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(54) 전기발광용 유기금속 화합물 및 이를 발광재료로 채용하고있는 표시소자

(57) 요약

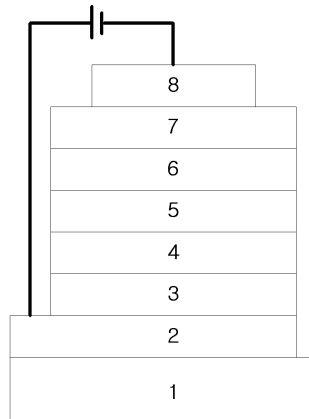
본 발명은 하기 화학식 1로 표시되는 전기 발광 화합물 및 이를 호스트 재료로 함유하는 전기 발광 소자에 관한 것이다.

[화학식 1]



본 발명에 따른 전기 발광 화합물은 OLED 소자에서 호스트 재료로 사용되어 구동전압을 현저히 낮추고, 파워효율을 상승시키는 장점이 있다.

대표도 - 도1



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특허청구의 범위

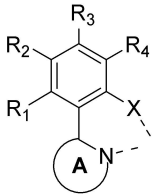
청구항 1

하기 화학식 1로 표시되는 전기 발광 화합물.

[화학식 1]



[리간드 L<sup>1</sup>은 하기 구조이고;

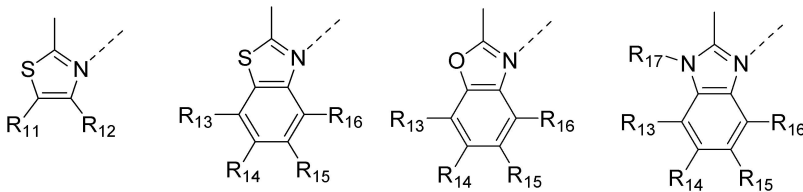


M은 2가 또는 3가 금속이며;

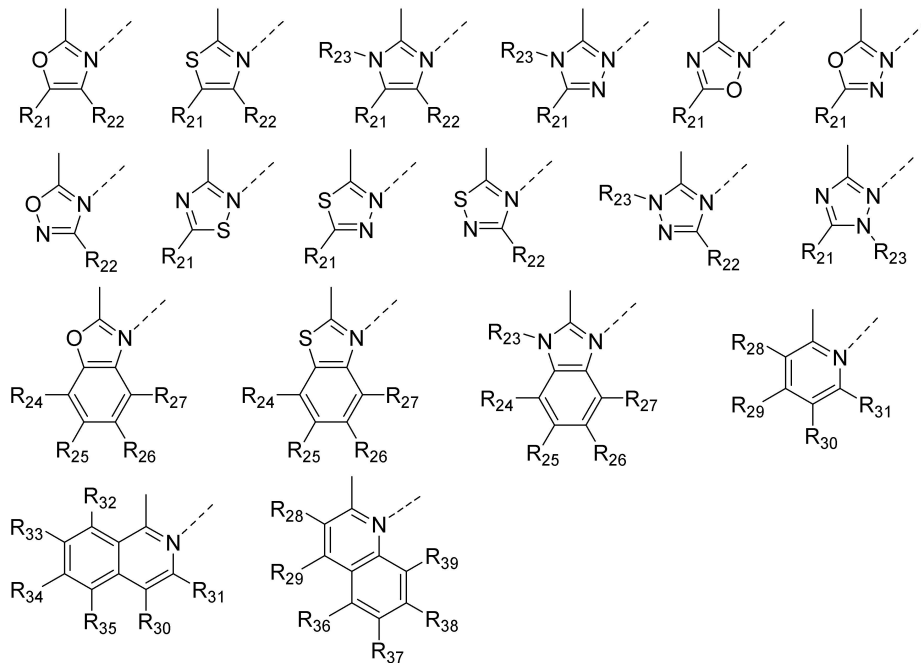
M이 2가 금속인 경우 m은 0이고, M이 3가 금속인 경우 m은 1이고;

Q는 (C6-C60)아릴옥시 또는 트리(C6-C30)아릴실릴이고, 상기 Q의 아릴옥시 및 트리아릴실릴은 직쇄 또는 분쇄의 (C1-C60)알킬 또는 (C6-C60)아릴이 더 치환될 수 있으며;

X가 O인 경우 A 고리는 하기 구조로부터 선택되고,



X가 S인 경우 A 고리는 하기 구조로부터 선택되고,



R<sub>1</sub> 내지 R<sub>4</sub>는 서로 독립적으로 수소, (C1-C60)알킬, 할로젠, 시아노, (C3-C60)시클로알킬, (C6-C60)아릴, (C4-

C60)헤테로아릴, 모노 또는 디(C1-C30)알킬아미노, 모노 또는 디(C6-C30)아릴아미노, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴 또는 트리(C6-C30)아릴실릴이거나, 인접한 치환체와 (C3-C12)알킬렌, 또는 (C3-C12)알케닐렌으로 결합되어 융합고리를 형성할 수 있으며;

R<sub>11</sub> 내지 R<sub>17</sub>은 서로 독립적으로 수소, (C1-C60)알킬, (C6-C60)아릴, (C4-C60)헤테로아릴, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴, 트리(C6-C30)아릴실릴, 모노 또는 디(C1-C30)알킬아미노, 모노 또는 디(C6-C30)아릴아미노, 시아노 또는 할로젠이거나, R<sub>13</sub> 내지 R<sub>16</sub>은 인접한 치환체와 (C3-C12)알킬렌, 또는 (C3-C12)알케닐렌으로 결합되어 융합고리를 형성할 수 있으며;

R<sub>21</sub> 내지 R<sub>39</sub>는 서로 독립적으로 수소, (C1-C60)알킬, (C6-C60)아릴, (C4-C60)헤테로아릴, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴, 트리(C6-C30)아릴실릴, 모노 또는 디(C1-C30)알킬아미노, 모노 또는 디(C6-C30)아릴아미노, 시아노 또는 할로젠이며;

