C60)알키닐, 시아노, (C1-C60)알킬아미노, (C6-C60)아릴아미노, (C6-C60)아르(C1-C60)알킬, (C6-C60)아릴옥시, (C1-C60)알킬옥시, (C6-C60)아릴티오, (C1-C60)알킬티오, (C1-C60)알콕시카보닐, (C1-C60)알킬카보닐, (C6-C60)아릴카보닐, 카르복실, 나이트로, 하이드록시로 이루어진 군에서 선택되는 하나 이상의 치환기가 더 치환될 수 있다.]

[0215] 상기 아릴아민계 화합물 또는 스티릴아릴아민계 화합물은 보다 구체적으로 하기의 화합물로서 예시될 수 있으나, 하기 화합물로 한정되는 것은 아니다.



[0217]

[0218] 또한, 본 발명의 유기 발광 소자에 있어서, 유기물층에 상기 화학식 1의 유기 발광 화합물 이외에 1족, 2족, 4족, 5족 전이금속, 란타계열금속 및 d-전이원소의 유기금속으로 이루어진 군으로부터 선택되는 하나 이상의 금속을 더 포함할 수도 있고, 상기 유기물층은 발광층 이외에 전하생성층을 동시에 포함할 수 있다.

[0219] 본 발명의 화학식 1의 유기 발광 화합물을 포함하는 유기 발광 소자를 서브픽셀로 하고, Ir, Pt, Pd, Rh, Re, Os, Tl, Pb, Bi, In, Sn, Sb, Te, Au 및 Ag로 이루어진 군에서 선택되는 하나 이상의 금속화합물을 포함하는 서브픽셀 하나 이상을 동시에 병렬로 패터닝한 독립발광방식의 픽셀구조를 가진 유기 전기 발광 소자를 구현할 수도 있다.

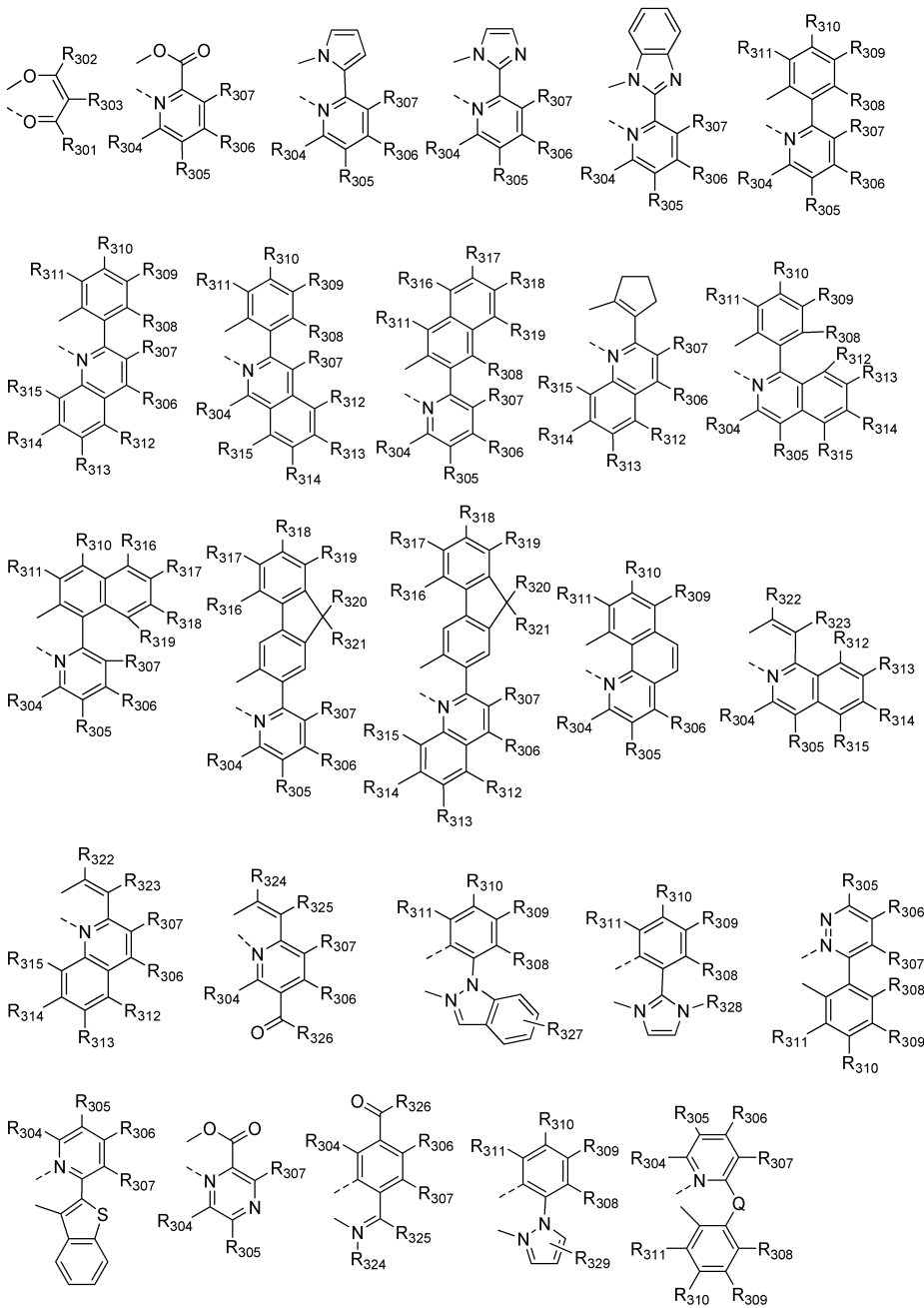
[0220] 또한, 상기 발광층에 500 내지 560nm의 파장을 발광피크로 갖는 화합물 또는 560nm이상의 파장을 발광피크로 갖는 화합물로부터 선택되는 하나 이상을 동시에 포함할 수 있으며, 하기 화학식 9 내지 화학식 15로 예시될 수 있으나 이에 한정되는 것은 아니다.

[0221] [화학식 9]



[0223] 여기서 M^1 은 7족, 8족, 9족, 10족, 11족, 13족, 14족, 15족 및 16족의 금속으로 이루어진 군으로부터 선택되고,

리간드 L^{101} , L^{102} 및 L^{103} 는 서로 독립적으로 하기 구조로부터 선택되어진다.



[0224]

[0225]

[R₃₀₁ 내지 R₃₀₃은 서로 독립적으로 수소, 중수소, 할로젠이 치환되거나 치환되지 않은 (C1-C60)알킬, (C1-C60)알킬이 치환되거나 치환되지 않은 (C6-C60)아릴 또는 할로젠이고;

[0226]

R₃₀₄ 내지 R₃₁₉는 서로 독립적으로 수소, 중수소, (C1-C60)알킬, (C1-C30)알콕시, (C3-C60)시클로알킬, (C2-C30)알케닐, (C6-C60)아릴, 모노 또는 디(C1-C30)알킬아미노, 모노 또는 디(C6-C30)아릴아미노, SF₅, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴, 트리(C6-C30)아릴실릴, 시아노 또는 할로젠이고, 상기 R₃₀₄ 내지 R₃₁₉의 알킬, 시클로알킬, 알케닐 또는 아릴은 중수소, (C1-C60)알킬, (C6-C60)아릴 또는 할로젠으로부터 선택되는 하나 이상의 치환기로 더 치환될 수 있으며;

[0227]

R₃₂₀ 내지 R₃₂₃는 서로 독립적으로 수소, 중수소, 할로젠이 치환되거나 치환되지 않은 (C1-C60)알킬 또는 (C1-C60)알킬이 치환되거나 치환되지 않은 (C6-C60)아릴이고;

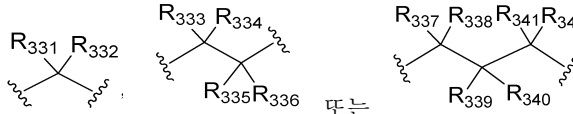
[0228]

R₃₂₄ 및 R₃₂₅는 서로 독립적으로 수소, 중수소, (C1-C60)알킬, (C6-C60)아릴 또는 할로젠이거나, R₃₂₄와 R₃₂₅는 용

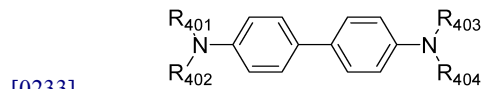
합고리를 포함하거나 포함하지 않는 (C3-C12)알킬렌 또는 (C3-C12)알케닐렌으로 연결되어 지환족 고리 및 단일 환 또는 다환의 방향족 고리를 형성하며, 상기 R₃₂₄ 및 R₃₂₅의 알킬, 아릴 또는 융합고리를 포함하거나 포함하지 않는 (C3-C12)알킬렌 또는 (C3-C12)알케닐렌으로 연결되어 형성된 지환족 고리 및 단일 환 또는 다환의 방향족 고리는 중수소, 할로젠이 치환되거나 치환되지 않은 (C1-C60)알킬, (C1-C30)알콕시, 할로젠, 트리(C1-C30)알킬실릴, 트리(C6-C30)아릴실릴 및 (C6-C60)아릴로부터 선택되는 하나 이상의 치환기로 더 치환될 수 있으며;

[0229] R₃₂₆은 (C1-C60)알킬, (C6-C60)아릴, (C5-C60)헤테로아릴 또는 할로젠이고;

[0230] R₃₂₇ 내지 R₃₂₉은 서로 독립적으로 수소, 중수소, (C1-C60)알킬, (C6-C60)아릴 또는 할로젠이고, 상기 R₃₂₆ 내지 R₃₂₉의 알킬 및 아릴은 할로젠 또는 (C1-C60)알킬로 더 치환될 수 있으며;

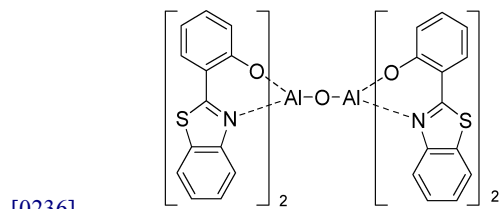
[0231] Q는 이며, R₃₃₁ 내지 R₃₄₂는 서로 독립적으로 수소, 중수소, 할로젠이 치환되거나 치환되지 않은 (C1-C60)알킬, (C1-C30)알콕시, 할로젠, (C6-C60)아릴, 시아노, (C5-C60)시클로알킬이거나, R₃₃₁ 내지 R₃₄₂는 서로 인접한 치환체와 알킬렌 또는 알케닐렌으로 연결되어 (C5-C7)스피로고리 또는 (C5-C9)융합고리를 형성하거나, R₃₀₇ 또는 R₃₀₈과 알킬렌 또는 알케닐렌으로 연결되어 (C5-C7)융합고리를 형성할 수 있다.]

[0232] [화학식 10]

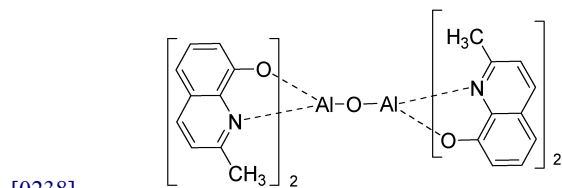


[0234] [상기 화학식 10에서, R₄₀₁ 내지 R₄₀₄은 서로 독립적으로 (C1-C60)알킬 또는 (C6-C60)아릴이거나, 서로 인접한 치환체와 융합고리를 포함하거나 포함하지 않는 (C3-C60)알킬렌 또는 (C3-C60)알케닐렌으로 연결되어 지환족 고리 및 단일 환 또는 다환의 방향족 고리를 형성하며; 상기 R₄₀₁ 내지 R₄₀₄의 알킬, 아릴 또는 융합고리를 포함하거나 포함하지 않는 (C3-C60)알킬렌 또는 (C3-C60)알케닐렌으로 연결되어 형성된 지환족 고리 및 단일 환 또는 다환의 방향족 고리는 할로젠이 치환되거나 치환되지 않은 (C1-C60)알킬, (C1-C60)알콕시, 중수소, 할로젠, 트리(C1-C60)알킬실릴, 트리(C6-C60)아릴실릴 및 (C6-C60)아릴로부터 선택되는 하나 이상의 치환기로 더 치환될 수 있다.]

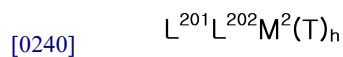
[0235] [화학식 11]



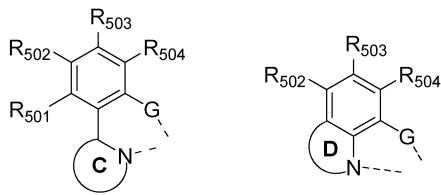
[0237] [화학식 12]



[0239] [화학식 13]



[0241] [상기 화학식 13에서, 리간드 L^{201} 및 L^{202} 는 서로 독립적으로 하기 구조로부터 선택되고;



[0242]

[0243] M^2 은 2가 또는 3가 금속이며;

[0244] M^2 이 2가 금속인 경우 h는 0이고, M^2 이 3가 금속인 경우 h는 1이고;

[0245] T는 (C6-C60)아릴옥시 또는 트리(C6-C60)아릴실릴이고, 상기 T의 아릴옥시 및 트리아릴실릴은 (C1-C60)알킬 또는 (C6-C60)아릴이 더 치환될 수 있으며;

[0246] G는 O, S 또는 Se 이고;

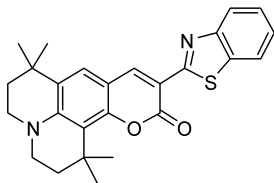
[0247] C 고리는 옥사졸, 싸이아졸, 이미다졸, 옥사디아졸, 싸이아디아졸, 벤조옥사졸, 벤조싸이아졸, 벤조이미다졸, 피리딘 또는 퀴놀린이고;

[0248] D 고리는 피리딘 또는 퀴놀린이며, 상기 D 고리는 (C1-C60)알킬, (C1-C60)알킬이 치환되거나 치환되지 않은 페닐 또는 나프틸이 더 치환될 수 있고;

[0249] R_{501} 내지 R_{504} 은 서로 독립적으로 수소, 중수소, (C1-C60)알킬, 할로젠, 트리(C1-C60)알킬실릴, 트리(C6-C60)아릴실릴 또는 (C6-C60)아릴이거나, 인접한 치환체와 (C3-C60)알킬렌, 또는 (C3-C60)알케닐렌으로 결합되어 융합고리를 형성할 수 있으며, 상기 피리딘 및 퀴놀린은 R_{501} 과 화학결합을 이루어 융합고리를 형성할 수 있으며;

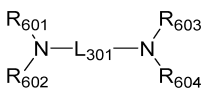
[0250] 상기 C 고리와 R_{501} 내지 R_{504} 의 아릴기는 중수소, (C1-C60)알킬, 할로젠, 할로겐이 치환된 (C1-C60)알킬, 페닐, 나프틸, 트리(C1-C60)알킬실릴, 트리(C6-C60)아릴실릴 또는 아미노기로 더 치환될 수 있다.]

[0251] [화학식 14]



[0252]

[0253] [화학식 15]



[0254]

[0255] [상기 화학식 15에서,

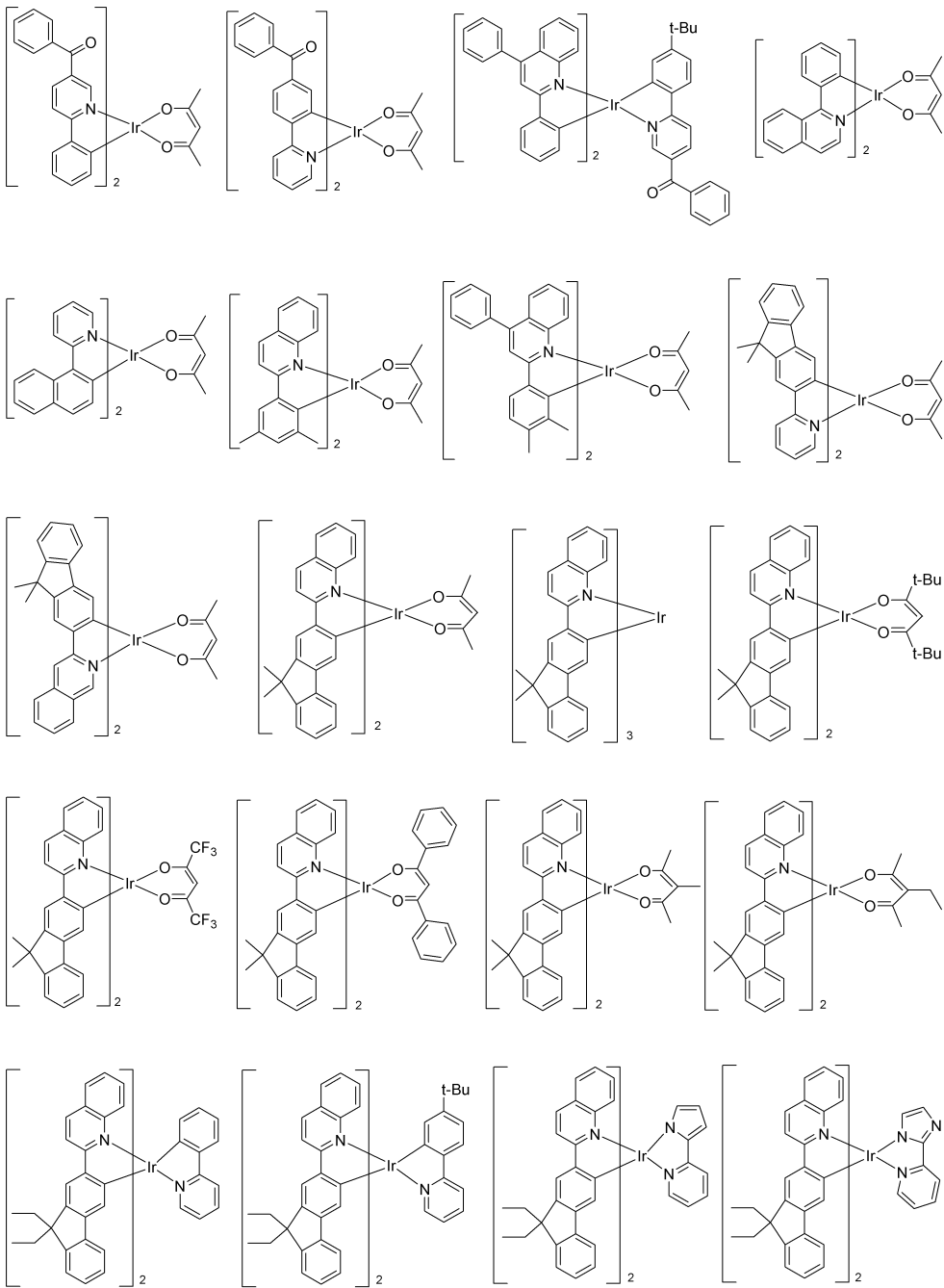
[0256] L_{301} 은 중수소, 할로젠, (C1-C60)알킬, (C6-C60)아릴, (C4-C60)헤테로아릴, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬 (C6-C60)아릴실릴, 트리(C6-C60)아릴실릴, 아다만틸, (C7-C60)바이시클로알킬, (C2-C60)알케닐, (C2-C60)알키닐, (C1-C60)알콕시, 시아노, (C1-C60)알킬아미노, (C6-C60)아릴아미노, (C6-C60)아르(C1-C60)알킬, (C6-C60)아릴옥시, (C6-C60)아릴티오, (C1-C60)알콕시카보닐, 카르복실, 나이트로 또는 하이드록시로 이루어진 군으로부터 선택된 하나 이상의 치환기가 치환되거나 치환되지 않은 (C6-C60)아릴렌이고, 상기 아릴렌에 치환되는 치환기인 알킬, 시클로알킬, 헤테로시클로알킬, 아릴, 헤테로아릴, 아릴실릴, 알킬실릴, 알킬아미노 및 아릴아미노는 중수소, 할로젠, (C1-C60)알킬, (C6-C60)아릴, (C4-C60)헤테로아릴, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬 (C6-C60)아릴실릴, 트리(C6-C60)아릴실릴, 아다만틸, (C7-C60)바이시클로알킬, (C2-C60)알케닐, (C2-C60)알키