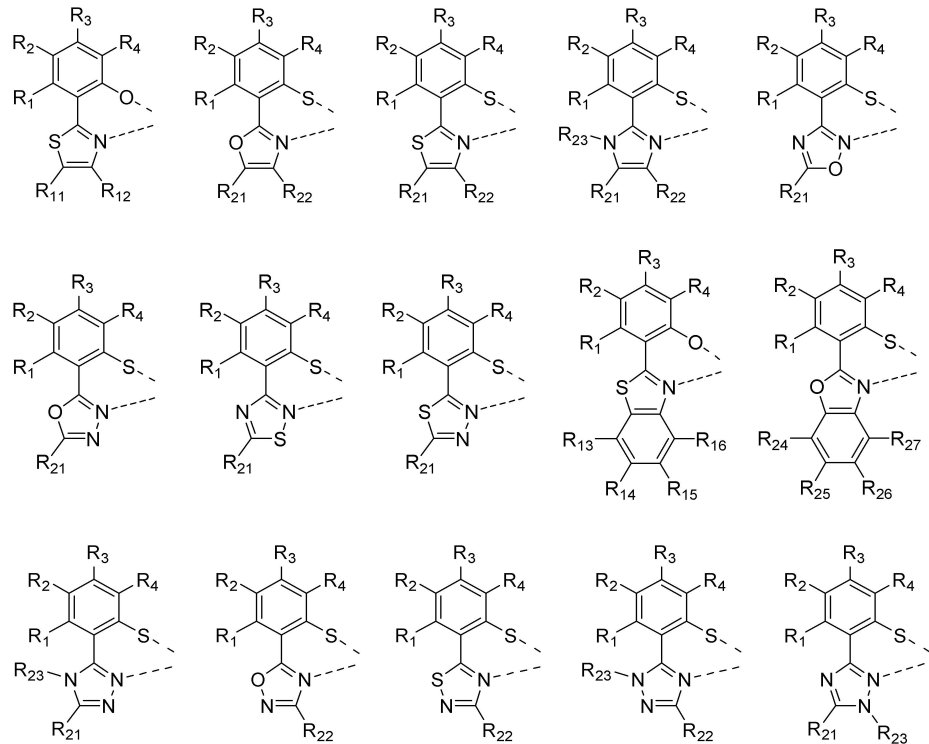
상기 R<sub>1</sub> 내지 R<sub>4</sub>의 알킬, 아릴, 헤테로아릴 또는 인접한 치환체와 (C3-C12)알킬렌, 또는 (C3-C12)알케닐렌으로 결합되어 형성된 융합고리는 (C1-C60)알킬, 할로젠이 치환된 (C1-C60)알킬, (C6-C60)아릴, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴, 트리(C6-C30)아릴실릴, 모노 또는 디(C1-C30)알킬아미노, 모노 또는 디(C6-C30)아릴아미노, 시아노 또는 할로젠으로부터 선택된 하나 이상이 더 치환될 수 있고;

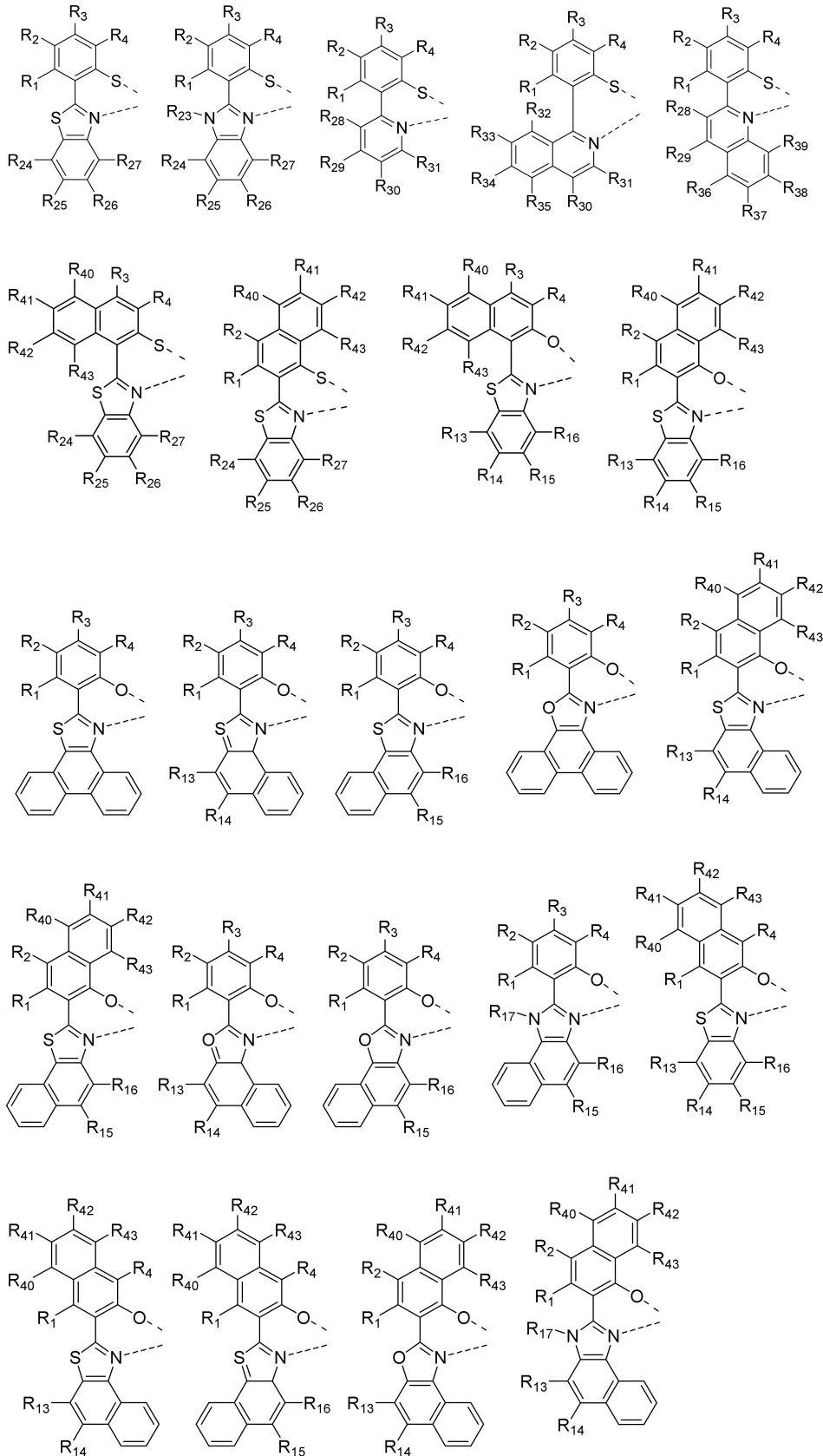
상기 R<sub>11</sub> 내지 R<sub>17</sub> 및 R<sub>21</sub> 내지 R<sub>39</sub>의 알킬, 아릴 또는 헤테로아릴은 (C1-C60)알킬, 할로젠이 치환된 (C1-C60)알킬, 할로젠, (C6-C60)아릴, 모노 또는 디(C1-C30)알킬아미노, 모노 또는 디(C6-C30)아릴아미노, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴, 트리(C6-C30)아릴실릴 또는 시아노로부터 선택된 하나 이상이 더 치환될 수 있다.]

**청구항 2**

제 1항에 있어서,

리간드 L<sup>1</sup>은 하기 구조로부터 선택되는 것을 특징으로 하는 전기 발광 화합물.