닐, (C1-C60)알콕시, 시아노, (C1-C60)알킬아미노, (C6-C60)아릴아미노, (C6-C60)아르(C1-C60)알킬, (C6-C60)아릴옥시, (C6-C60)아릴티오, (C1-C60)알콕시카보닐, 카르복실, 나이트로 또는 하이드록시로부터 선택된 하나 이상이 더 치환될 수 있으며;

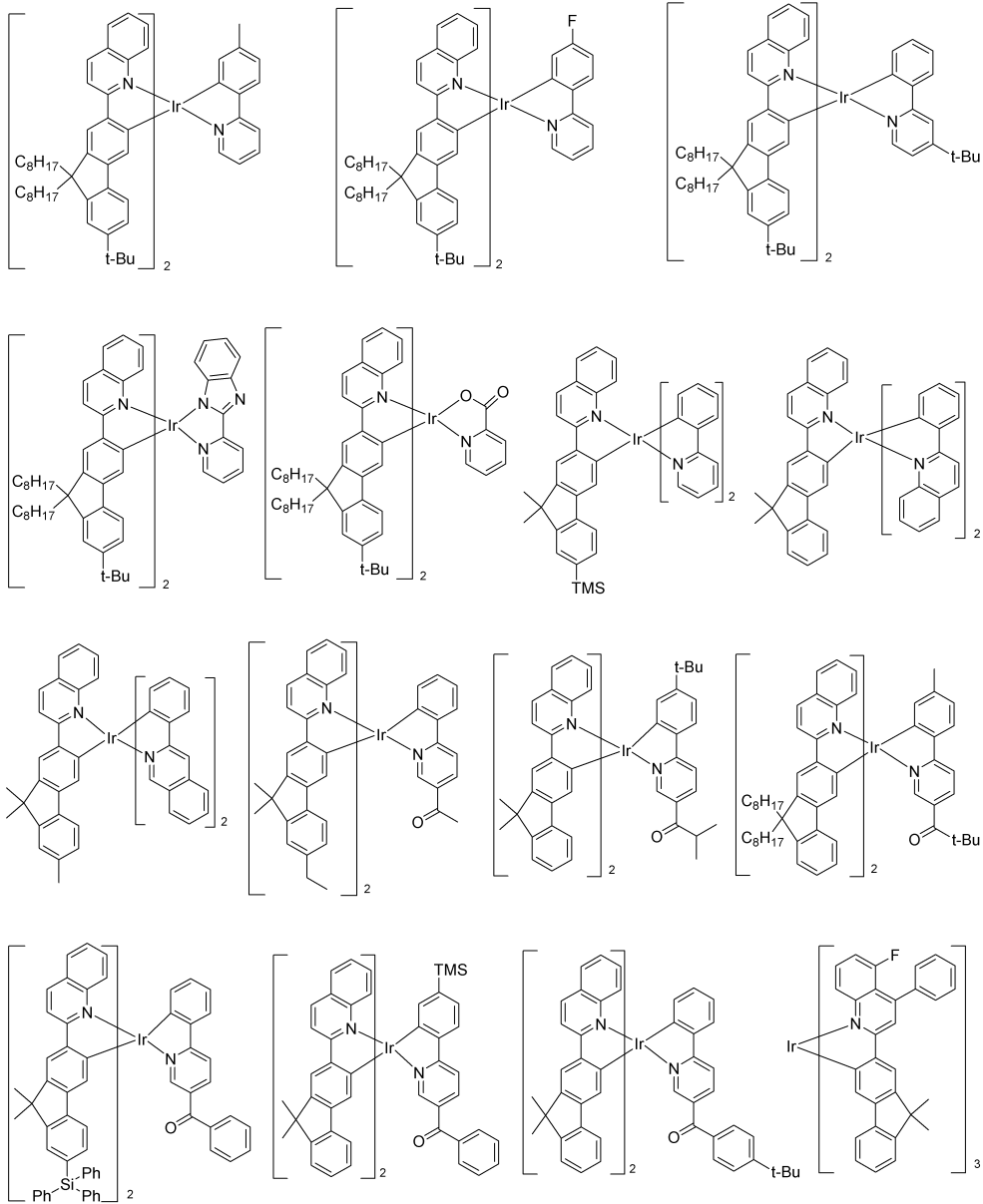
[0257] R₆₀₁ 내지 R₆₀₄는 서로 독립적으로 (C1-C60)알킬, (C6-C60)아릴, (C4-C60)헤테로아릴, (C6-C60)아릴아미노, (C1-C60)알킬아미노, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬이거나, R₆₀₁ 내지 R₆₀₄는 인접한 치환체와 융합고리를 포함하거나 포함하지 않는 (C₃-C₆₀)알킬렌 또는 (C₃-C₆₀)알케닐렌으로 연결되어 지환족 고리 및 단일환 또는 다환의 방향족 고리를 형성할 수 있고,

[0258] 상기 R₆₀₁ 내지 R₆₀₄의 알킬, 아릴, 헤테로아릴, 아릴아미노, 알킬아미노, 시클로알킬 및 헤테로시클로알킬은 중 수소, 할로젠, (C1-C60)알킬, (C6-C60)아릴, (C4-C60)헤테로아릴, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴, 트리(C6-C60)아릴실릴, 아다만틸, (C7-C60)바이시클로알킬, (C2-C60)알케닐, (C2-C60)알키닐, (C1-C60)알콕시, 시아노, (C1-C60)알킬아미노, (C6-C60)아릴아미노, (C6-C60)아르(C1-C60)알킬, (C6-C60)아릴옥시, (C6-C60)아릴티오, (C1-C60)알콕시카보닐, 카르복실, 나이트로 또는 하이드록시로부터 선택된 하나 이상이 더 치환될 수 있다.]

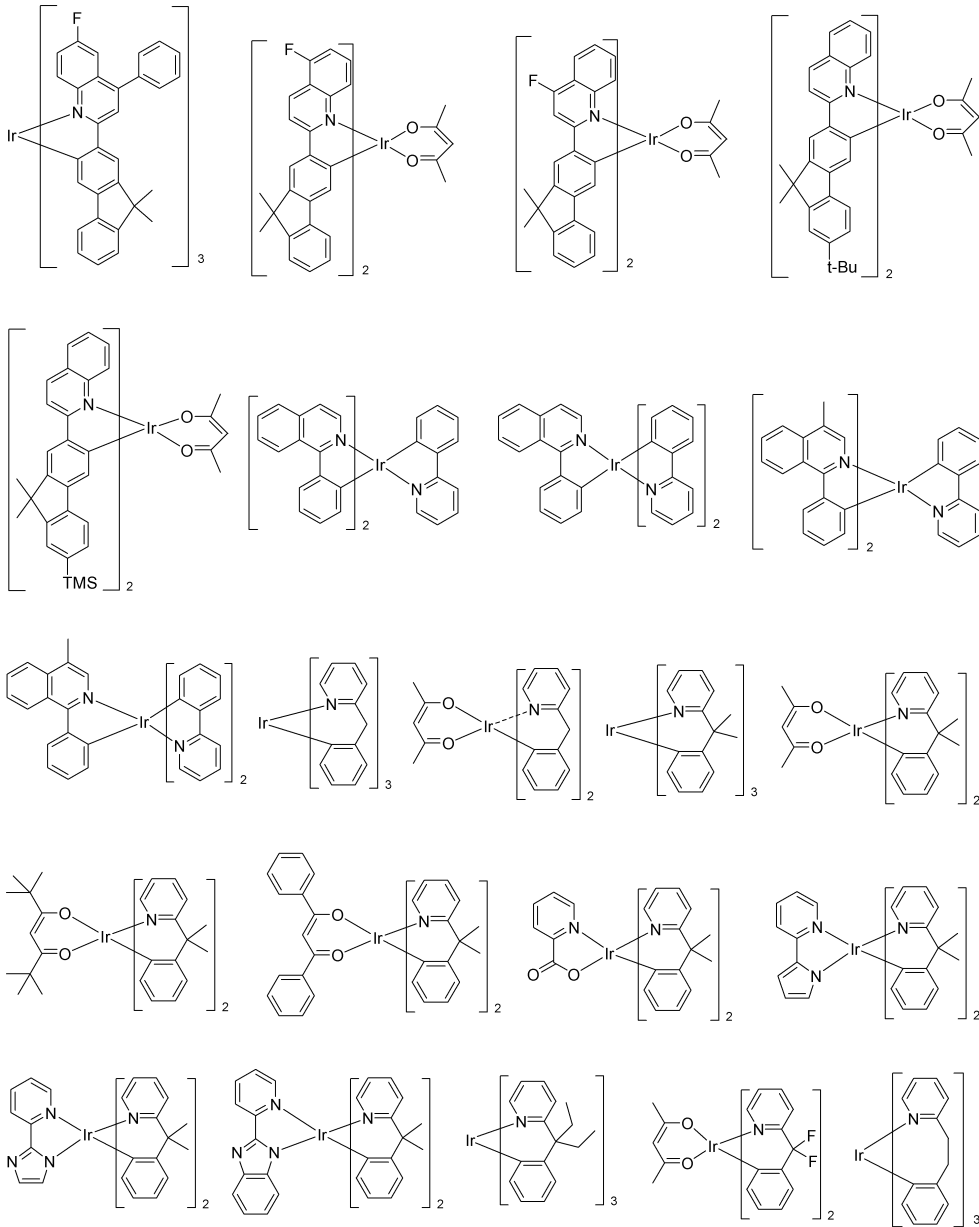
[0259] 상기 발광층에 500 내지 560nm의 파장을 발광피크로 갖는 화합물 또는 560nm이상의 파장을 발광피크로 갖는 화합물은 하기 화합물로 예시될 수 있으나, 이에 한정되는 것은 아니다.



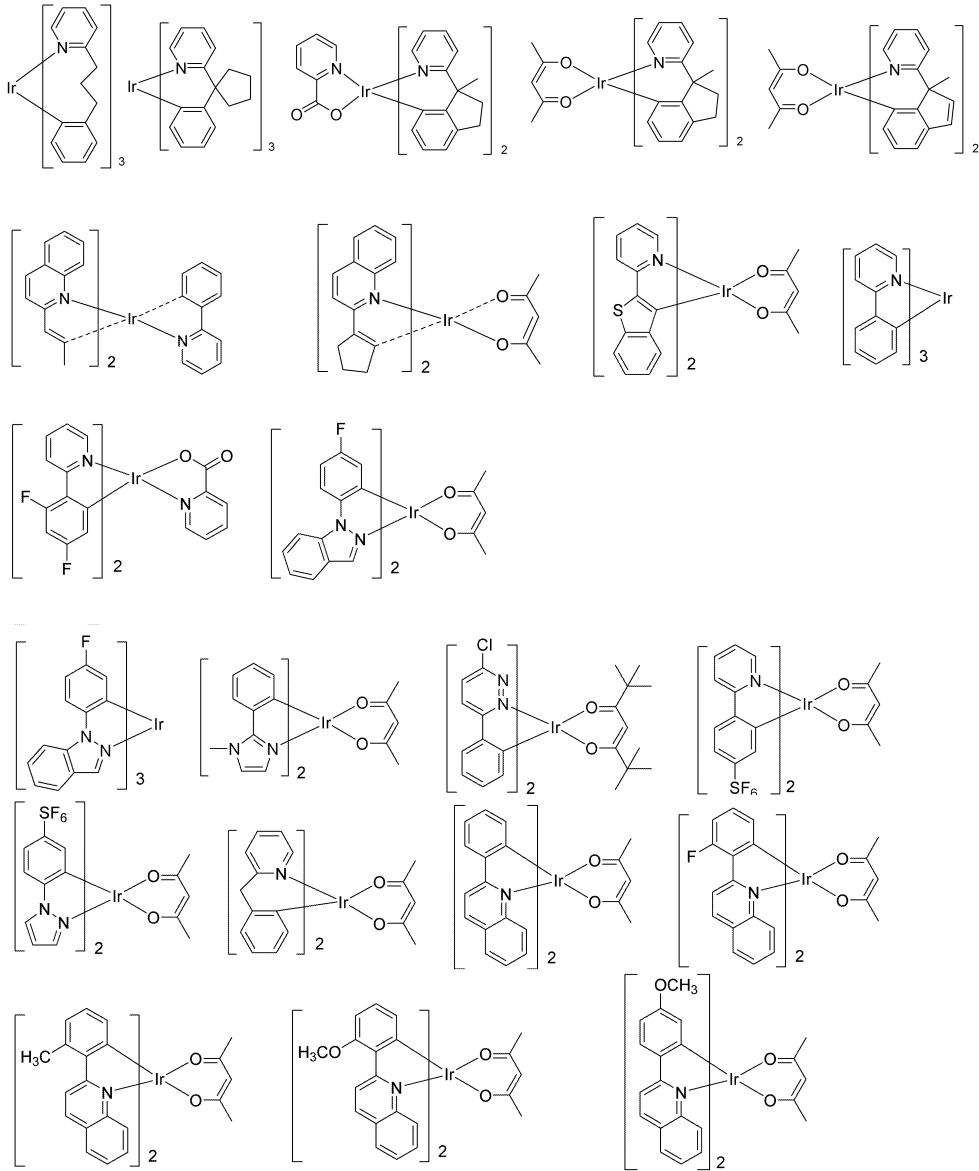
[0260]



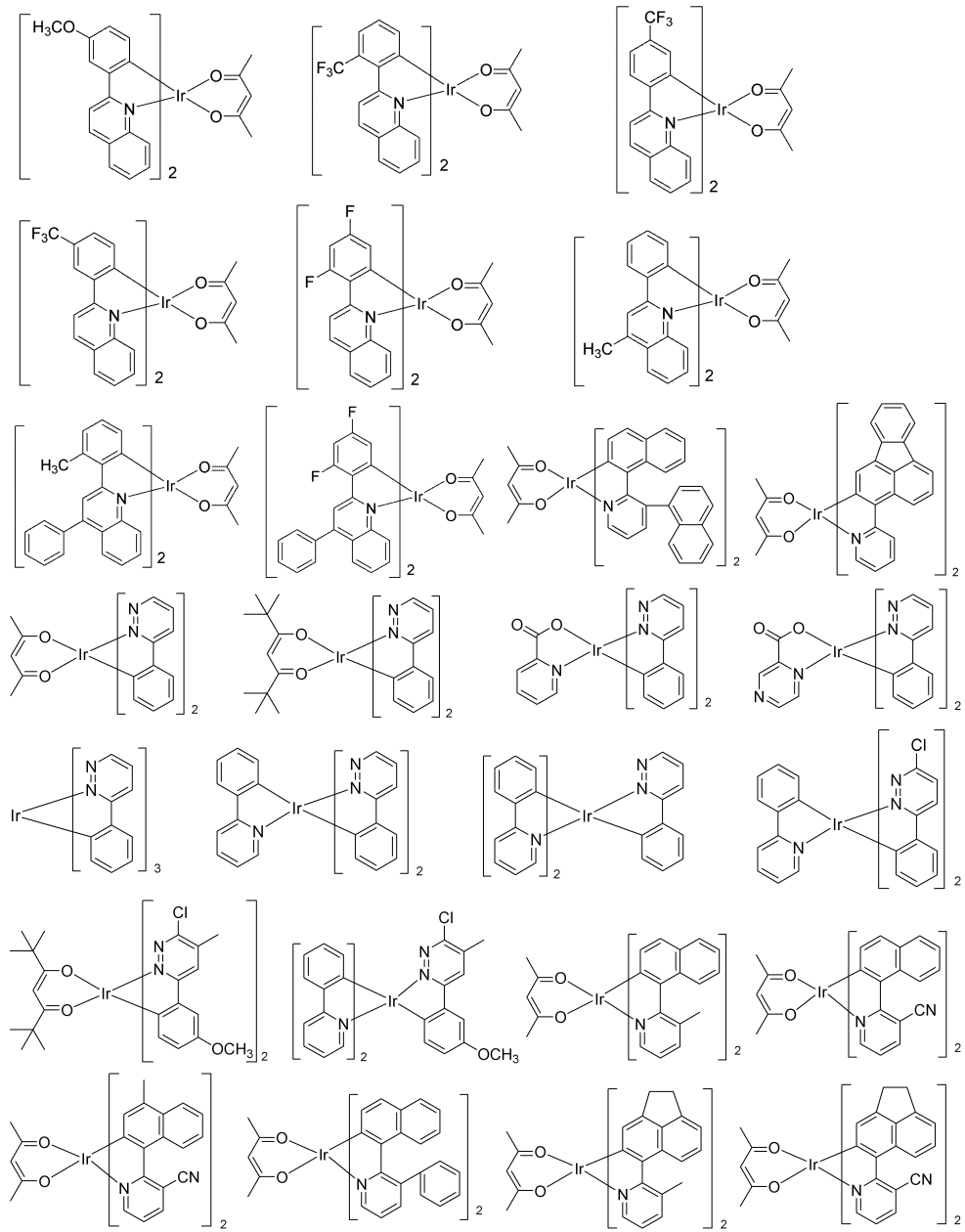
[0261]



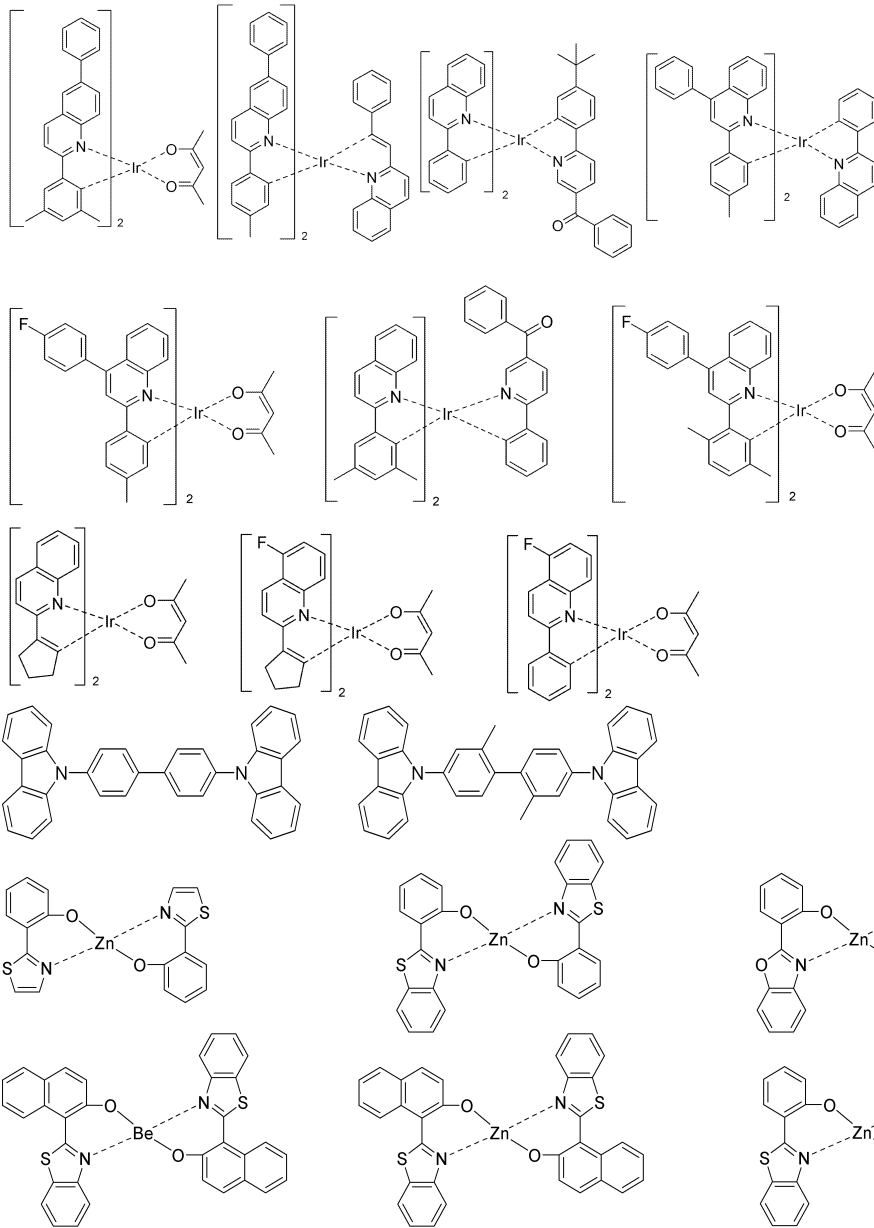
[0262]



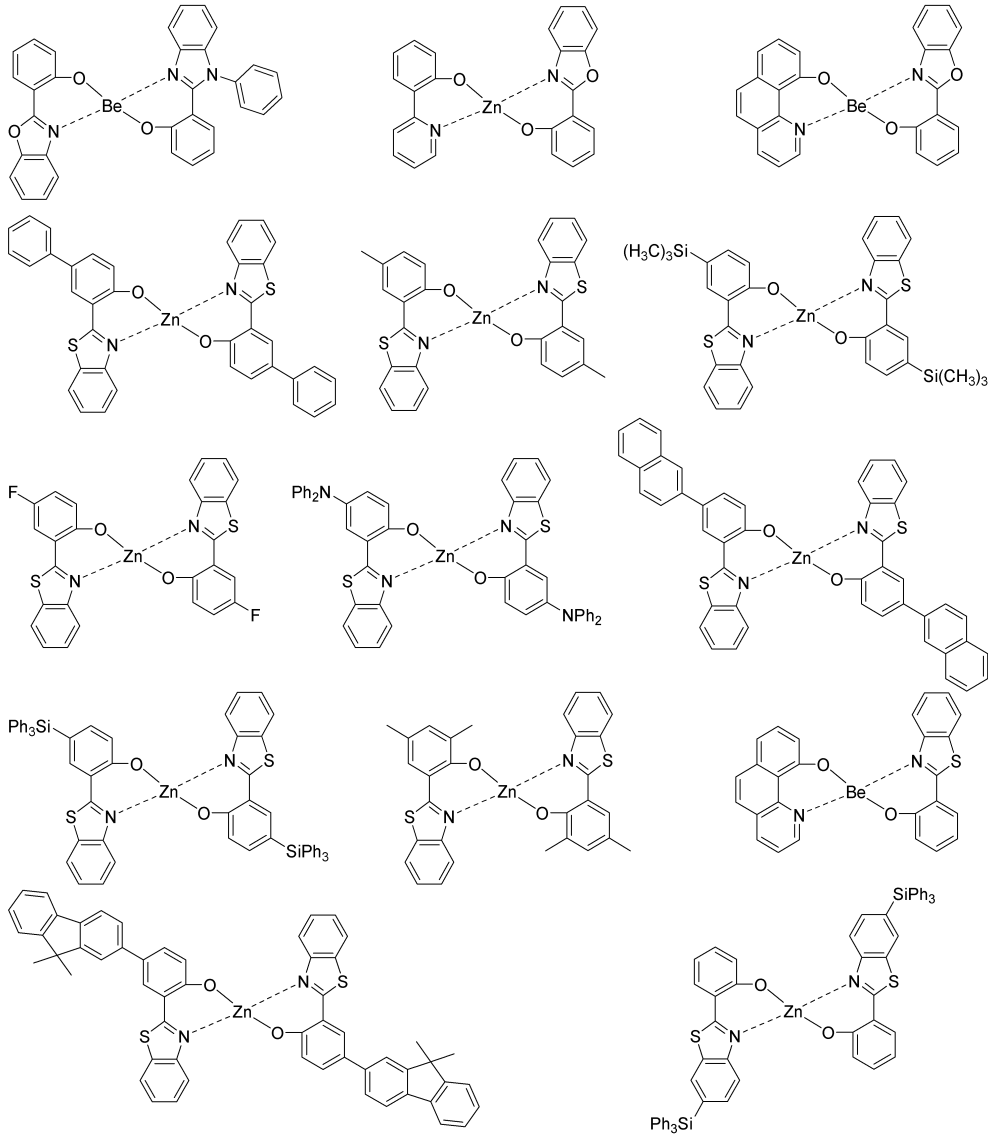
[0263]



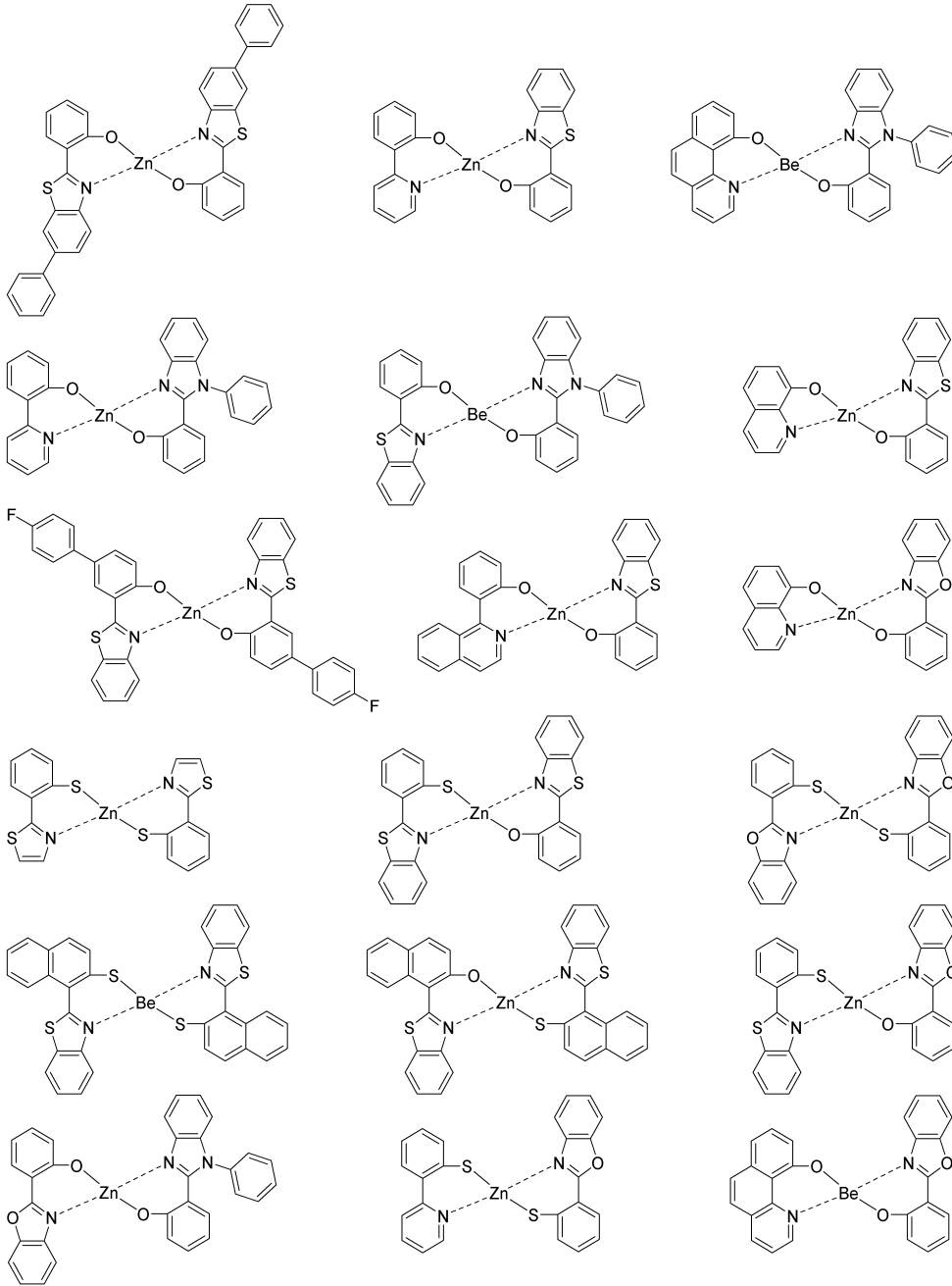
[0264]



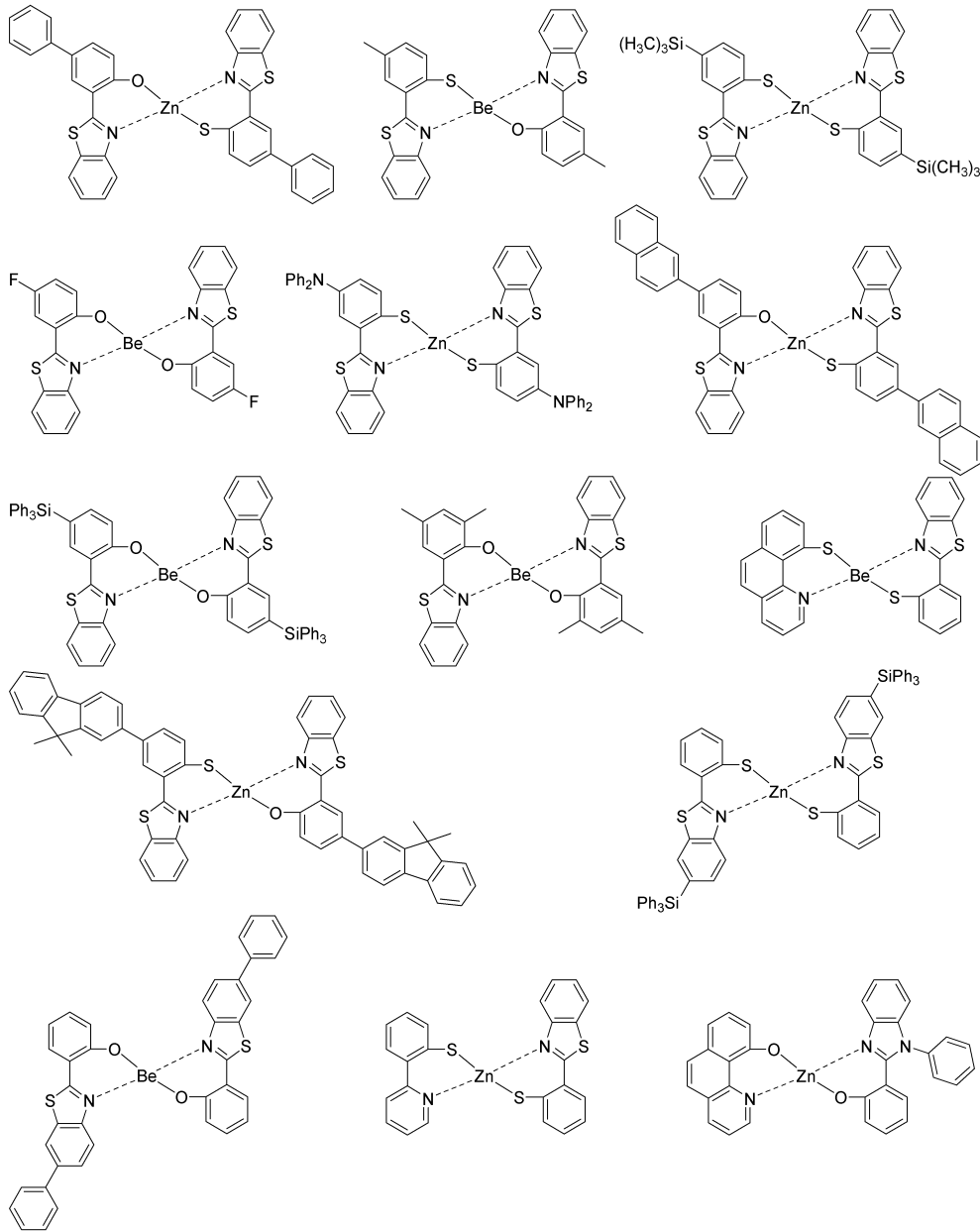
[0265]



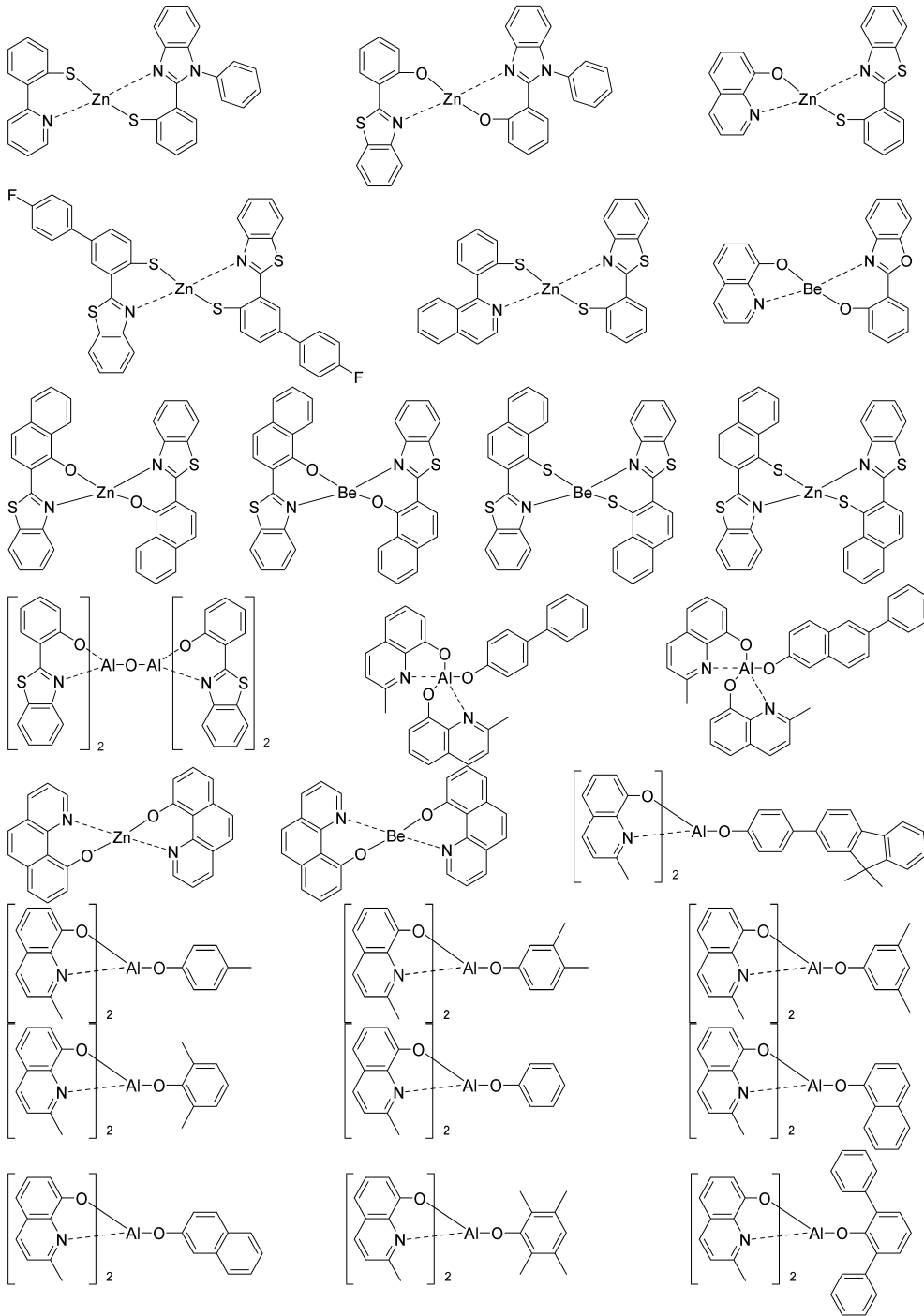
[0266]