[상기 리간드에서, R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub> 및 R<sub>4</sub>는 상기 청구항 제1항의 화학식 1에서 정의한 바와 동일하며;

R<sub>11</sub> 내지 R<sub>16</sub>은 서로 독립적으로 수소, (C1-C60)알킬, 할로겐, 할로겐이 치환된 (C1-C60)알킬, 페닐, 나프틸, 비페닐, 플루오레닐, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴, 트리(C6-C30)아릴실릴, 디(C1-C30)알킬아미노, 디(C6-C30)아릴아미노, 싸이오펜일 또는 퓨란일이며;

R<sub>17</sub>은 (C1-C60)알킬, 페닐 또는 나프틸이며;

R<sub>21</sub> 및 R<sub>22</sub>는 서로 독립적으로 수소, (C1-C60)알킬, 할로젠, 할로젠이 치환된 (C1-C60)알킬, 페닐, 나프틸, 비페닐, 플루오레닐, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴, 트리(C6-C30)아릴실릴, 디(C1-C30)알킬아미노, 디(C6-C30)아릴아미노, 싸이오펜일 또는 퓨란일이며;

R<sub>23</sub>은 (C1-C60)알킬, 페닐 또는 나프틸이며;

R<sub>24</sub> 내지 R<sub>39</sub>는 서로 독립적으로 수소, (C1-C60)알킬, 할로젠, 할로젠이 치환된 (C1-C60)알킬, 페닐, 나프틸, 비페닐, 플루오레닐, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴, 트리(C6-C30)아릴실릴, 디(C1-C30)알킬아미노, 디(C6-C30)아릴아미노, 싸이오펜일 또는 퓨란일이며;

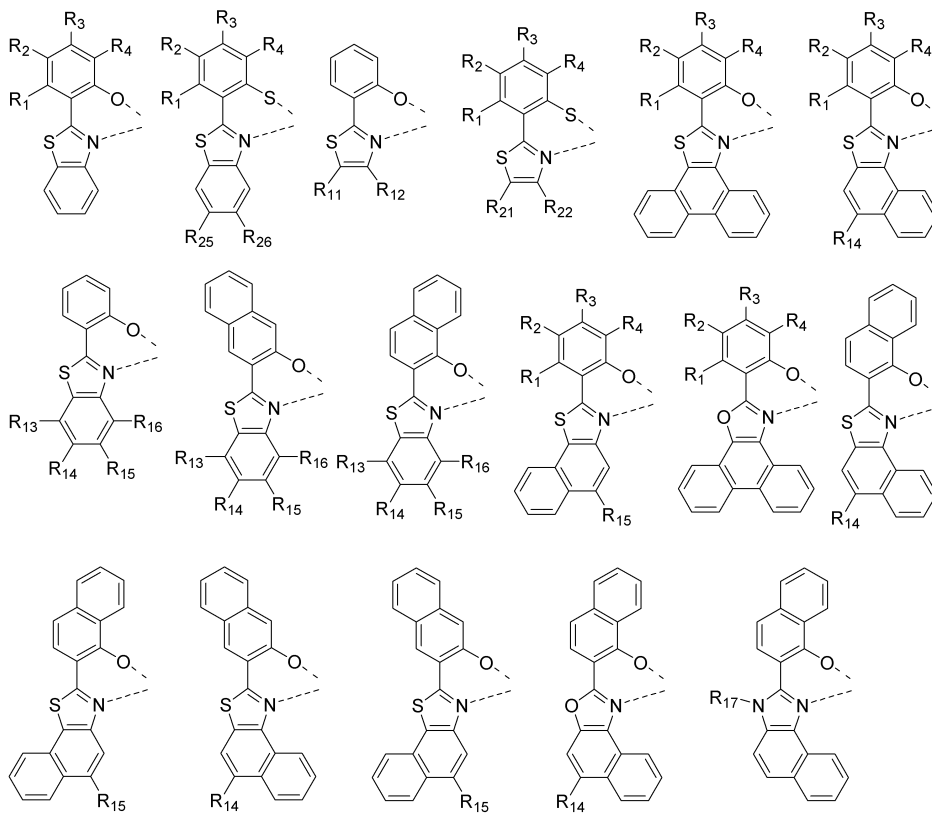
R<sub>40</sub> 내지 R<sub>43</sub>은 서로 독립적으로 수소, (C1-C60)알킬, 할로젠이 치환된 (C1-C60)알킬, 페닐, 나프틸, 비페닐, 플루오레닐, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴, 트리(C6-C30)아릴실릴, 디(C1-C30)알킬아미노, 디(C6-C30)아릴아미노 또는 할로젠이고;

상기 R<sub>11</sub> 내지 R<sub>17</sub>, R<sub>21</sub> 내지 R<sub>39</sub> 및 R<sub>40</sub> 내지 R<sub>43</sub>의 페닐, 나프틸, 비페닐, 플루오레닐, 싸이오펜일 또는 퓨란일은 (C1-C60)알킬, 할로젠, 페닐, 나프틸, 플루오레닐, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴, 트리(C6-C30)아릴실릴, 디(C1-C30)알킬아미노 또는 디(C6-C30)아릴아미노로부터 선택된 하나 이상이 더 치환될 수 있다.]

**청구항 3**

제 2항에 있어서,

리간드 L<sup>1</sup> 는 하기 구조로부터 선택되는 것을 특징으로 하는 전기 발광 화합물.



[상기 리간드에서, R<sub>1</sub> 내지 R<sub>4</sub>는 서로 독립적으로 수소, 메틸, 에틸, n-프로필, i-프로필, n-부틸, i-부틸, t-부틸, 염소, 플루오르, 페닐, 비페닐, 나프틸, 플루오레닐, 싸이오펜일, 트리메틸실릴, 트리페닐실릴, t-부틸디메틸실릴, 디메틸아미노, 디에틸아미노 또는 디페닐아미노이며;

R<sub>11</sub> 및 R<sub>12</sub>는 서로 독립적으로 메틸, 에틸, n-프로필, i-프로필, n-부틸, i-부틸, t-부틸, 트리메틸실릴, 트리페닐실릴, 페닐, 비페닐, 나프틸 또는 플루오레닐이고;

R<sub>13</sub> 내지 R<sub>16</sub>는 서로 독립적으로 메틸, 에틸, n-프로필, i-프로필, n-부틸, i-부틸, t-부틸, 트리메틸실릴, 트리페닐실릴, 페닐, 비페닐, 나프틸 또는 플루오레닐이고;

R<sub>17</sub>은 메틸, 에틸, n-프로필, i-프로필, n-부틸, i-부틸, t-부틸, 페닐 또는 나프틸이며;

R<sub>21</sub> 및 R<sub>22</sub>은 서로 독립적으로 수소, 메틸, 에틸, n-프로필, i-프로필, n-부틸, i-부틸, t-부틸, 플루오르, 트리플루오르메틸, 페닐, 나프틸, 비페닐, 트리메틸실릴, 트리페닐실릴, 디메틸아미노, 디페닐아미노, 싸이오펜일 또는 퓨란일이며;

R<sub>25</sub> 및 R<sub>26</sub>은 서로 독립적으로 수소, 메틸, 에틸, n-프로필, i-프로필, n-부틸, i-부틸, t-부틸, 플루오르, 트리플루오르메틸, 페닐, 나프틸, 비페닐, 트리메틸실릴, 트리페닐실릴, 디메틸아미노, 디페닐아미노, 싸이오펜일 또는 퓨란일이며;

상기 R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>, R<sub>11</sub>, R<sub>12</sub>, R<sub>13</sub>, R<sub>14</sub>, R<sub>15</sub>, R<sub>16</sub>, R<sub>17</sub>, R<sub>21</sub>, R<sub>22</sub>, R<sub>25</sub> 및 R<sub>26</sub>의 페닐, 비페닐, 나프틸, 플루오레닐 및 싸이오펜일은 플루오르, 메틸, 에틸, n-프로필, i-프로필, n-부틸, i-부틸, t-부틸, 트리메틸실릴, 트리페닐실릴, t-부틸디메틸실릴, 페닐, 나프틸, 플루오레닐, 디메틸아미노, 디에틸아미노 또는 디페닐아미노로부터 선택된 하나 이상이 더 치환될 수 있다.]