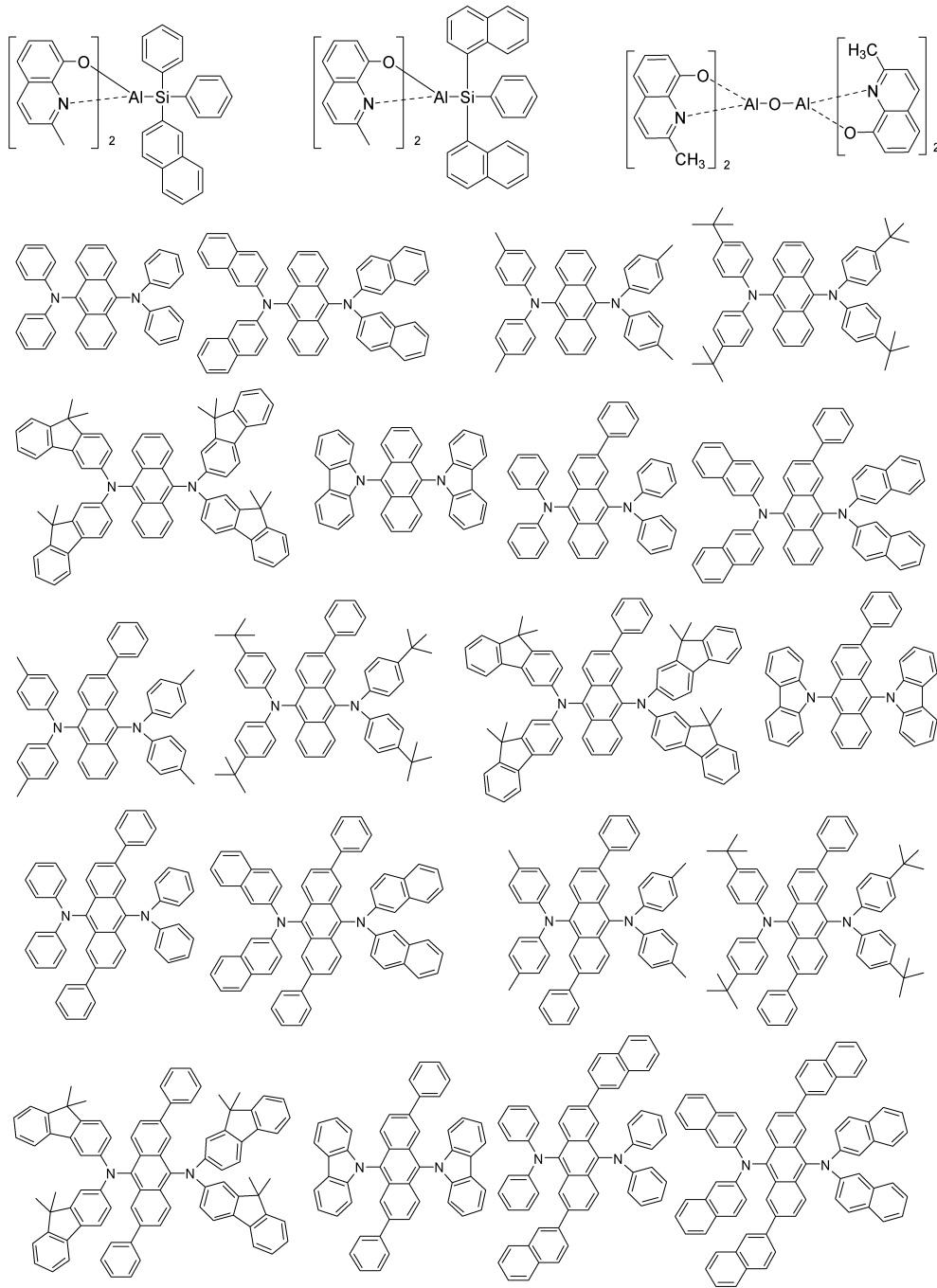
[0267]



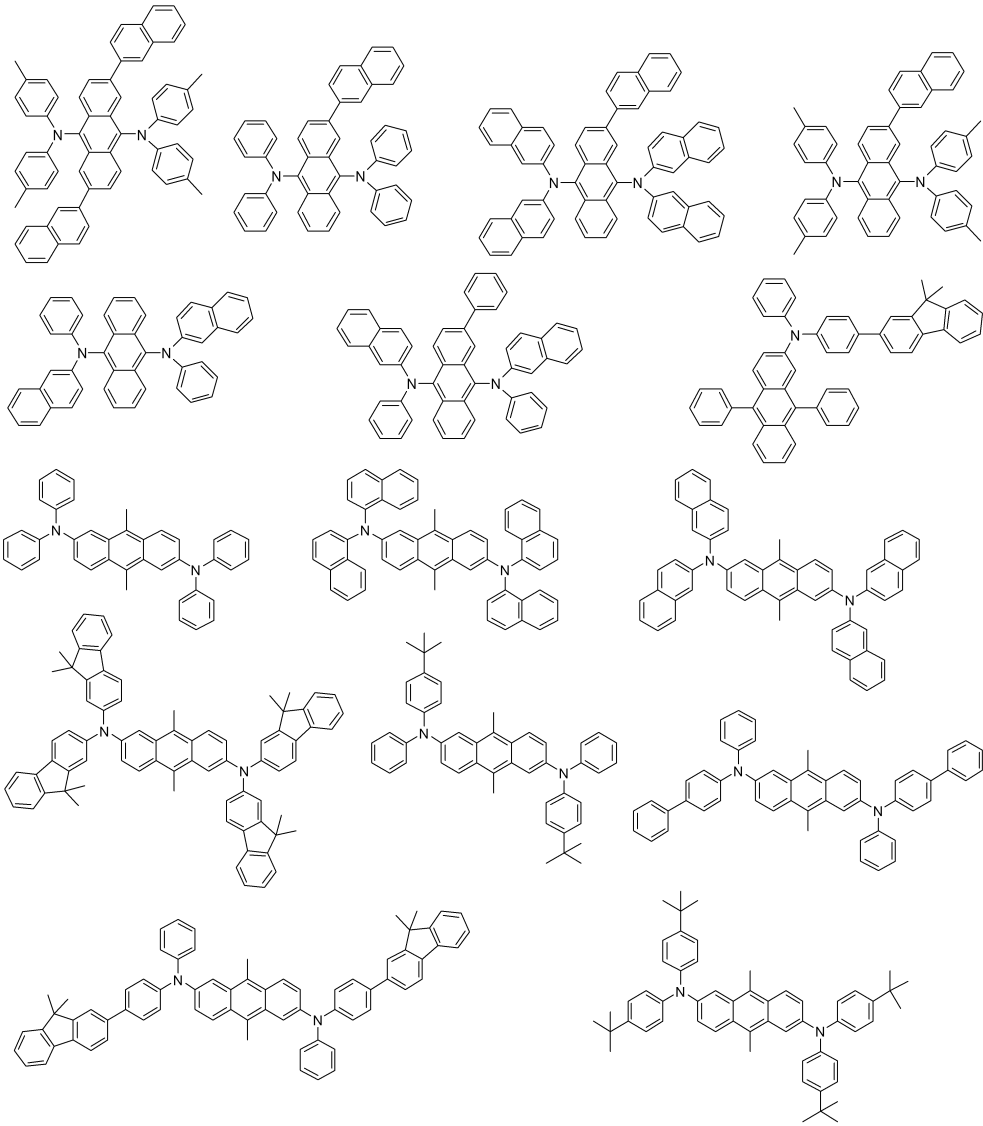
[0268]



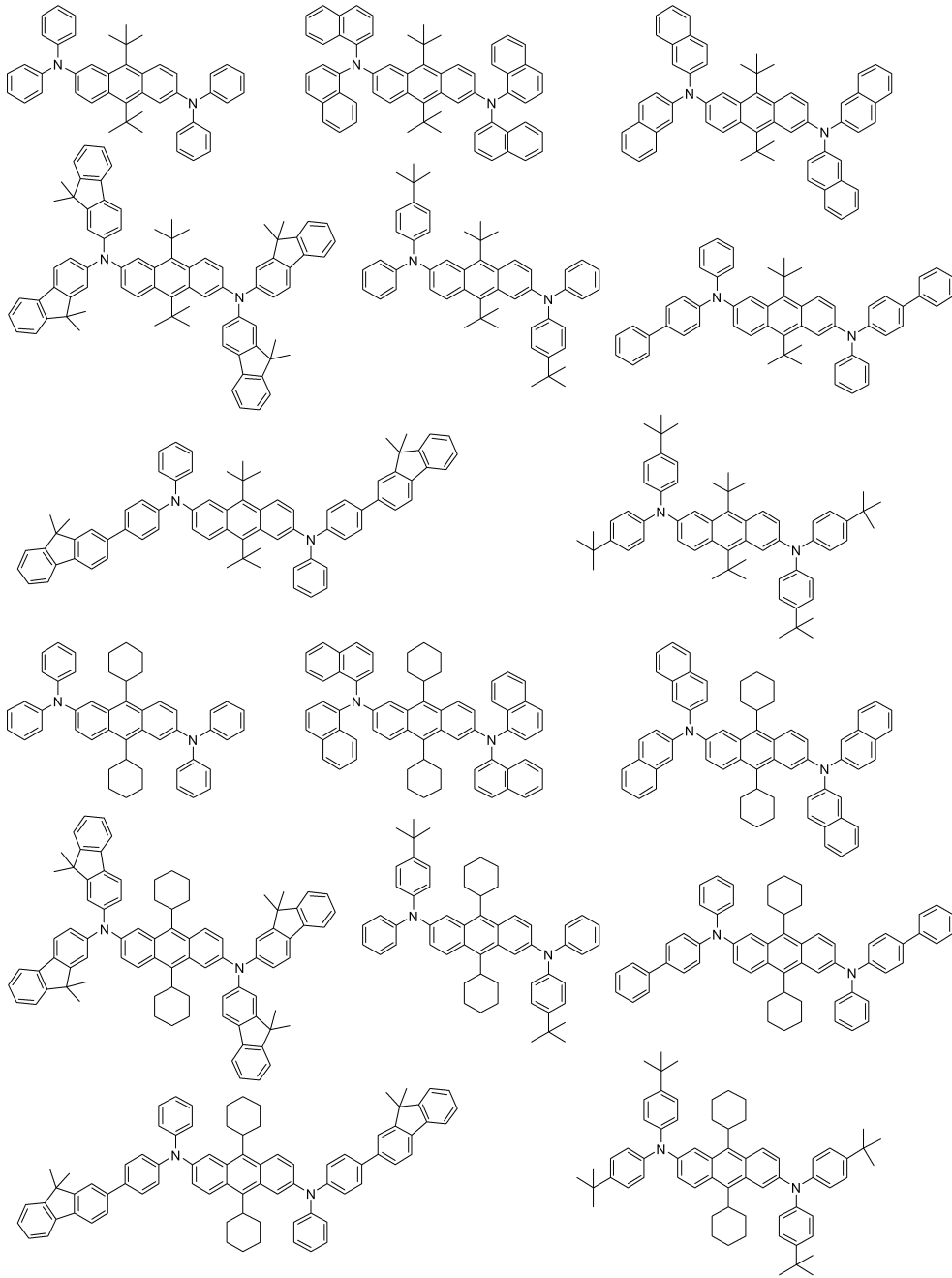
[0269]



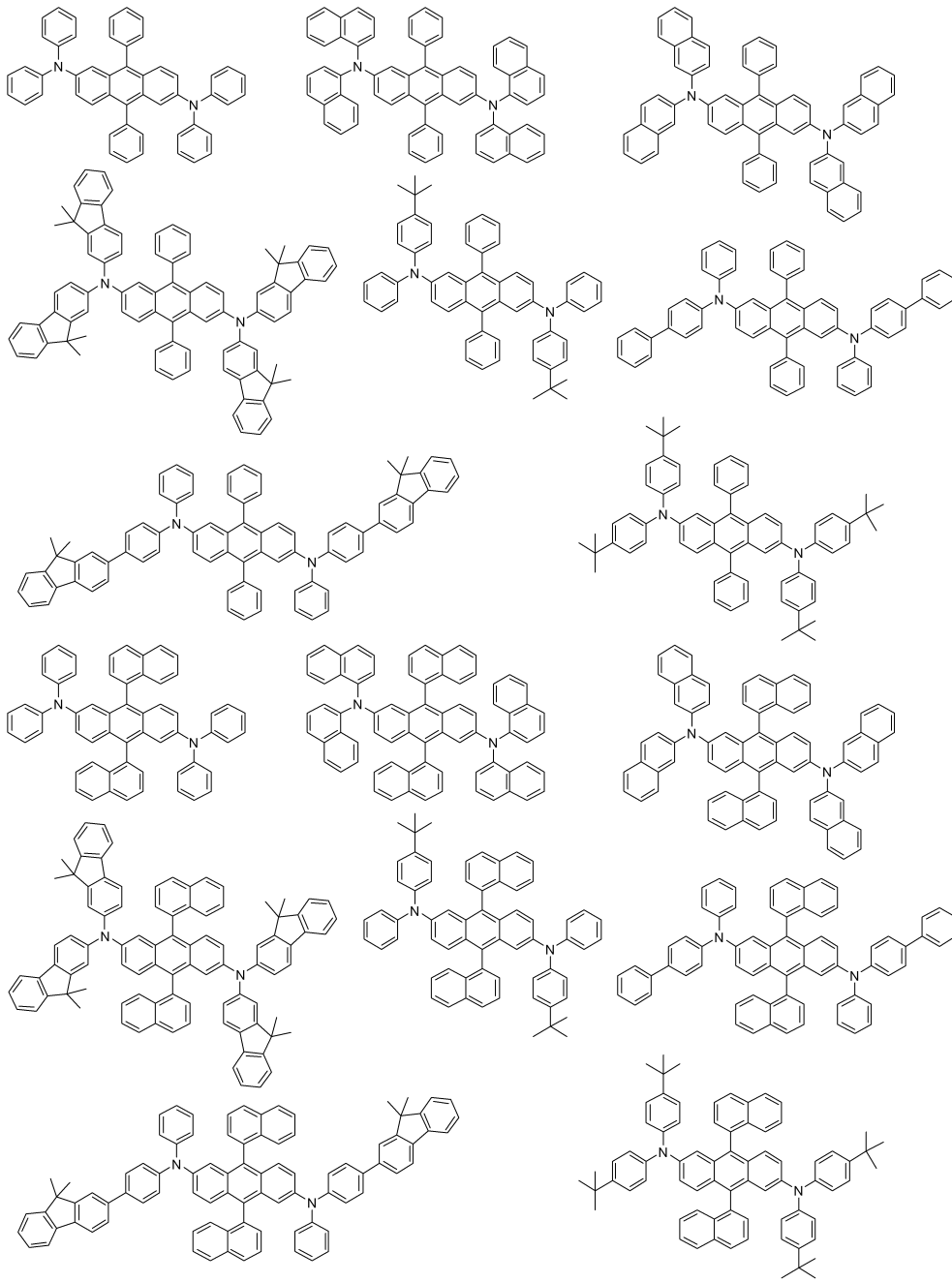
[0270]



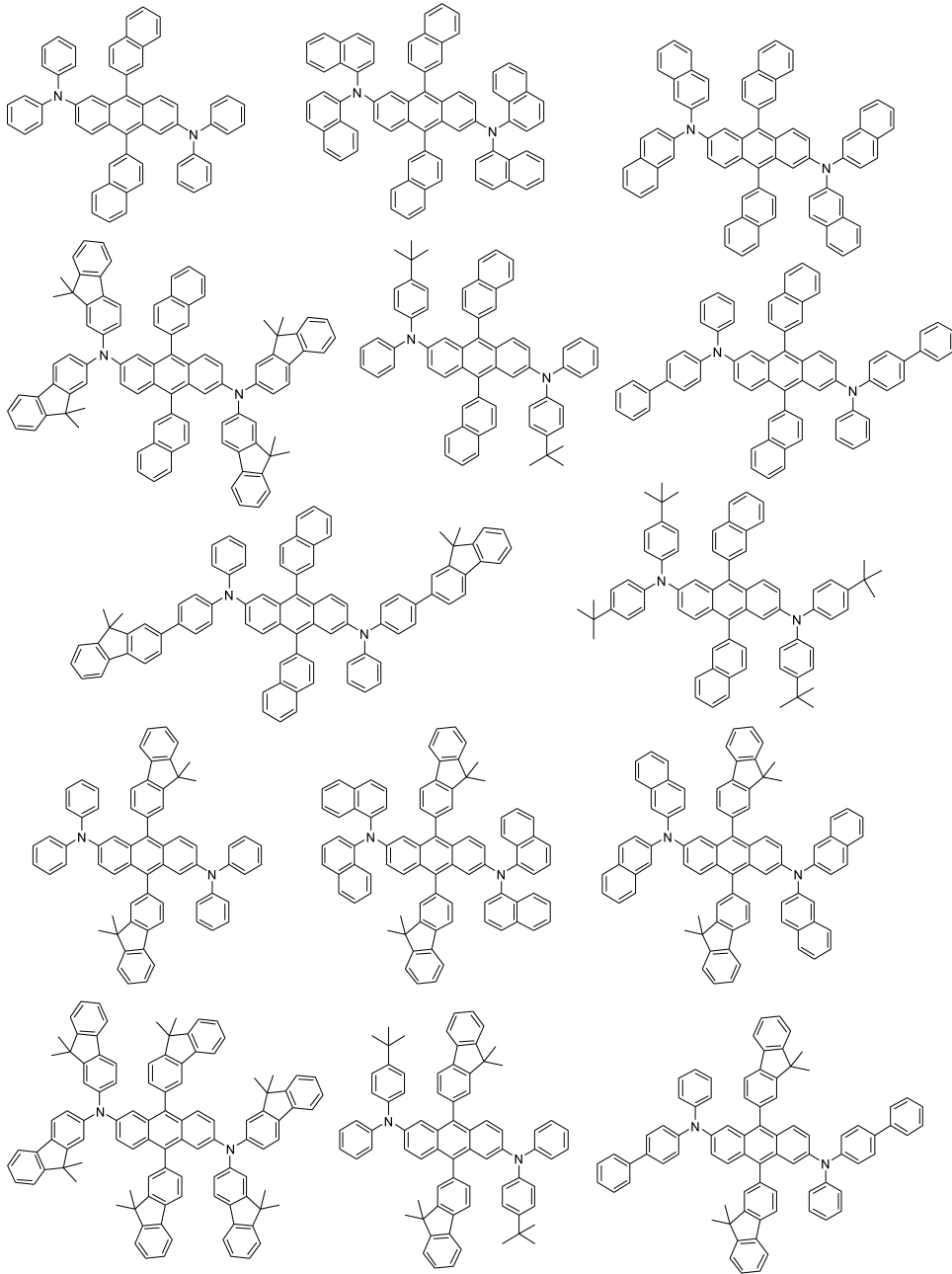
[0271]