**청구항 4**

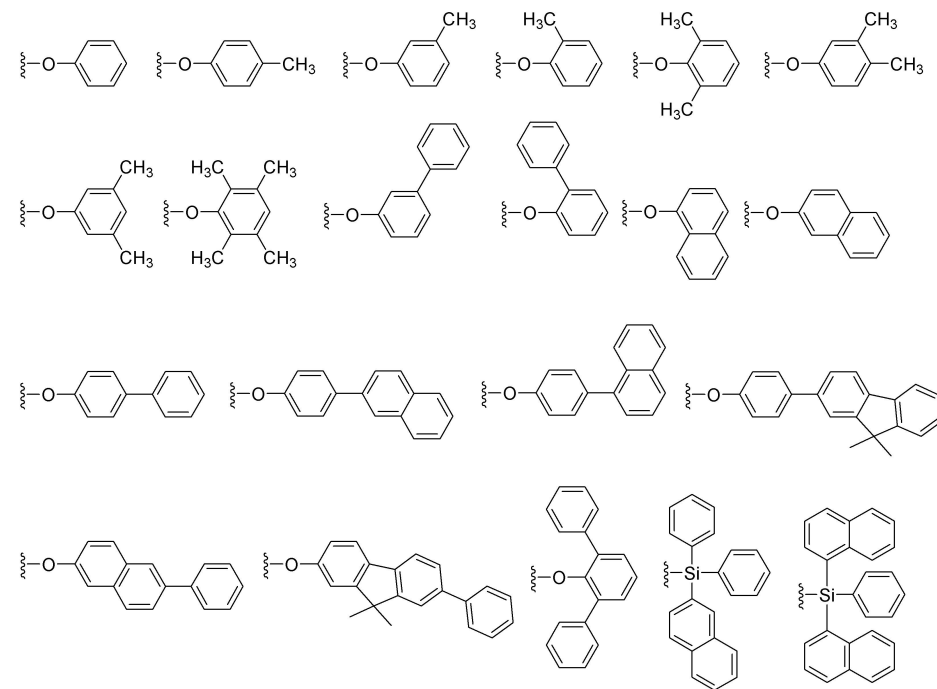
제 1항에 있어서,

M은 Be, Zn, Mg, Cu 및 Ni로 이루어진 군에서 선택되는 2가 금속 또는 Al, Ga, In 및 B로 이루어진 군에서 선택되는 3가 금속인 것을 특징으로 하는 전기 발광 화합물.

**청구항 5**

제 1항에 있어서,

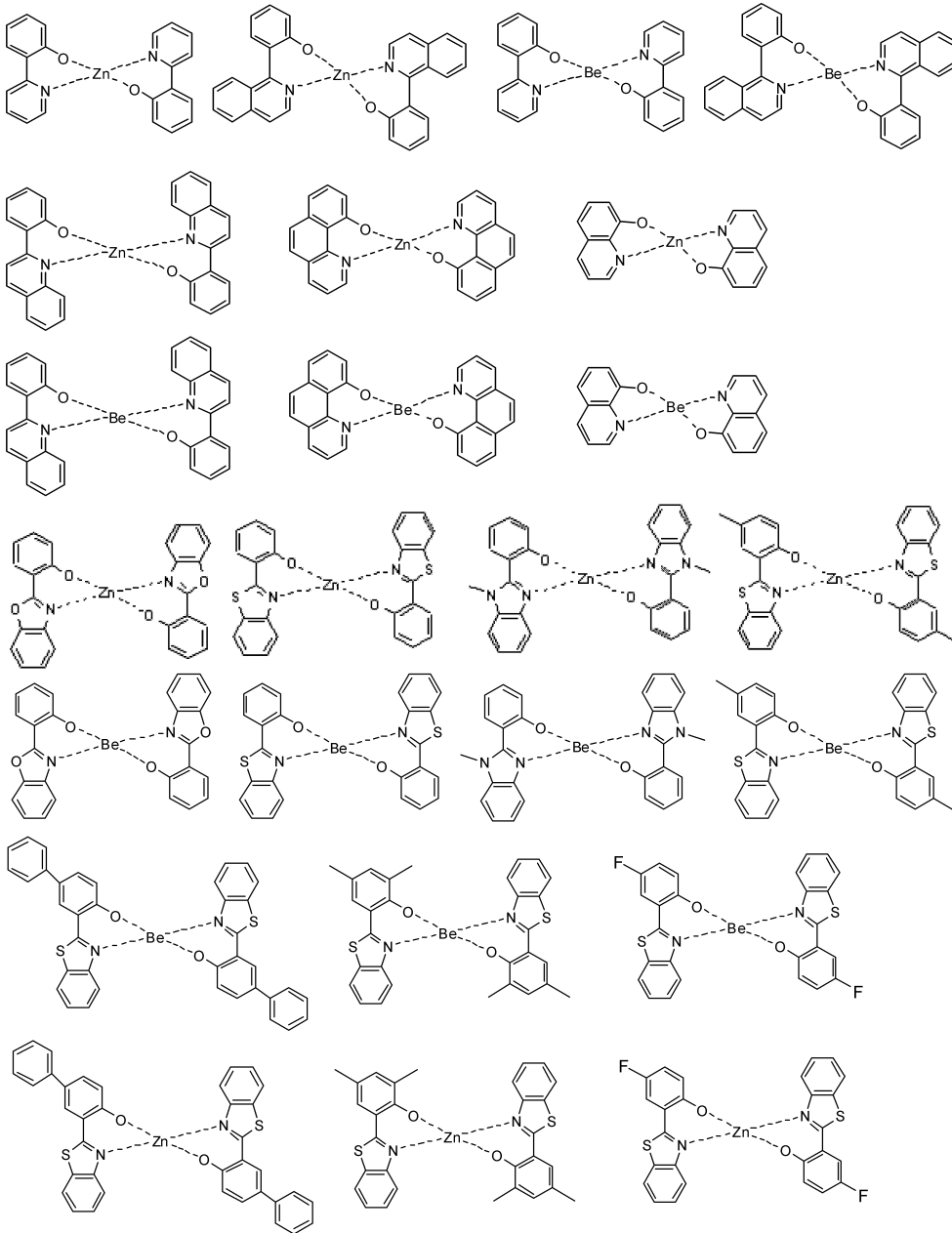
Q는 하기 구조로부터 선택되는 것을 특징으로 하는 전기 발광 화합물.