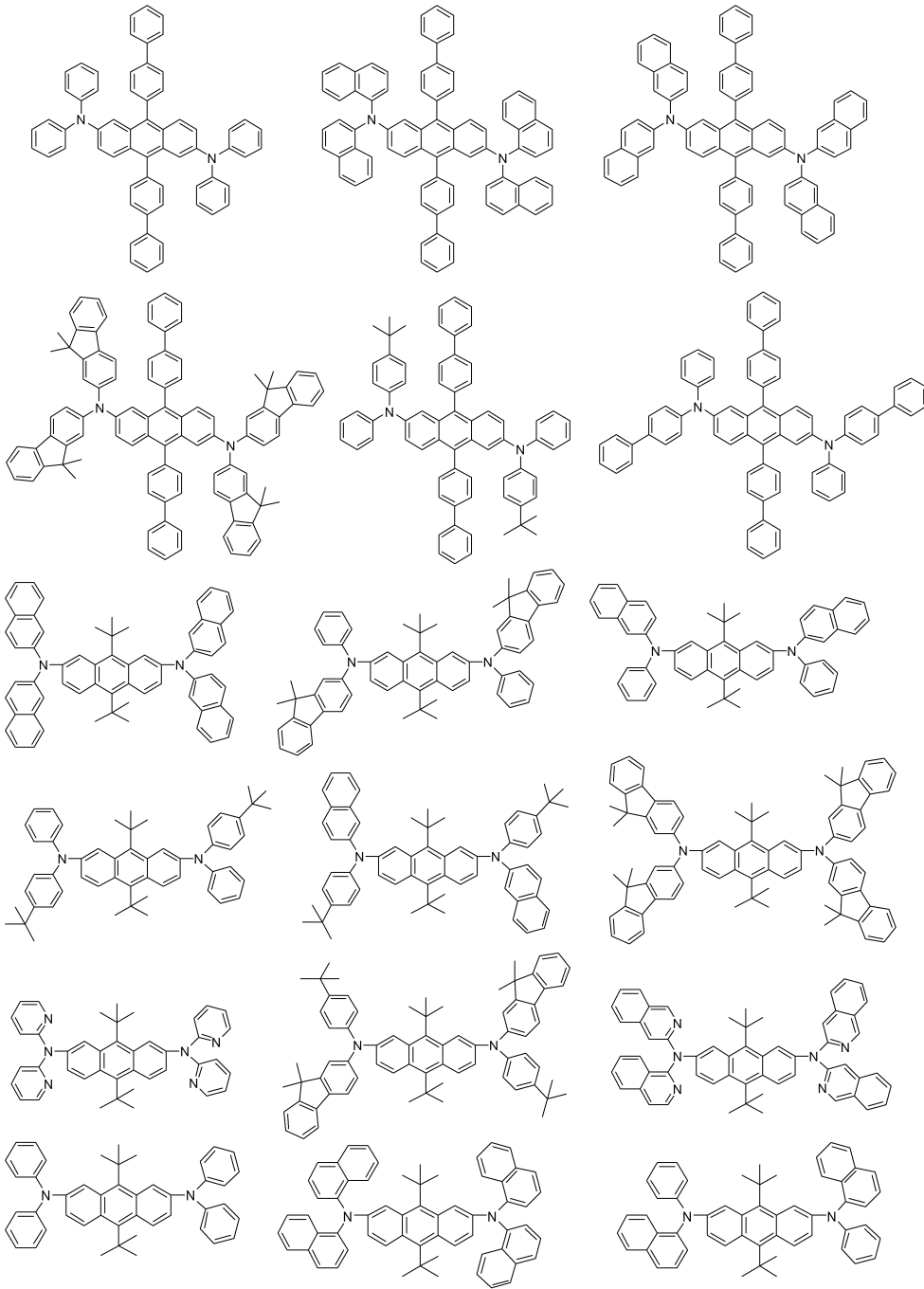
[0272]



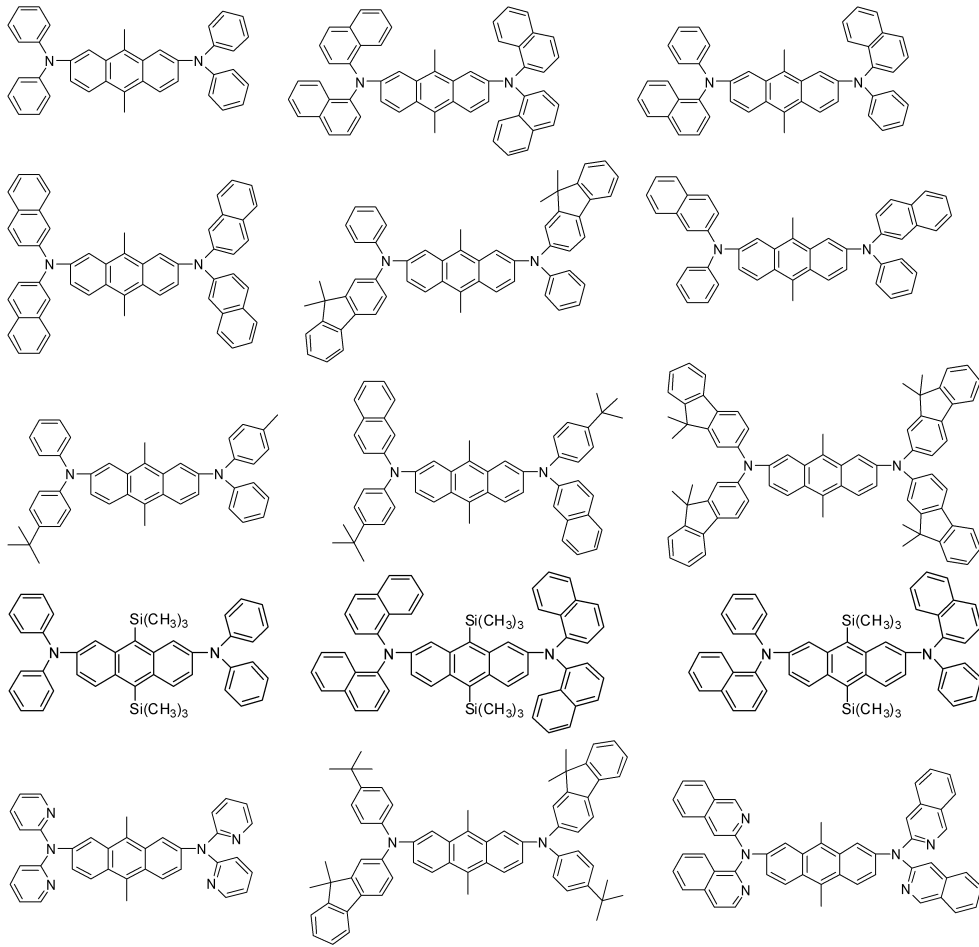
[0273]



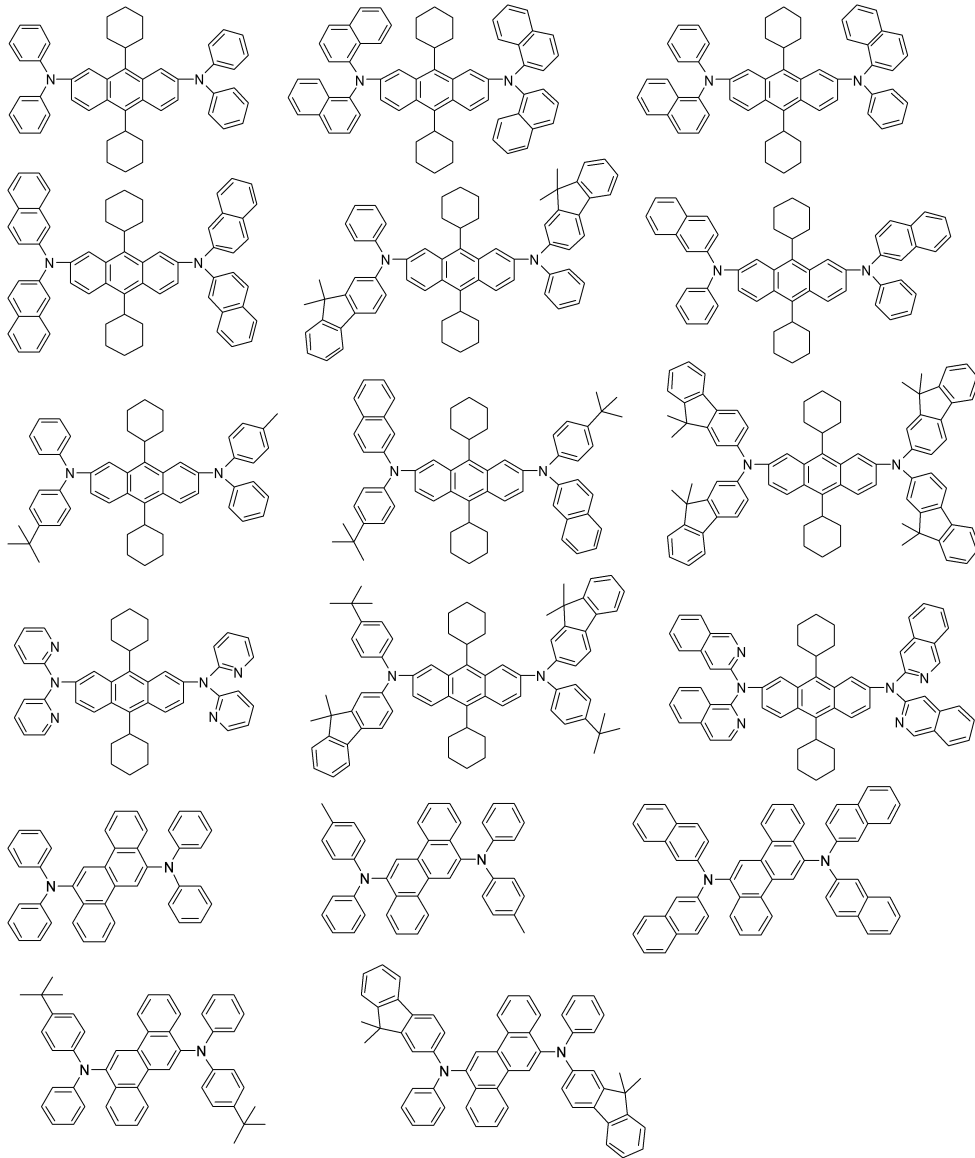
[0274]



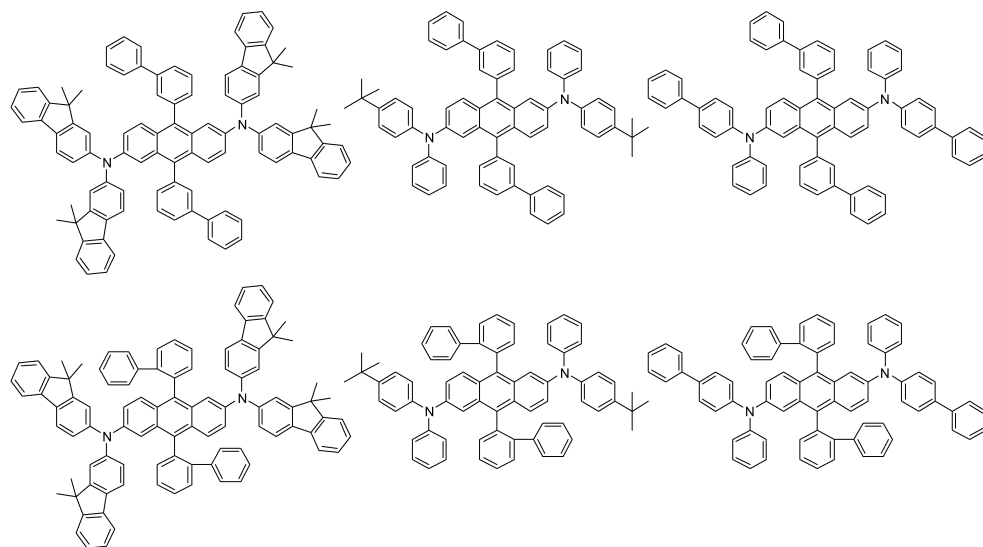
[0275]



[0276]



[0277]



[0278]

[0279]

본 발명의 유기 전기 발광 소자에 있어서, 한 쌍의 전극의 적어도 한쪽의 내측표면에, 칼코제나이드(chalcogenide)층, 할로겐화 금속층 및 금속 산화물층으로부터 선택되는 일층(이하, 이들을 "표면층"이라고 지칭함) 이상을 배치하는 것이 바람직하다. 구체적으로는, 발광 매체층 측의 양극 표면에 규소 및 알루미늄의 금

속의 칼코제나이드(산화물을 포함한다)층을, 또한 발광매체층 측의 음극 표면에 할로겐화 금속층 또는 금속 산화물층을 배치하는 것이 바람직하다. 이것에 의해, 구동의 안정화를 얻을 수 있다.

[0280] 상기 칼코제나이드로서는 예컨대 $SiO_x(1 \leq x \leq 2)$, $AlO_x(1 \leq x \leq 1.5)$, $SiON$, $SiAlON$ 등을 바람직하게 들 수 있으며, 할로겐화 금속으로서는 예컨대 LiF , MgF_2 , CaF_2 , 불화 희토류 금속 등을 바람직하게 들 수 있으며, 금속 산화물로서는 예컨대 Cs_2O , Li_2O , MgO , SrO , BaO , CaO 등을 바람직하게 들 수 있다.

[0281] 또한, 본 발명의 유기 전기 발광 소자에 있어서, 이렇게 제작된 한 쌍의 전극의 적어도 한쪽의 표면에 전자 전달 화합물과 환원성 도판트의 혼합 영역 또는 정공 전달 화합물과 산화성 도판트의 혼합 영역을 배치하는 것도 바람직하다. 이러한 방식으로, 전자 전달 화합물이 음이온으로 환원되므로 혼합 영역으로부터 발광 매체에 전자를 주입 및 전달하기 용이해진다. 또한, 정공 전달 화합물은 산화되어 양이온으로 되므로 혼합 영역으로부터 발광 매체에 정공을 주입 및 전달하기 용이해진다. 바람직한 산화성 도판트로서는 각종 루이스산 및 억셉터(acceptor) 화합물을 들 수 있다. 바람직한 환원성 도판트로서는 알칼리 금속, 알칼리 금속 화합물, 알칼리 토류 금속, 희토류 금속 및 이들의 혼합물을 들 수 있다.

효과

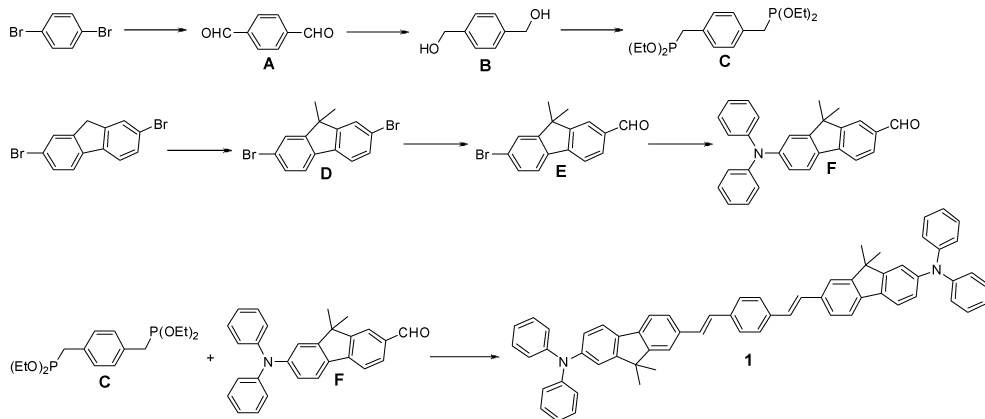
[0282] 본 발명에 따른 유기 발광 화합물은 발광 효율이 좋고 재료의 수명특성이 뛰어나 소자의 구동수명이 매우 우수한 OLED 소자를 제조할 수 있는 장점이 있다.

발명의 실시를 위한 구체적인 내용

[0283] 이하에서, 본 발명의 상세한 이해를 위하여 본 발명의 대표 화합물을 들어 본 발명에 따른 유기 발광 화합물, 이의 제조방법 및 소자의 발광특성을 설명하나, 이는 단지 그 실시 양태를 예시하기 위한 것일 뿐, 본 발명의 범위를 한정하는 것은 아니다.

[제조예]

[0285] [제조예 1] 화합물 1의 제조



[0286]

화합물 A의 제조

[0288] 1,4-디브로모벤젠 (20.0 g, 56.81 mmol)을 테트라히드로푸란 (1000 mL)에 녹이고 -78°C로 온도를 낮춘 다음 2.5M 부틸리튬(n-BuLi) (56.81 mL, 142.02 mmol)을 천천히 적가하여 주었다. 30분 교반 후, N,N-디메틸포름아미드(DMF) (13.19 mL, 170.43 mmol)을 넣어 주었다. 온도를 천천히 올려 2시간동안 교반한 다음, NH_4Cl 수용액 (800 mL)과 증류수 (800 mL)를 가해 반응을 종료하고, 유기층을 분리하여 유기층을 감압 제거시킨 후 메탄올과 헥산으로 재결정하여 화합물 A (11.09 g, 44.31 mmol)을 얻었다.

화합물 B의 제조

[0290] 화합물 A (11.09 g, 44.31 mmol)과 $NaBH_4$ (2.5g, 66.47 mmol)을 반응기에 넣고 감압하여 공기를 제거한 후 질 소기체를 채운다. 테트라하이드로푸란 용매(600 mL)를 넣고 교반하였다. 교반하면서 메탄올 (350 mL)을 천천히 적가하였다. 반응 종료 후에 물 (1000 mL)로 씻어주고 에틸아세테이트로 추출한다. 디클로로메탄과 헥산 조건으

로 컬럼하여 목적 화합물 **B** (8.45 g, 33.12 mmol)을 얻었다

[0291] 화합물 C의 제조

[0292] 화합물 **B** (5.0 g, 19.66 mmol)을 반응용기에 넣은 후 감압으로 공기를 제거한 후 질소가스로 채운 후에 트리에틸포스파이트 (10.15 mL, 58.98 mmol) 중 5 mL를 넣고서 녹인다. 다른 반응용기에 트리에틸포스파이트 나머지 5.15 mL를 넣고서 뚜껑을 열고 I₂ (9.98 g, 39.32 mmol)를 조금씩 넣어주면서 0°C에서 30분 동안 교반하였다. 요오드와 트리에틸포스파이트의 혼합물을 화합물 **B**가 들어있는 반응 용기에 넣는다. 150°C까지 온도를 올린 후 4시간 동안 교반하였다. 반응이 종료되면 감압증류를 통해 트리에틸포스파이트를 제거한 후 물 (50 mL)로 씻어 주고 에틸아세테이트 (50 mL)로 추출하였다. 얻은 화합물을 메탄올로 재결정하여 화합물 **C** (13.59 g, 27.48 mmol)을 얻었다.

[0293] 화합물 D의 제조

[0294] 질소 존재 하에서, 2,7-디브로모플루오렌(2,7-dibromofluorene) (50 g, 154.26 mmol), 포타슘하드이록사이드 (KOH) (69.2 g, 1234 mmol)을 DMSO (700 mL)에 녹이고 0°C로 냉각, 증류수 (113 mL)을 천천히 적가해주고 한 시간동안 교반하였다. 그 후 아이오도메탄(CH₃I) (38.49 mL, 617.04 mmol)을 천천히 적가해 주고 온도를 천천히 올려 실온에서 15시간동안 교반하였다. 과량의 물을 넣어 반응을 종결하고 디클로로메탄으로 추출하였다. 여기서 얻어진 유기층을 마그네슘 설페이트로 건조하고 여과하여 감압 농축시킨 후 컬럼을 통해 화합물 **D** (53.0 g, 150.50 mmol)을 얻었다.

[0295] 화합물 E의 제조

[0296] 얻어진 화합물 **D** (53.0 g, 150.50 mmol)을 테트라히드로퓨란 (350 mL)에 녹이고 -78°C로 온도를 낮춘다음 1.6M *n*-BuLi (63.2 mL, 158.04 mmol)을 천천히 적가해주었다. 30분 교반후, *N,N*-디메틸 포름아미드 (16.32 mL, 210.7 mmol)을 넣어 주었다. 온도를 천천히 올려 2시간동안 교반한 다음, NH₄Cl 수용액 (80 mL)과 증류수 (80 mL)를 가해 반응을 종료하고, 유기층을 분리하여 유기층을 감압 제거시킨 후 컬럼을 통해 분리하여 화합물 **E** (20.9 g, 69.40 mmol)을 얻었다.

[0297] 화합물 F의 제조

[0298] 얻어진 알데히드 화합물 **E** (20.9 g, 69.40 mmol), 디페닐아민 (12.5 g, 104.10 mmol), 세슘 카보네이트 (24.1 g, 104.10 mmol), Pd(OAc)₂ (332 mg, 2.08 mmol)을 톨루엔 (800 mL)에 현탁한 후 P(*t*-Bu)₃ (599 mg, 4.16 mmol)을 가하고 120°C에서 4시간동안 교반하였다. 포화 NH₄Cl수용액 (500 mL)를 가하고 에틸아세테이트 (500 mL)로 추출한 다음 건조, 여과, 감압농축하여 메탄올/*n*-헥산 (300 mL (부피비 = 1/1))으로 재결정하여 화합물 **F** (15.2 g, 39.00 mmol)을 얻었다.

[0299] 화합물 1의 제조

[0300] 화합물 **C** (5.1 g, 9.72 mmol)과 화합물 **F** (5.8 g, 21.37 mmol)을 반응용기에 넣은 후, 감압 건조하였다. 질소 분위기를 만든 후 테트라하이드로퓨란 용매 (200 mL)를 넣고 교반하였다. 칼륨터트부톡사이드(*t*-BuOK) (4.14 g, 37.17 mmol)를 테트라하이드로퓨란 (30 mL)에 녹여 0°C하에서 천천히 적가한 후 서서히 상온으로 온도를 올린다. 4시간 동안 교반 후 반응이 종료되면 물 (500 mL)을 부은 후 생성되는 고체를 여과하였다. 메탄올 (1 L)로 씻어주며 3회 반복한다. 테트라하이드로퓨란과 메탄올로 재결정 한 후 헥산으로 씻어주어 목적화합물 **1** (5.00 g, 6.6 mmol)로 얻었다.

[0301] 상기 제조예 1의 방법을 이용하여 유기 발광 화합물 **1** 내지 화합물 **719**을 제조하였으며, 표 1에 제조된 유기 발광 화합물들의 ¹H NMR 및 MS/FAB를 나타내었다.

[0302] [표 1]

화합물	¹ H NMR(CDCI ₃ , 200 MHz)	MS/FAB	
		found	calculated
1	δ = 1.72(12H, s), 6.58~6.63(10H, m), 6.75~6.81(6H, m), 6.95(4H, m), 7.2(8H, m), 7.5~7.54(6H, m), 7.62(2H, m), 7.71(2H, m), 7.87(2H, m)	849.11	848.41
4	δ = 1.72(12H, s), 2.34(12H, s), 6.44(4H, m), 6.55~6.59(10H, m), 6.75(2H, m), 6.95(4H, m), 7.08(4H, m), 7.5~7.54(6H, m), 7.62(2H, m), 7.71(2H, m), 7.87(2H, m)	905.22	904.48
9	δ = 1.35(36H, s), 1.72(12H, s), 6.55~6.58(10H, m), 6.75(2H, m), 6.95~7.01(12H, m), 7.5~7.54(6H, m), 7.62(2H, m), 7.71(2H, m), 7.87(2H, m)	1073.54	1072.66
10	δ = 1.72(36H, s), 6.58(6H, m), 6.75(6H, m), 6.95(4H, m), 7.28(4H, m), 7.38(4H, m), 7.5~7.55(10H, m), 7.62(6H, m), 7.71(2H, m), 7.87(6H, m)	1313.75	1312.66
13	δ = 1.72(12H, s), 6.95(4H, m), 7.17(2H, m), 7.25~7.34(10H, m), 7.5(8H, m), 7.63(2H, m), 7.87(4H, m), 7.94(2H, m), 8.12(2H, m), 8.55(2H, m)	845.08	844.38
15	δ = 1.72(12H, s), 6.58~6.63(6H, m), 6.75~6.81(4H, m), 6.95~6.98(6H, m), 7.2(4H, m), 7.38(2H, m), 7.5~7.62(14H, m), 7.71(2H, m), 7.87(2H, m), 8.02~8.07(4H, m)	949.23	948.44
20	δ = 1.72(24H, s), 6.58~6.63(8H, m), 6.75~6.81(6H, m), 6.95(4H, m), 7.2(4H, m), 7.28(2H, m), 7.38(2H, m), 7.5~7.55(8H, m), 7.62(4H, m), 7.71(2H, m), 7.87(4H, m)	1081.43	1080.54
28	δ = 1.72(12H, s), 6.58~6.63(6H, m), 6.75~6.81(4H, m), 6.91~6.95(6H, m), 7.2(4H, m), 7.5~7.54(6H, m), 7.62(2H, m), 7.71(2H, m), 7.82~7.88(10H, m), 8.12(4H, m), 8.93(4H, m)	1049.35	1048.48
33	δ = 1.35(18H, s), 1.72(12H, s), 6.55~6.58(6H, m), 6.75(2H, m), 6.95~7.01(10H, m), 7.38(2H, m), 7.5~7.62(14H, m), 7.71(2H, m), 7.87(2H, m), 8.02~8.07(4H, m)	1061.44	1060.57
37	δ = 1.72(24H, s), 6.58(4H, m), 6.75(4H, m), 6.95~6.98(6H, m), 7.28(2H, m), 7.38(4H, m), 7.5~7.62(18H, m), 7.71(2H, m), 7.87(4H, m), 8.02~8.07(4H, m)	1181.55	1180.57
46	δ = 1.72(12H, s), 6.58(2H, m), 6.69~6.75(6H, m), 6.95(4H, m), 7.36~7.41(4H, m), 7.49~7.54(22H, m), 7.62(2H, m), 7.71~7.77(6H, m), 7.84~7.88(6H, m)	1101.42	1100.51
54	δ = 1.72(24H, s), 2.34(12H, s), 6.36(4H, m), 6.58(4H, m), 6.71~6.75(6H, m), 6.95(4H, m), 7.28(2H, m), 7.38(2H, m), 7.5~7.55(8H, m), 7.62(4H, m), 7.71(2H, m), 7.87(4H, m)	1137.54	1136.60
66	δ = 1.35(18H, s), 1.72(12H, s), 6.55~6.58(6H, m), 6.69~6.75(6H, m), 6.95~7.01(8H, m), 7.41(2H, m), 7.5~7.54(18H, m), 7.62(2H, m), 7.71(2H, m), 7.87(2H, m)	1113.52	1112.60

[0303]

70	$\delta = 1.72(12H, s), 2.34(18H, s), 6.36(4H, m), 6.51(4H, m), 6.58(2H, m), 6.71\sim 6.75(4H, m), 6.95\sim 6.98(8H, m), 7.5\sim 7.54(6H, m), 7.62(2H, m), 7.71(2H, m), 7.87(2H, m)$	933.27	932.51
84	$\delta = 1.72(12H, s), 2.34(12H, s), 6.36(4H, m), 6.58(2H, m), 6.71\sim 6.75(4H, m), 6.91\sim 6.95(6H, m), 7.5\sim 7.54(6H, m), 7.62(2H, m), 7.71(2H, m), 7.82\sim 7.88(10H, m), 8.12(4H, m), 8.93(4H, m)$	1105.45	1104.54
106	$\delta = 1.72(12H, s), 6.58\sim 6.62(4H, m), 6.7\sim 6.75(4H, m), 6.95(4H, m), 7.27(2H, m), 7.36(2H, m), 7.5\sim 7.55(8H, m), 7.62(2H, m), 7.71(2H, m), 7.87(2H, m), 8.04\sim 8.09(6H, m)$	853.06	852.39
112	$\delta = 1.72(12H, s), 6.58\sim 6.62(4H, m), 6.7\sim 6.75(4H, m), 6.95\sim 6.99(6H, m), 7.41\sim 7.62(16H, m), 7.71(2H, m), 7.87(2H, m), 8.07(2H, m), 8.17(2H, m), 8.28(2H, m)$	953.18	952.43
117	$\delta = 1.72(12H, s), 6.58\sim 6.63(6H, m), 6.69\sim 6.81(8H, m), 6.95(4H, m), 7.2(4H, m), 7.5\sim 7.62(18H, m), 7.71\sim 7.73(4H, m), 7.87\sim 7.92(4H, m), 8(4H, m)$	1101.42	1100.51
120	$\delta = 1.72(24H, s), 6.58\sim 6.63(6H, m), 6.69\sim 6.81(8H, m), 6.95(4H, m), 7.2(4H, m), 7.28(2H, m), 7.38(2H, m), 7.5\sim 7.55(12H, m), 7.62\sim 7.63(4H, m), 7.71\sim 7.77(4H, m), 7.87\sim 7.93(6H, m)$	1233.62	1232.60
123	$\delta = 1.72(24H, s), 6.58(2H, m), 6.69\sim 6.75(6H, m), 6.95\sim 6.98(6H, m), 7.28(2H, m), 7.38(4H, m), 7.5\sim 7.63(22H, m), 7.71\sim 7.77(4H, m), 7.87\sim 7.93(6H, m), 8.02\sim 8.07(4H, m)$	1333.74	1332.63
130	$\delta = 1.72(12H, s), 6.58(2H, m), 6.69\sim 6.75(10H, m), 6.95(4H, m), 7.5\sim 7.62(28H, m), 7.71\sim 7.73(6H, m), 7.87\sim 7.92(6H, m), 8(8H, m)$	1353.73	1352.60
135	$\delta = 1.72(24H, s), 2.34(6H, s), 6.51(4H, m), 6.58(2H, m), 6.69\sim 6.75(6H, m), 6.95\sim 6.98(8H, m), 7.28(2H, m), 7.38(2H, m), 7.5\sim 7.55(12H, m), 7.62\sim 7.63(4H, m), 7.71\sim 7.77(4H, m), 7.87\sim 7.93(6H, m)$	1261.68	1260.63
142	$\delta = 1.72(12H, s), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.2(8H, m), 7.54\sim 7.56(6H, m), 7.62\sim 7.64(6H, m), 7.71(2H, m), 7.87(2H, m)$	925.21	924.44
145	$\delta = 1.72(12H, s), 6.58(2H, m), 6.75(2H, m), 6.95(4H, m), 7.36(4H, m), 7.49\sim 7.56(14H, m), 7.62\sim 7.64(6H, m), 7.71\sim 7.77(10H, m), 7.84\sim 7.88(10H, m)$	1125.44	1124.51
154	$\delta = 1.72(12H, s), 6.58\sim 6.63(6H, m), 6.75\sim 6.81(4H, m), 6.95\sim 6.98(6H, m), 7.2(4H, m), 7.38(2H, m), 7.53\sim 7.64(18H, m), 7.71(2H, m), 7.87(2H, m), 8.02\sim 8.07(4H, m)$	1025.32	1024.48
162	$\delta = 1.72(24H, s), 6.58(4H, m), 6.75(4H, m), 6.95\sim 6.98(6H, m), 7.28(2H, m), 7.38(4H, m), 7.53\sim 7.64(22H, m), 7.71(2H, m), 7.87(4H, m), 8.02\sim 8.07(4H, m)$	1257.64	1256.60

[0304]

166	$\delta = 1.72(24H, s), 6.58(4H, m), 6.75(4H, m), 6.95(4H, m), 7.28(2H, m), 7.36\sim 7.38(4H, m), 7.49\sim 7.56(12H, m), 7.62\sim 7.64(8H, m), 7.71\sim 7.77(6H, m), 7.84\sim 7.88(8H, m)$	1257.64	1256.60
171	$\delta = 1.72(24H, s), 6.58\sim 6.61(8H, m), 6.75(4H, m), 6.95\sim 6.99(8H, m), 7.28(2H, m), 7.38(2H, m), 7.54\sim 7.56(8H, m), 7.62\sim 7.64(8H, m), 7.71(2H, m), 7.87(4H, m)$	1193.51	1192.55
173	$\delta = 1.72(12H, s), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.2\sim 7.25(12H, m), 7.54\sim 7.56(6H, m), 7.62\sim 7.64(6H, m), 7.71(2H, m), 7.87(2H, m)$	1001.30	1000.48
176	$\delta = 1.72(12H, s), 2.34(24H, s), 6.36(8H, m), 6.58(2H, m), 6.71\sim 6.75(6H, m), 6.95(4H, m), 7.25(4H, m), 7.54\sim 7.56(6H, m), 7.62\sim 7.64(6H, m), 7.71(2H, m), 7.87(2H, m)$	1113.52	1112.60
181	$\delta = 1.72(12H, s), 6.58\sim 6.63(6H, m), 6.75\sim 6.81(4H, m), 6.95(4H, m), 7.2\sim 7.25(8H, m), 7.36(2H, m), 7.49\sim 7.56(10H, m), 7.62\sim 7.64(6H, m), 7.71\sim 7.77(6H, m), 7.84\sim 7.88(6H, m)$	1101.42	1100.51
187	$\delta = 1.35(18H, s), 1.72(24H, s), 6.55\sim 6.58(8H, m), 6.75(4H, m), 6.95\sim 7.01(8H, m), 7.25\sim 7.28(6H, m), 7.38(2H, m), 7.54\sim 7.56(8H, m), 7.62\sim 7.64(8H, m), 7.71(2H, m), 7.87(4H, m)$	1345.84	1344.73
194	$\delta = 1.72(12H, s), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.2(8H, m), 7.54\sim 7.55(4H, m), 7.62(2H, m), 7.71(2H, m), 7.87\sim 7.93(6H, m)$	899.17	898.43
198	$\delta = 1.35(36H, s), 1.72(12H, s), 6.55\sim 6.58(10H, m), 6.75(2H, m), 6.95\sim 7.01(12H, m), 7.54\sim 7.55(4H, m), 7.62(2H, m), 7.71(2H, m), 7.87\sim 7.93(6H, m)$	1123.60	1122.68
199	$\delta = 1.72(12H, s), 6.58\sim 6.62(6H, m), 6.7\sim 6.75(6H, m), 6.95(4H, m), 7.54\sim 7.55(8H, m), 7.62(2H, m), 7.71(2H, m), 7.87\sim 7.93(6H, m), 8.07(4H, m)$	903.12	902.41
203	$\delta = 1.72(24H, s), 6.58\sim 6.63(8H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.2(4H, m), 7.28(2H, m), 7.38(2H, m), 7.54\sim 7.55(6H, m), 7.62(4H, m), 7.71(2H, m), 7.87\sim 7.93(8H, m)$	1131.49	1130.55
212	$\delta = 1.72(12H, s), 2.34(24H, s), 6.36(8H, m), 6.58(2H, m), 6.71\sim 6.75(6H, m), 6.95(4H, m), 7.54\sim 7.55(4H, m), 7.62(2H, m), 7.71(2H, m), 7.78(2H, m), 7.87\sim 7.9(4H, m)$	1011.38	1010.55
220	$\delta = 1.72(12H, s), 6.58\sim 6.63(6H, m), 6.69\sim 6.81(8H, m), 6.95(4H, m), 7.2(4H, m), 7.41(2H, m), 7.51\sim 7.55(16H, m), 7.62(2H, m), 7.71(2H, m), 7.78(2H, m), 7.87\sim 7.9(4H, m)$	1051.36	1050.49
223	$\delta = 1.72(12H, s), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.2(8H, m), 7.54\sim 7.62(6H, m), 7.71(2H, m), 7.8(2H, m), 7.87(2H, m), 7.95(2H, m)$	899.17	898.43

[0305]

231	$\delta = 1.35(18H, s), 1.72(12H, s), 6.55\sim 6.63(10H, m), 6.75\sim 6.81(4H, m), 6.95\sim 7.01(8H, m), 7.2(4H, m), 7.54\sim 7.62(6H, m), 7.71(2H, m), 7.8(2H, m), 7.87(2H, m), 7.95(2H, m)$	1011.38	1010.55
237	$\delta = 1.35(18H, s), 1.72(12H, s), 6.55\sim 6.58(6H, m), 6.75(2H, m), 6.95\sim 7.01(10H, m), 7.38(2H, m), 7.53\sim 7.62(12H, m), 7.71(2H, m), 7.8(2H, m), 7.87(2H, m), 7.95(2H, m), 8.02\sim 8.07(4H, m)$	1111.50	1110.59
238	$\delta = 1.72(12H, s), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.2(8H, m), 7.54(2H, m), 7.62(2H, m), 7.71(4H, m), 7.87(2H, m), 8.04(2H, m), 8.28(2H, m), 8.93(2H, m)$	949.23	948.44
242	$\delta = 1.72(12H, s), 2.34(12H, s), 6.44(4H, m), 6.55\sim 6.59(10H, m), 6.75(2H, m), 6.95(4H, m), 7.08(4H, m), 7.54(2H, m), 7.62(2H, m), 7.71(4H, m), 7.87(2H, m), 8.04(2H, m), 8.28(2H, m), 8.93(2H, m)$	1005.33	1004.51
251	$\delta = 1.35(18H, s), 1.72(12H, s), 6.55\sim 6.63(10H, m), 6.75\sim 6.81(4H, m), 6.95\sim 7.01(8H, m), 7.2(4H, m), 7.54(2H, m), 7.62(2H, m), 7.71(4H, m), 7.87(2H, m), 8.04(2H, m), 8.28(2H, m), 8.93(2H, m)$	1061.44	1060.57
256	$\delta = 1.72(12H, s), 6.58(2H, m), 6.75(2H, m), 6.95\sim 6.98(8H, m), 7.38(4H, m), 7.53\sim 7.62(16H, m), 7.71(6H, m), 7.87(2H, m), 7.98\sim 8.07(12H, m)$	1173.48	1172.51
265	$\delta = 1.72(12H, s), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.2(8H, m), 7.39(4H, m), 7.54\sim 7.55(4H, m), 7.62(2H, m), 7.71(2H, m), 7.87\sim 7.91(6H, m)$	1023.31	1022.46
270	$\delta = 1.72(36H, s), 6.58(6H, m), 6.75(6H, m), 6.95(4H, m), 7.28(4H, m), 7.38\sim 7.39(8H, m), 7.54\sim 7.55(8H, m), 7.62(6H, m), 7.71(2H, m), 7.87\sim 7.91(10H, m)$	1487.95	1486.71
275	$\delta = 1.72(12H, s), 6.58(2H, m), 6.69\sim 6.75(6H, m), 6.95(4H, m), 7.36\sim 7.41(8H, m), 7.49\sim 7.55(20H, m), 7.62(2H, m), 7.71\sim 7.77(6H, m), 7.84\sim 7.91(10H, m)$	1275.62	1274.55
280	$\delta = 1.72(12H, s), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.2(8H, m), 7.54(2H, m), 7.62(2H, m), 7.71(2H, m), 7.85\sim 7.87(4H, m), 8.04(2H, m), 8.28(2H, m), 8.52(2H, m), 8.93(2H, m)$	999.29	998.46
289	$\delta = 1.72(12H, s), 6.58(2H, m), 6.69\sim 6.75(10H, m), 6.95(4H, m), 7.41(4H, m), 7.51\sim 7.54(26H, m), 7.62(2H, m), 7.71(2H, m), 7.85\sim 7.87(4H, m), 8.04(2H, m), 8.28(2H, m), 8.52(2H, m), 8.93(2H, m)$	1303.67	1302.59