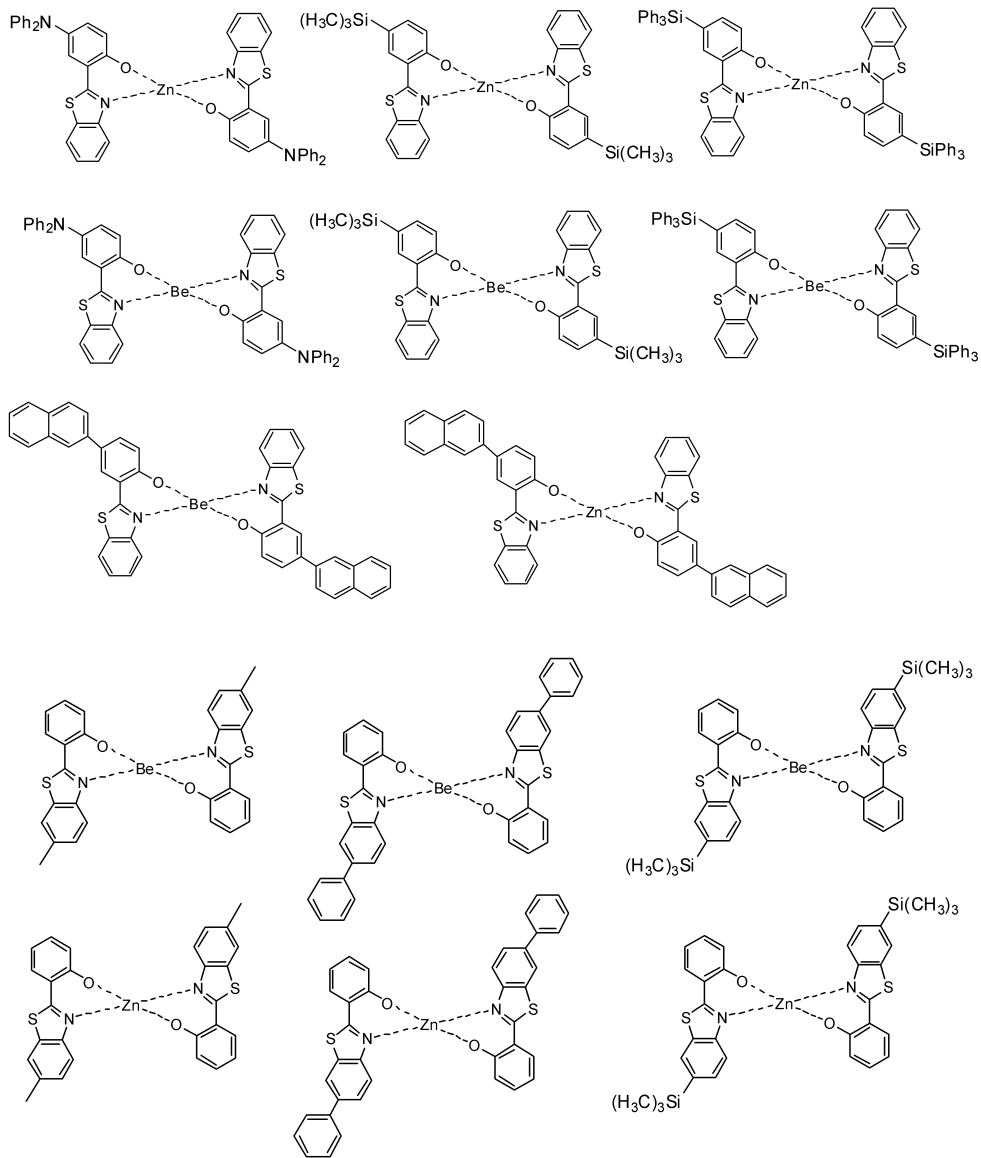


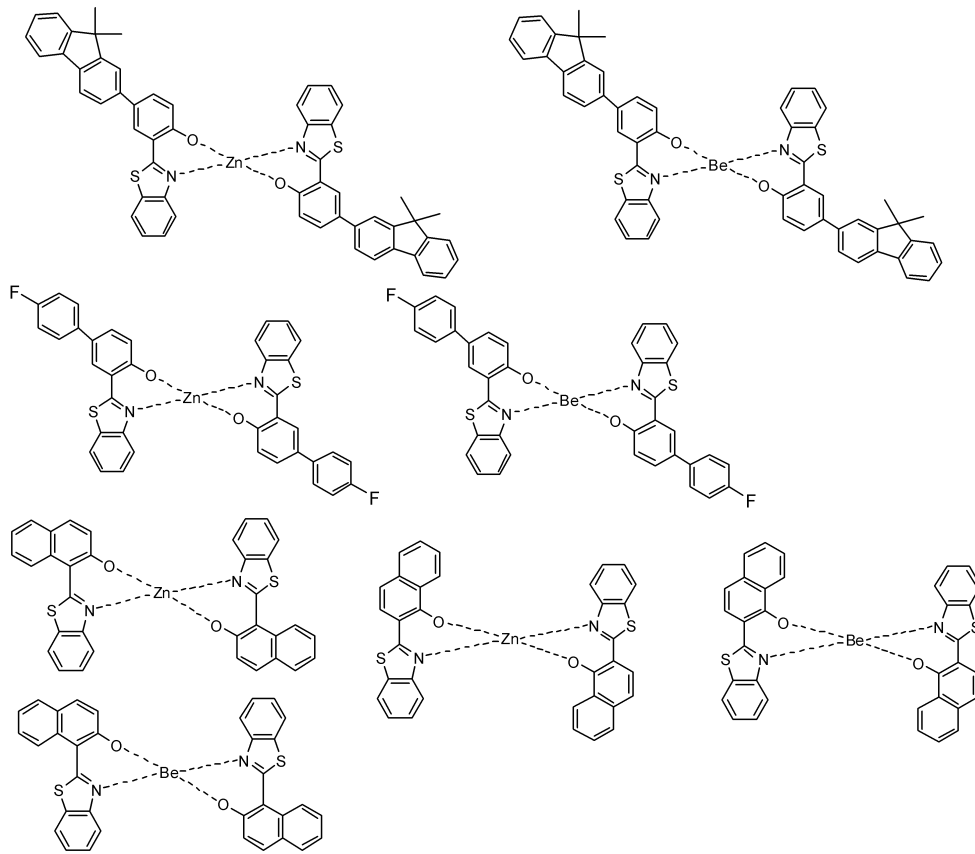
**청구항 6**

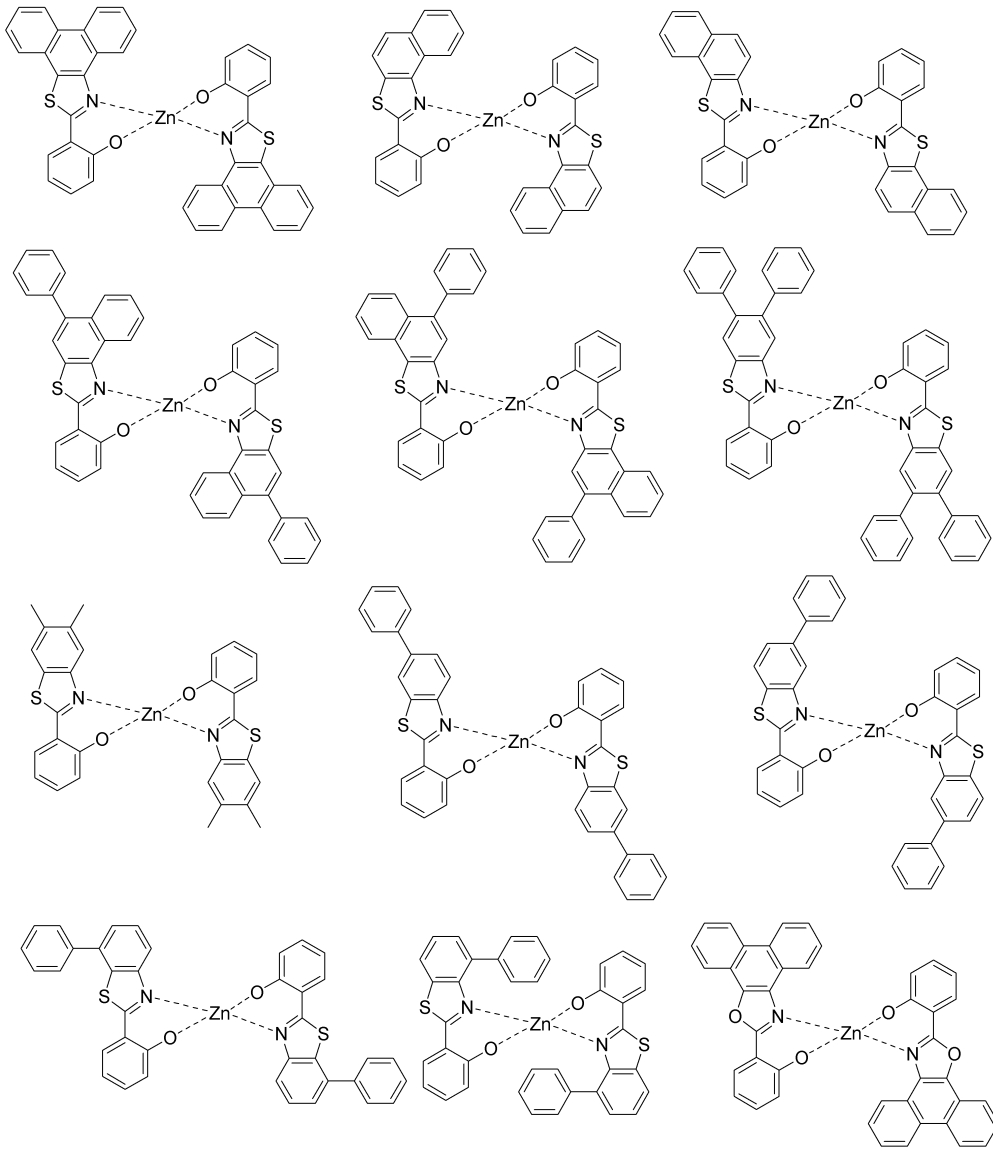
제 1항에 있어서,

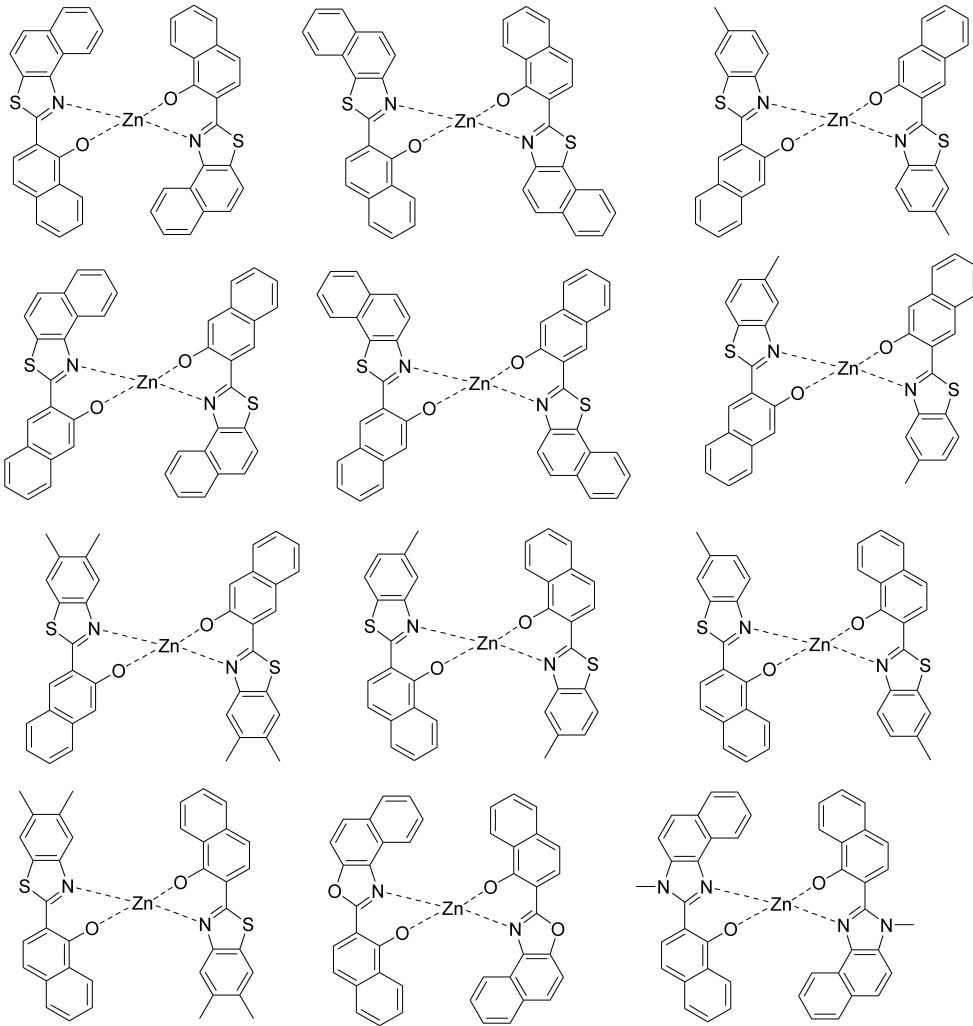
하기 화합물들로부터 선택되는 것을 특징으로 하는 전기 발광 화합물.