[0306]

296	$\delta = 1.72(12H, s), 2.34(6H, s), 6.44(2H, m), 6.55\sim 6.63(10H, m), 6.75\sim 6.81(4H, m), 6.95(4H, m), 7.08(2H, m), 7.2(4H, m), 7.54(2H, m), 7.62(2H, m), 7.71(2H, m), 7.85\sim 7.87(4H, m), 8.04(2H, m), 8.28(2H, m), 8.52(2H, m), 8.93(2H, m)$	1027.34	1026.49
299	$\delta = 1.35(18H, s), 1.72(12H, s), 6.55\sim 6.63(10H, m), 6.75\sim 6.81(4H, m), 6.95\sim 7.01(8H, m), 7.2(4H, m), 7.54(2H, m), 7.62(2H, m), 7.71(2H, m), 7.85\sim 7.87(4H, m), 8.04(2H, m), 8.28(2H, m), 8.52(2H, m), 8.93(2H, m)$	1111.50	1110.59
305	$\delta = 1.72(12H, s), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.2(8H, m), 7.43(2H, m), 7.54(2H, m), 7.62(2H, m), 7.71(2H, m), 7.87(2H, m), 7.98\sim 7.99(4H, m)$	955.26	954.40
309	$\delta = 1.72(12H, s), 2.34(12H, s), 6.44(4H, m), 6.55\sim 6.59(10H, m), 6.75(2H, m), 6.95(4H, m), 7.08(4H, m), 7.43(2H, m), 7.54(2H, m), 7.62(2H, m), 7.71(2H, m), 7.87(2H, m), 7.98\sim 7.99(4H, m)$	1011.36	1010.46
315	$\delta = 1.35(36H, s), 1.72(12H, s), 6.55\sim 6.58(10H, m), 6.75(2H, m), 6.95\sim 7.01(12H, m), 7.43(2H, m), 7.54(2H, m), 7.62(2H, m), 7.71(2H, m), 7.87(2H, m), 7.98\sim 7.99(4H, m)$	1179.68	1178.65
320	$\delta = 0.66(6H, s), 1.72(12H, s), 6.58(2H, m), 6.75(2H, m), 6.95(4H, m), 7.36(4H, m), 7.49\sim 7.56(14H, m), 7.62(2H, m), 7.71\sim 7.77(10H, m), 7.84\sim 7.88(10H, m), 8.17(2H, m)$	1181.58	1180.52
326	$\delta = 0.66(6H, s), 1.72(12H, s), 6.58\sim 6.63(6H, m), 6.75\sim 6.81(4H, m), 6.95\sim 6.98(6H, m), 7.2(4H, m), 7.38(2H, m), 7.52\sim 7.62(14H, m), 7.71(2H, m), 7.87(2H, m), 8.02\sim 8.07(4H, m), 8.17(2H, m)$	1081.46	1080.48
330	$\delta = 1.72(12H, s), 6.58(2H, m), 6.75(2H, m), 6.95(4H, m), 7.08(1H, m), 7.36(4H, m), 7.45\sim 7.63(18H, m), 7.7\sim 7.77(11H, m), 7.84\sim 7.88(10H, m), 7.94(1H, m), 8.46(1H, m), 8.59(1H, m)$	1214.54	1213.53
337	$\delta = 1.72(12H, s), 2.34(6H, s), 6.51(4H, m), 6.58\sim 6.63(6H, m), 6.75\sim 6.81(4H, m), 6.95\sim 6.98(8H, m), 7.08(1H, m), 7.2(4H, m), 7.45\sim 7.63(10H, m), 7.7\sim 7.71(3H, m), 7.87(2H, m), 7.94(1H, m), 8.46(1H, m), 8.59(1H, m)$	1042.35	1041.50
340	$\delta = 1.72(12H, s), 6.58(2H, m), 6.75(2H, m), 6.95(4H, m), 7.36\sim 7.42(8H, m), 7.49\sim 7.54(10H, m), 7.62(2H, m), 7.71\sim 7.78(25H, m), 8.4(2H, m)$	1231.50	1230.50
345	$\delta = 1.72(12H, s), 6.58\sim 6.63(6H, m), 6.75\sim 6.81(4H, m), 6.95(4H, m), 7.2(4H, m), 7.36\sim 7.42(6H, m), 7.49\sim 7.54(6H, m), 7.62(2H, m), 7.71\sim 7.78(17H, m), 8.4(2H, m)$	1131.39	1130.47
349	$\delta = 1.72(12H, s), 3.81(2H, s), 6.44(2H, m), 6.58\sim 6.63(12H, m), 6.75\sim 6.81(7H, m), 6.95\sim 6.98(6H, m), 7.07(2H, m), 7.2(10H, m), 7.54(2H, m), 7.62(2H, m), 7.71(2H, m), 7.87(2H, m)$	1028.33	1027.49

[0307]

350	$\delta = 1.72(18H, s), 6.48(2H, m), 6.58\sim 6.63(12H, m), 6.75\sim 6.81(7H, m), 6.95(4H, m), 7.05(2H, m), 7.11(2H, m), 7.2(10H, m), 7.54(2H, m), 7.62(2H, m), 7.71(2H, m), 7.87(2H, m)$	1056.38	1055.52
351	$\delta = 1.72(12H, s), 6.58\sim 6.63(12H, m), 6.75\sim 6.84(9H, m), 6.91\sim 6.95(6H, m), 7.16\sim 7.2(12H, m), 7.54(2H, m), 7.62(2H, m), 7.71(2H, m), 7.87(2H, m)$	1046.37	1045.44
352	$\delta = 1.72(12H, s), 6.52(2H, m), 6.58\sim 6.63(12H, m), 6.75\sim 6.81(7H, m), 6.89(2H, m), 6.95(4H, m), 7.17\sim 7.2(12H, m), 7.54(2H, m), 7.62(2H, m), 7.71(2H, m), 7.87(2H, m)$	1030.30	1029.47
353	$\delta = 1.3(4H, m), 1.45(4H, m), 1.72(12H, s), 6.58\sim 6.66(14H, m), 6.75\sim 6.81(7H, m), 6.95\sim 6.96(6H, m), 7.2\sim 7.21(12H, m), 7.54(2H, m), 7.62(2H, m), 7.71(2H, m), 7.87(2H, m)$	1098.49	1097.51
354	$\delta = 1.72(12H, s), 6.31(2H, m), 6.38(2H, m), 6.58\sim 6.63(14H, m), 6.75\sim 6.81(8H, m), 6.95(4H, m), 7.13(2H, m), 7.2(12H, m), 7.54(2H, m), 7.62(2H, m), 7.71(2H, m), 7.87(2H, m)$	1105.41	1104.51
355	$\delta = 1.72(12H, s), 2.88(4H, m), 6.51(2H, m), 6.58\sim 6.63(12H, m), 6.75\sim 6.81(7H, m), 6.95(4H, m), 7.04(2H, m), 7.14(2H, m), 7.2(10H, m), 7.54(2H, m), 7.62(2H, m), 7.71(2H, m), 7.87(2H, m)$	1042.35	1041.50
356	$\delta = 1.72(12H, s), 6.56\sim 6.63(14H, m), 6.75\sim 6.86(9H, m), 6.95\sim 6.99(6H, m), 7.2\sim 7.25(12H, m), 7.54(2H, m), 7.62(2H, m), 7.71(2H, m), 7.87(2H, m)$	1040.34	1039.49
357	$\delta = 1.72(12H, s), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.2(8H, m), 7.54(2H, m), 7.62(2H, m), 7.71(2H, m), 7.82\sim 7.88(6H, m), 8.12(2H, m), 8.48(2H, s), 8.93(2H, m)$	999.29	998.46
358	$\delta = 1.72(12H, s), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.2(8H, m), 7.39(4H, m), 7.54\sim 7.56(6H, m), 7.62\sim 7.64(6H, m), 7.71(2H, m), 7.87\sim 7.91(6H, m)$	1101.42	1100.51
359	$\delta = 1.72(12H, s), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.2(8H, m), 7.39(4H, m), 7.54(2H, m), 7.62(2H, m), 7.71(2H, m), 7.87\sim 7.91(6H, m)$	649.23	648.44
360	$\delta = 1.72(18H, s), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.2(8H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	965.27	964.48
364	$\delta = 1.72(18H, s), 2.34(12H, s), 6.44(4H, m), 6.55\sim 6.59(10H, m), 6.75(2H, m), 6.95(4H, m), 7.08(4H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1021.38	1020.54
368	$\delta = 1.72(18H, s), 6.58\sim 6.61(10H, m), 6.75(2H, m), 6.95\sim 6.99(12H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1037.23	1036.44

[0308]

373	$\delta = 1.72(18H, s), 6.58(2H, m), 6.75(2H, m), 6.91\sim 6.95(8H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.82\sim 7.88(20H, m), 8.12(8H, m), 8.93(8H, m)$	1365.74	1364.60
378	$\delta = 0.25(36H, s), 1.72(18H, s), 6.58\sim 6.61(10H, m), 6.75(2H, m), 6.95(4H, m), 7.15(8H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1254.00	1252.63
381	$\delta = 1.72(18H, s), 6.58(2H, m), 6.75(2H, m), 6.95(4H, m), 7.27(4H, m), 7.36(4H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m), 8.04\sim 8.09(8H, m)$	969.22	968.46
389	$\delta = 1.72(18H, s), 2.34(12H, s), 6.36(4H, m), 6.58\sim 6.63(6H, m), 6.71\sim 6.81(6H, m), 6.95(4H, m), 7.2(4H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1021.38	1020.54
395	$\delta = 1.35(18H, s), 1.72(18H, s), 6.55\sim 6.63(10H, m), 6.75\sim 6.81(4H, m), 6.95\sim 7.01(8H, m), 7.2(4H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1077.48	1076.60
404	$\delta = 1.72(30H, s), 6.58\sim 6.63(8H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.2(4H, m), 7.28(2H, m), 7.38(2H, m), 7.54\sim 7.55(6H, m), 7.62(4H, m), 7.71(4H, m), 7.87(6H, m)$	1197.59	1196.60
411	$\delta = 1.72(18H, s), 6.58\sim 6.63(6H, m), 6.75\sim 6.86(6H, m), 6.95(4H, m), 7.2(4H, m), 7.4(2H, m), 7.5\sim 7.54(8H, m), 7.62(2H, m), 7.71\sim 7.73(6H, m), 7.87(4H, m), 7.98(2H, m), 8.45(2H, m)$	1177.56	1176.45
415	$\delta = 1.72(30H, s), 6.58\sim 6.63(6H, m), 6.69\sim 6.81(8H, m), 6.95(4H, m), 7.2(4H, m), 7.28(2H, m), 7.38(2H, m), 7.54\sim 7.55(10H, m), 7.62\sim 7.63(4H, m), 7.71\sim 7.77(6H, m), 7.87\sim 7.93(8H, m)$	1349.78	1348.66
422	$\delta = 1.35(18H, s), 1.72(18H, s), 2.34(12H, s), 6.36(4H, m), 6.55\sim 6.58(6H, m), 6.71\sim 6.75(4H, m), 6.95\sim 7.01(8H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1133.59	1132.66
428	$\delta = 1.72(18H, s), 2.34(12H, s), 6.36(4H, m), 6.58(2H, m), 6.69\sim 6.75(8H, m), 6.95(4H, m), 7.41(2H, m), 7.51\sim 7.54(16H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1173.57	1172.60
435	$\delta = 1.72(18H, s), 2.34(12H, s), 6.36(4H, m), 6.58(2H, m), 6.71\sim 6.75(4H, m), 6.91\sim 6.95(6H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.82\sim 7.88(12H, m), 8.12(4H, m), 8.93(4H, m)$	1221.61	1220.60
447	$\delta = 1.35(18H, s), 1.72(18H, s), 6.55\sim 6.58(6H, m), 6.75(2H, m), 6.95\sim 7.01(8H, m), 7.36(2H, m), 7.49\sim 7.54(8H, m), 7.62(2H, m), 7.71\sim 7.77(8H, m), 7.84\sim 7.88(8H, m)$	1177.60	1176.63
454	$\delta = 1.72(18H, s), 6.58(2H, m), 6.69\sim 6.75(6H, m), 6.95(4H, m), 7.36\sim 7.41(4H, m), 7.49\sim 7.54(20H, m), 7.62(2H, m), 7.71\sim 7.77(8H, m), 7.84\sim 7.88(8H, m)$	1217.58	1216.57

[0309]

457	$\delta = 1.72(30H, s), 6.58(4H, m), 6.75(4H, m), 6.95(4H, m), 7.28(2H, m), 7.36\sim 7.38(4H, m), 7.49\sim 7.55(10H, m), 7.62(4H, m), 7.71\sim 7.77(8H, m), 7.84\sim 7.88(10H, m)$	1297.71	1296.63
458	$\delta = 1.72(18H, s), 6.58(2H, m), 6.75(2H, m), 6.91\sim 6.95(6H, m), 7.36(2H, m), 7.49\sim 7.54(8H, m), 7.62(2H, m), 7.71\sim 7.88(24H, m), 8.12(4H, m), 8.93(4H, m)$	1265.62	1264.57
466	$\delta = 1.72(18H, s), 6.58(2H, m), 6.69\sim 6.75(6H, m), 6.95(4H, m), 7.36(2H, m), 7.49\sim 7.62(20H, m), 7.71\sim 7.77(10H, m), 7.84\sim 7.92(10H, m), 8(4H, m)$	1317.70	1316.60
472	$\delta = 1.35(18H, s), 1.72(18H, s), 2.34(6H, s), 6.51\sim 6.58(10H, m), 6.75(2H, m), 6.95\sim 7.01(12H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1105.54	1104.60
483	$\delta = 1.72(30H, s), 2.34(6H, s), 6.51(4H, m), 6.58(4H, m), 6.75(4H, m), 6.95\sim 6.98(8H, m), 7.28(2H, m), 7.38(2H, m), 7.54\sim 7.55(6H, m), 7.62(4H, m), 7.71(4H, m), 7.87(6H, m)$	1225.64	1224.63
497	$\delta = 1.35(18H, s), 1.72(18H, s), 2.34(6H, s), 6.44(2H, m), 6.55\sim 6.59(10H, m), 6.75(2H, m), 6.95\sim 7.01(8H, m), 7.08(2H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1105.54	1104.63
510	$\delta = 1.72(18H, s), 2.34(6H, s), 6.44(2H, m), 6.55\sim 6.59(6H, m), 6.75(2H, m), 6.91\sim 6.95(6H, m), 7.08(2H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.82\sim 7.88(12H, m), 8.12(4H, m), 8.93(4H, m)$	1193.56	1192.57
521	$\delta = 1.72(18H, s), 2.12(6H, s), 6.51(2H, m), 6.58\sim 6.61(6H, m), 6.69\sim 6.75(4H, m), 6.95\sim 7.01(10H, m), 7.15(2H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1029.30	1028.49
527	$\delta = 1.72(18H, s), 6.58\sim 6.61(6H, m), 6.75(2H, m), 6.95\sim 6.99(10H, m), 7.38(2H, m), 7.53\sim 7.62(12H, m), 7.71(4H, m), 7.87(4H, m), 8.02\sim 8.07(4H, m)$	1101.37	1100.49
537	$\delta = 1.72(18H, s), 6.58(2H, m), 6.75(2H, m), 6.95\sim 6.99(10H, m), 7.38(2H, m), 7.53\sim 7.62(12H, m), 7.71(4H, m), 7.87(4H, m), 8.02\sim 8.07(4H, m), 8.46(4H, m)$	1067.36	1066.50
540	$\delta = 1.72(30H, s), 6.58(4H, m), 6.75(4H, m), 6.95\sim 6.98(6H, m), 7.28(2H, m), 7.38(4H, m), 7.53\sim 7.62(16H, m), 7.71(4H, m), 7.87(6H, m), 8.02\sim 8.07(4H, m)$	1297.71	1296.63
542	$\delta = 1.72(18H, s), 6.58(2H, m), 6.75(2H, m), 6.91\sim 6.98(8H, m), 7.38(2H, m), 7.53\sim 7.62(12H, m), 7.71(4H, m), 7.82\sim 7.88(12H, m), 8.02\sim 8.12(8H, m), 8.93(4H, m)$	1265.62	1264.57
547	$\delta = 1.72(30H, s), 6.58(2H, m), 6.69\sim 6.75(6H, m), 6.95\sim 6.98(6H, m), 7.28(2H, m), 7.38(4H, m), 7.53\sim 7.63(20H, m), 7.71\sim 7.77(6H, m), 7.87\sim 7.93(8H, m), 8.02\sim 8.07(4H, m)$	1449.90	1448.69

[0310]

549	$\delta = 1.35(18H, s), 1.72(18H, s), 6.55\sim 6.58(6H, m), 6.69\sim 6.75(6H, m), 6.95\sim 7.01(8H, m), 7.41(2H, m), 7.51\sim 7.54(16H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1229.68	1228.66
556	$\delta = 1.35(18H, s), 1.72(30H, s), 6.55\sim 6.58(8H, m), 6.75(4H, m), 6.95\sim 7.01(8H, m), 7.28(2H, m), 7.38(2H, m), 7.54\sim 7.55(6H, m), 7.62(4H, m), 7.71(4H, m), 7.87(6H, m)$	1309.80	1308.73
567	$\delta = 1.35(18H, s), 1.72(18H, s), 6.55\sim 6.58(6H, m), 6.75(2H, m), 6.95\sim 7.04(10H, m), 7.53\sim 7.62(16H, m), 7.71\sim 7.78(8H, m), 7.87\sim 7.92(6H, m), 8(4H, m), 8.07(2H, m), 8.49(2H, m)$	1429.91	1428.73
577	$\delta = 1.72(30H, s), 6.58\sim 6.61(8H, m), 6.75(4H, m), 6.95\sim 6.99(8H, m), 7.28(2H, m), 7.38(2H, m), 7.54\sim 7.55(6H, m), 7.62(4H, m), 7.71(4H, m), 7.87(6H, m)$	1233.57	1232.58
584	$\delta = 1.72(18H, s), 6.58(2H, m), 6.69\sim 6.75(6H, m), 6.91\sim 6.95(6H, m), 7.41(2H, m), 7.51\sim 7.54(16H, m), 7.62(2H, m), 7.71(4H, m), 7.82\sim 7.88(12H, m), 8.12(4H, m), 8.93(4H, m)$	1317.70	1316.60
588	$\delta = 1.72(18H, s), 6.58(2H, m), 6.69\sim 6.75(10H, m), 6.95(4H, m), 7.41(2H, m), 7.51\sim 7.55(24H, m), 7.61\sim 7.62(4H, m), 7.71(4H, m), 7.87(4H, m), 8.04\sim 8.08(4H, m), 8.42(2H, m), 8.55(2H, m)$	1369.77	1368.63
598	$\delta = 1.72(18H, s), 6.58\sim 6.62(4H, m), 6.7\sim 6.75(4H, m), 6.95\sim 6.99(8H, m), 7.54\sim 7.55(6H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m), 8.07(2H, m), 8.46(4H, m)$	969.22	968.46
599	$\delta = 1.72(30H, s), 6.58(4H, m), 6.75(4H, m), 6.91\sim 6.95(6H, m), 7.28(2H, m), 7.38(2H, m), 7.54\sim 7.55(6H, m), 7.62(4H, m), 7.71(4H, m), 7.82\sim 7.88(14H, m), 8.12(4H, m), 8.93(4H, m)$	1397.83	1396.66
607	$\delta = 1.72(18H, s), 2.34(6H, s), 6.51(4H, m), 6.58(2H, m), 6.75(2H, m), 6.91\sim 6.98(10H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.82\sim 7.88(12H, m), 8.12(4H, m), 8.93(4H, m)$	1193.56	1192.57
612	$\delta = 1.72(18H, s), 6.58(2H, m), 6.75(2H, m), 6.95\sim 6.99(10H, m), 7.41\sim 7.47(4H, m), 7.54\sim 7.62(8H, m), 7.71(4H, m), 7.87(4H, m), 8.17(2H, m), 8.28(2H, m), 8.46(4H, m)$	1069.34	1068.49
620	$\delta = 1.72(18H, s), 3.83(6H, s), 6.52(4H, m), 6.58(2H, m), 6.74\sim 6.81(10H, m), 6.95(4H, m), 7.39(4H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1075.34	1074.49
625	$\delta = 1.72(18H, s), 3.83(6H, s), 6.52(4H, m), 6.58(2H, m), 6.74\sim 6.81(8H, m), 6.95(4H, m), 7.54\sim 7.62(8H, m), 7.71\sim 7.78(8H, m), 7.87\sim 7.88(6H, m), 8.1(4H, m), 8.42(4H, m)$	1273.60	1272.56
632	$\delta = 0.9(6H, m), 1.72(12H, s), 1.91(4H, m), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.2(8H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	993.32	992.51

[0311]

635	$\delta = 0.9(6H, m), 1.72(12H, s), 1.91(4H, m), 2.34(12H, s), 6.51(8H, m), 6.58(2H, m), 6.75(2H, m), 6.95\sim 6.98(12H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1049.43	1048.57
643	$\delta = 0.9(6H, m), 1.72(12H, s), 1.91(4H, m), 6.58\sim 6.62(6H, m), 6.7\sim 6.75(6H, m), 6.95(4H, m), 7.54\sim 7.55(8H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m), 8.07(4H, m)$	997.28	996.46
648	$\delta = 1.72(12H, s), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.16\sim 7.2(12H, m), 7.35(2H, m), 7.54(4H, m), 7.62(2H, m), 7.71\sim 7.75(6H, m), 7.87(4H, m)$	1087.39	1086.49
659	$\delta = 1.72(12H, s), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.11(4H, m), 7.2\sim 7.26(10H, m), 7.33(4H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1089.41	1088.51
663	$\delta = 1.72(12H, s), 2.34(12H, s), 6.44(4H, m), 6.55\sim 6.59(10H, m), 6.75(2H, m), 6.95(4H, m), 7.08\sim 7.11(8H, m), 7.26(2H, m), 7.33(4H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1145.52	1144.57
670	$\delta = 1.72(12H, s), 3.49(4H, s), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.2(12H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1039.35	1038.49
680	$\delta = 1.72(12H, s), 3.49(4H, s), 6.58(2H, m), 6.75(2H, m), 6.95\sim 6.99(8H, m), 7.2(4H, m), 7.41\sim 7.47(8H, m), 7.54\sim 7.62(10H, m), 7.71(4H, m), 7.87(4H, m), 8.17(4H, m), 8.28(4H, m)$	1243.54	1242.53
681	$\delta = 0.9(12H, m), 1.72(6H, s), 1.91(8H, m), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.2(8H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1021.38	1020.54
686	$\delta = 0.9(12H, m), 1.72(6H, s), 1.91(8H, m), 2.12(12H, s), 6.51(4H, m), 6.58(2H, m), 6.69\sim 6.75(6H, m), 6.95\sim 7.01(8H, m), 7.15(4H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1077.48	1076.60
698	$\delta = 1.72(6H, s), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.11(8H, m), 7.2\sim 7.26(12H, m), 7.33(8H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1213.55	1212.54
699	$\delta = 1.72(6H, s), 3.49(8H, s), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.2(16H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1113.43	1112.51
700	$\delta = 1.51(8H, m), 1.72(6H, s), 2.09(8H, m), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.2(8H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1017.35	1016.51
701	$\delta = 1.72(6H, s), 2.62(4H, m), 2.91(4H, m), 6.58\sim 6.63(10H, m), 6.75\sim 6.81(6H, m), 6.95(4H, m), 7.02\sim 7.06(4H, m), 7.15\sim 7.2(12H, m), 7.54(4H, m), 7.62(2H, m), 7.71(4H, m), 7.87(4H, m)$	1113.43	1112.51

[0312]

702	$\delta = 1.72(12\text{H, s}), 6.58\sim 6.63(10\text{H, m}), 6.75\sim 6.81(6\text{H, m}), 6.95(2\text{H, m}), 7.2(9\text{H, m}), 7.42\sim 7.43(3\text{H, m}), 7.56\sim 7.63(6\text{H, m}), 7.82(2\text{H, m}), 8.4(1\text{H, m})$	850.10	849.41
710	$\delta = 1.72(12\text{H, s}), 6.58\sim 6.63(10\text{H, m}), 6.75\sim 6.81(6\text{H, m}), 6.95\sim 6.99(4\text{H, m}), 7.08(2\text{H, m}), 7.2(8\text{H, m}), 7.42(2\text{H, m}), 7.59\sim 7.62(4\text{H, m}), 7.82(2\text{H, m})$	855.14	854.37
712	$\delta = 1.72(12\text{H, s}), 6.58\sim 6.63(6\text{H, m}), 6.75\sim 6.81(4\text{H, m}), 6.95(4\text{H, m}), 7.2(4\text{H, m}), 7.36(2\text{H, m}), 7.49\sim 7.54(10\text{H, m}), 7.62(2\text{H, m}), 7.71\sim 7.77(6\text{H, m}), 7.84\sim 7.88(6\text{H, m})$	949.23	948.44
716	$\delta = 1.72(12\text{H, s}), 6.58\sim 6.63(8\text{H, m}), 6.75\sim 6.81(5\text{H, m}), 6.95\sim 6.98(5\text{H, m}), 7.2(6\text{H, m}), 7.38(1\text{H, m}), 7.5\sim 7.62(11\text{H, m}), 7.71(2\text{H, m}), 7.87(2\text{H, m}), 8.02\sim 8.07(2\text{H, m})$	899.17	898.43
717	$\delta = 1.72(18\text{H, s}), 6.58\sim 6.63(9\text{H, m}), 6.75\sim 6.81(6\text{H, m}), 6.95(4\text{H, m}), 7.2(6\text{H, m}), 7.28(1\text{H, m}), 7.38(1\text{H, m}), 7.5\sim 7.55(7\text{H, m}), 7.62(3\text{H, m}), 7.71(2\text{H, m}), 7.87(3\text{H, m})$	965.27	964.48
719	$\delta = 1.35(9\text{H, s}), 1.72(18\text{H, s}), 6.55\sim 6.58(5\text{H, m}), 6.75(3\text{H, m}), 6.95\sim 7.01(8\text{H, m}), 7.28(1\text{H, m}), 7.38(3\text{H, m}), 7.5\sim 7.62(16\text{H, m}), 7.71(2\text{H, m}), 7.87(3\text{H, m}), 8.02\sim 8.07(4\text{H, m})$	1121.49	1120.57

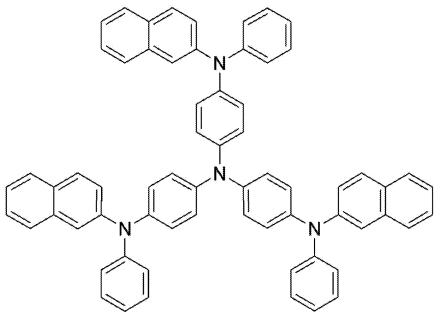
[0313]

[0314] [실시예 1] 본 발명에 따른 유기 발광 화합물을 이용한 OLED 소자 제작

[0315] 본 발명의 발광 재료를 이용한 구조의 OLED 소자를 제작하였다.

[0316] 우선, OLED용 글래스(삼성-코닝사 제조)(1)로부터 얻어진 투명전극 ITO 박막(15 Ω/\square) (2)을, 트리클로로에틸렌, 아세톤, 에탄올, 증류수를 순차적으로 사용하여 초음파 세척을 실시한 후, 이소프로판올에 넣어 보관한 후 사용하였다.

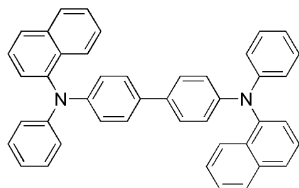
[0317] 다음으로, 진공 증착 장비의 기관 폴더에 ITO 기관을 설치하고, 진공 증착 장비 내의 셀에 하기 구조의 4,4',4''-tris(N,N-(2-naphthyl)-phenylamino)triphenylamine (2-TNATA)을 넣고, 챔버 내의 진공도가 10^{-6} torr에 도달할 때까지 배기시킨 후, 셀에 전류를 인가하여 2-TNATA를 증발시켜 ITO 기관 상에 60 nm 두께의 정공주입층(3)을 증착하였다.



2-TNATA

[0318]

[0319] 이어서, 진공 증착 장비 내의 다른 셀에 하기구조 N,N'-bis(α -naphthyl)-N,N'-diphenyl-4,4'-diamine (NPB)을 넣고, 셀에 전류를 인가하여 NPB를 증발시켜 정공주입층 위에 20 nm 두께의 정공전달층(4)을 증착하였다.

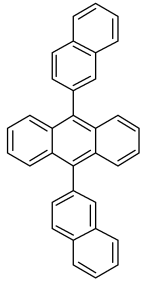


NPB

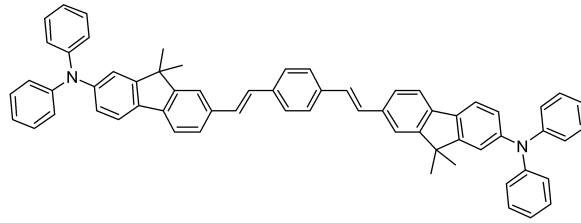
[0320]

[0321] 정공주입층, 정공전달층을 형성시킨 후, 그 위에 발광층을 다음과 같이 증착시켰다. 진공 증착 장비 내의 한쪽 셀에 호스트로서 하기 구조의 H-32를 넣고, 또 다른 셀에는 도판트로서 본 발명에 따른 화합물 1을 각각 넣은 후, 두 물질을 다른 속도로 증발시켜 호스트를 기준으로 2 내지 5 중량%로 도핑함으로써 상기 정공 전달층 위에

30 nm 두께의 발광층(5)을 증착하였다.



H-32

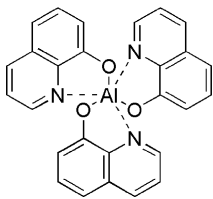


화합물 1

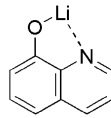
[0322]

[0323]

이어서 전자전달층(6)으로써 하기 구조의 tris(8-hydroxyquinoline)-aluminum(III) (Alq)를 20 nm 두께로 증착한 다음, 전자주입층(7)으로 하기 구조의 화합물 lithium quinolate (Liq)를 1 내지 2 nm 두께로 증착한 후, 다른 진공 증착 장비를 이용하여 Al 음극(8)을 150 nm의 두께로 증착하여 OLED를 제작하였다.



Alq



Liq

[0324]

[0325]

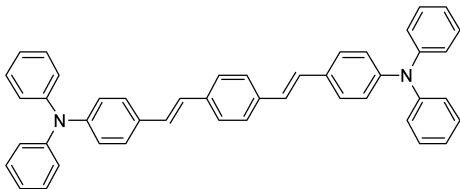
재료 별로 각 화합물은 10^{-6} torr 하에서 진공 승화 정제하여 OLED 발광재료로 사용하였다.

[0326]

[비교예 1] 종래의 발광 재료를 이용한 OLED 소자 제작

[0327]

상기 실시예 1과 동일한 방법으로 정공주입층, 정공전달층을 형성시킨 후, 상기 진공 증착 장비 내의 다른 셀에 발광 호스트 재료인 dinaphthylanthracene(DNA)를 넣고, 또 다른 셀에는 청색 발광 재료인 하기 구조의 화합물 A를 각각 넣은 후, 증착 속도를 100:1 로 하여 상기 정공 전달층 위에 30 nm 두께의 발광층을 증착하였다.



화합물 A

[0328]

[0329]

이어서 실시예 1과 동일한 방법으로 전자전달층과 전자주입층을 증착한 후, 다른 진공 증착 장비를 이용하여 Al 음극을 150 nm의 두께로 증착하여 OLED를 제작하였다.

[0330]

[실시예 2] 제조된 OLED 소자의 발광 특성

[0331]

상기 실시예 1과 비교예 1에서 제조된 본 발명에 따른 유기 발광 화합물과 종래의 발광 화합물을 함유하는 OLED 소자의 발광 효율을 각각 $1,000 \text{ cd/m}^2$ 에서 측정하여 하기 표 2에 나타내었다.

[0332] [표 2]

No.	호스트	도판트	도핑농도 (중량%)	발광효율(cd/A)	색
				@1000cd/m ²	
1	H-28	5	3.0	12.8	담청색
2	H-29	42	3.0	12.9	담청색
3	H-30	84	3.0	12.5	담청색
4	H-32	1	3.0	12.6	담청색
5	H-48	148	3.0	13.0	담청색
6	H-49	178	3.0	11.5	청색
7	H-89	212	3.0	11.8	청색
8	H-104	255	3.0	12.6	담청색
9	H-116	274	3.0	12.8	담청색
10	H-124	289	3.0	13.2	담청색
11	H-127	315	3.0	13.0	담청색
12	H-134	360	3.0	12.9	담청색
13	H-136	404	3.0	12.7	담청색
14	H-139	542	3.0	12.6	담청색
비교예1	DNA	화합물A	3.0	12.4	옥색

[0333]

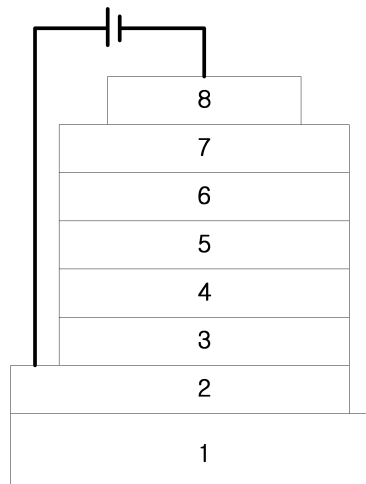
[0334] 상기 표 2에 나타난 바와 같이, 본 발명의 재료를 청색 발광 소자에 적용한 결과, 비교예 1의 화합물 A에서 페닐 대신 본 발명의 플루오렌을 적용하였더니 동등이상의 발광효율을 유지하면서 색순도가 옥색발광 대비 담청색 내지 청색발광으로 상당히 개선되었음을 확인할 수 있었다.

도면의 간단한 설명

- [0335] 도 1 - OLED 소자의 단면도
- [0336] <도면 주요 부분에 대한 부호의 설명>
- [0337] 1 - 글래스 2 - 투명전극
- [0338] 3 - 정공주입층 4 - 정공전달층
- [0339] 5 - 발광층 6 - 전자전달층
- [0340] 7 - 전자주입층 8 - Al 음극

도면

도면1



专利名称(译)	新型有机发光化合物和使用其作为发光材料的有机发光器件		
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摘要(译)

本发明涉及新型有机发光化合物和有机发光器件，具体而言，将其用作发光材料，本发明的有机发光化合物为下述化学式1的化合物。[化学式1] [在化学式1中选择Ar而不是从 (C6-C60) 亚芳基，N和O和S中选择Ar的一个或多个可以称为杂环亚烷基，(C3-C60) 亚环烯基，金刚烷基，(C7- C60) 自行车炉亚烷基，(C2-C60) 亚烯基，(C2-C60) 亚炔基，(C1-C60) 硫代亚烷基，

(C6-C60) 亚烷基氧基 , (C6-C60) 亚芳氧基 , 亚芳基硫基五元以上六元或包括它意味着 (C3-C60) s , N和选自O和S中的一种或多种。根据本发明的有机发光化合物具有发光效率可以良好和寿命的优点。该材料的性能非常好 , 并且其中的OLED器件驱动du该设备的可扩展性非常优秀 , 可以制造。掺杂剂 , 有机发光化合物 , 有机发光器件 , 蓝色。