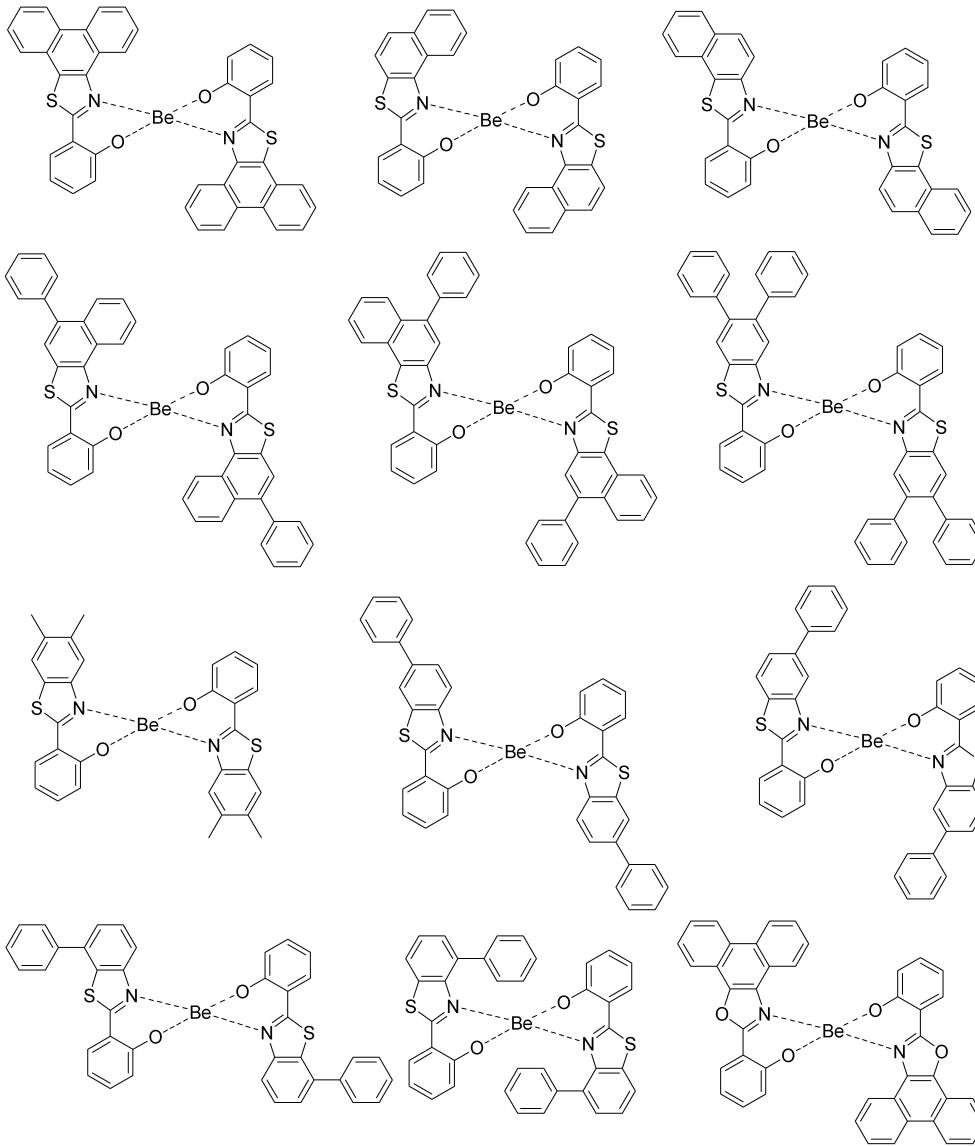


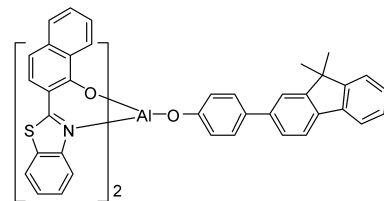
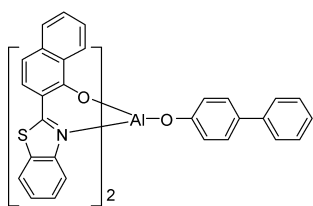
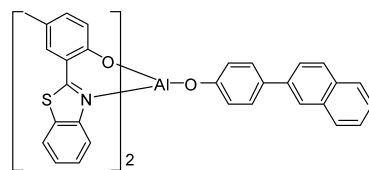
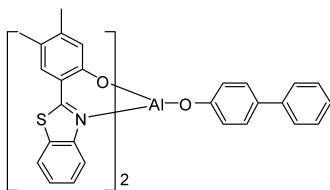
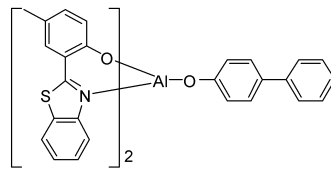
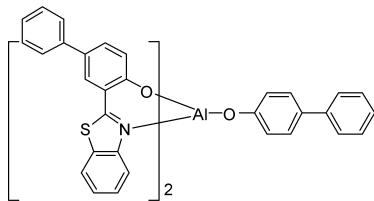
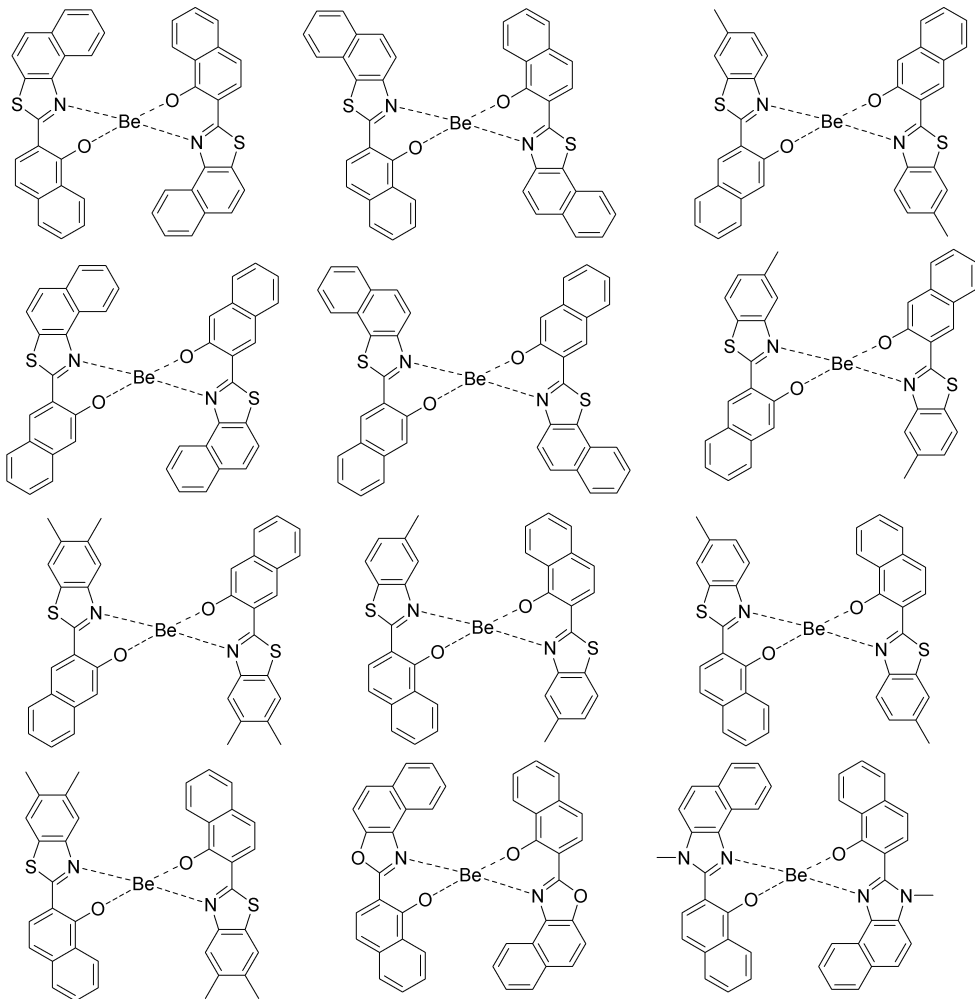












청구항 7

제 1항 내지 제 6항에서 선택되는 어느 한 항에 따른 전기 발광 화합물을 포함하는 것을 특징으로 하는 전기 발광 소자.

**청구항 8**

제 7항에 있어서,

상기 전기 발광 화합물은 발광층의 호스트 물질로 사용되는 것을 특징으로 하는 전기 발광 소자.

**청구항 9**

제1전극;

제2전극; 및

상기 제1전극 및 제2전극 사이에 개재되는 1층 이상의 유기물층으로 이루어진 전기 발광 소자에 있어서,

상기 유기물층은 제 1항 내지 제 6항에서 선택되는 어느 한 항에 따른 전기 발광 화합물을 하나 이상 포함하는 것을 특징으로 하는 전기 발광 소자.

**청구항 10**

제 9항에 있어서,

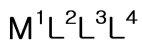
상기 유기물층은 발광영역을 포함하며, 상기 발광영역은 상기 전기 발광 화합물 하나 이상과 하나 이상의 발광 도판트를 포함하는 것을 특징으로 하는 전기 발광 소자.

**청구항 11**

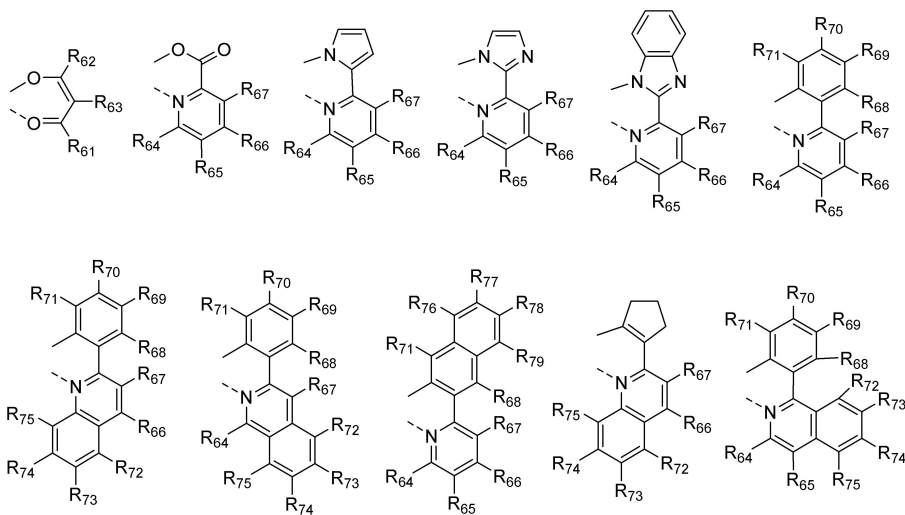
제 10항에 있어서,

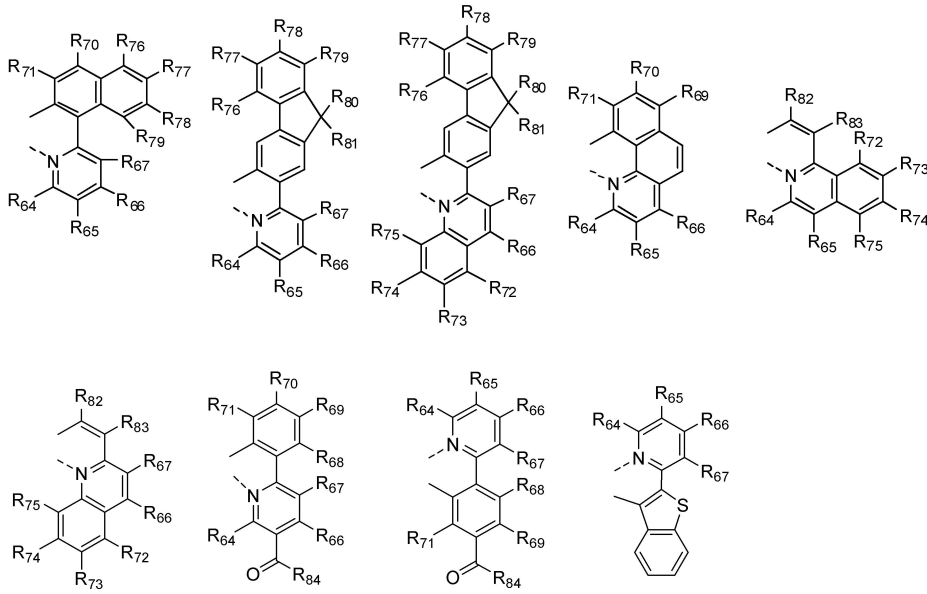
상기 발광 도판트는 화학식 2의 화합물인 것을 특징으로 하는 전기 발광 소자.

[화학식 2]



여기서  $M^1$ 은 7족, 8족, 9족, 10족, 11족, 13족, 14족, 15족 및 16족의 금속으로 이루어진 군으로부터 선택되고, 상기 리간드  $L^2$ ,  $L^3$  및  $L^4$ 는 서로 독립적으로 하기 구조로부터 선택되어진다.





[R<sub>61</sub> 및 R<sub>62</sub>는 서로 독립적으로 수소, (C1-C60)알킬, 페닐 또는 할로젠이고;

R<sub>63</sub> 내지 R<sub>79</sub>는 서로 독립적으로 수소, (C1-C60)알킬, 페닐, 트리(C1-C30)알킬실릴 또는 할로젠이고;

R<sub>80</sub> 내지 R<sub>83</sub>은 서로 독립적으로 수소, (C1-C60)알킬 또는 페닐이고;

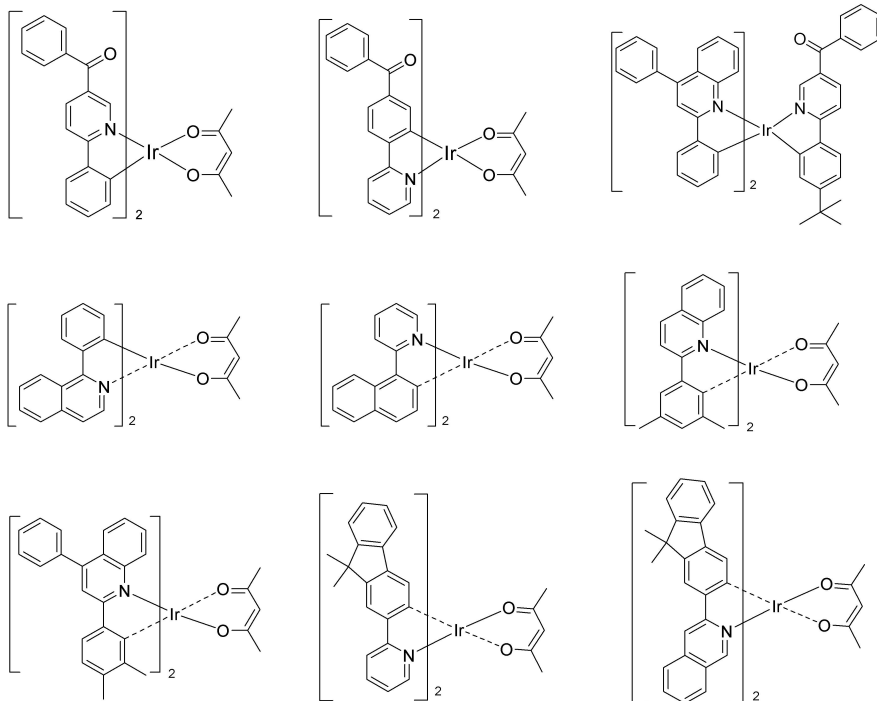
R<sub>84</sub>는 (C1-C60)알킬, 페닐 또는 할로젠이고;

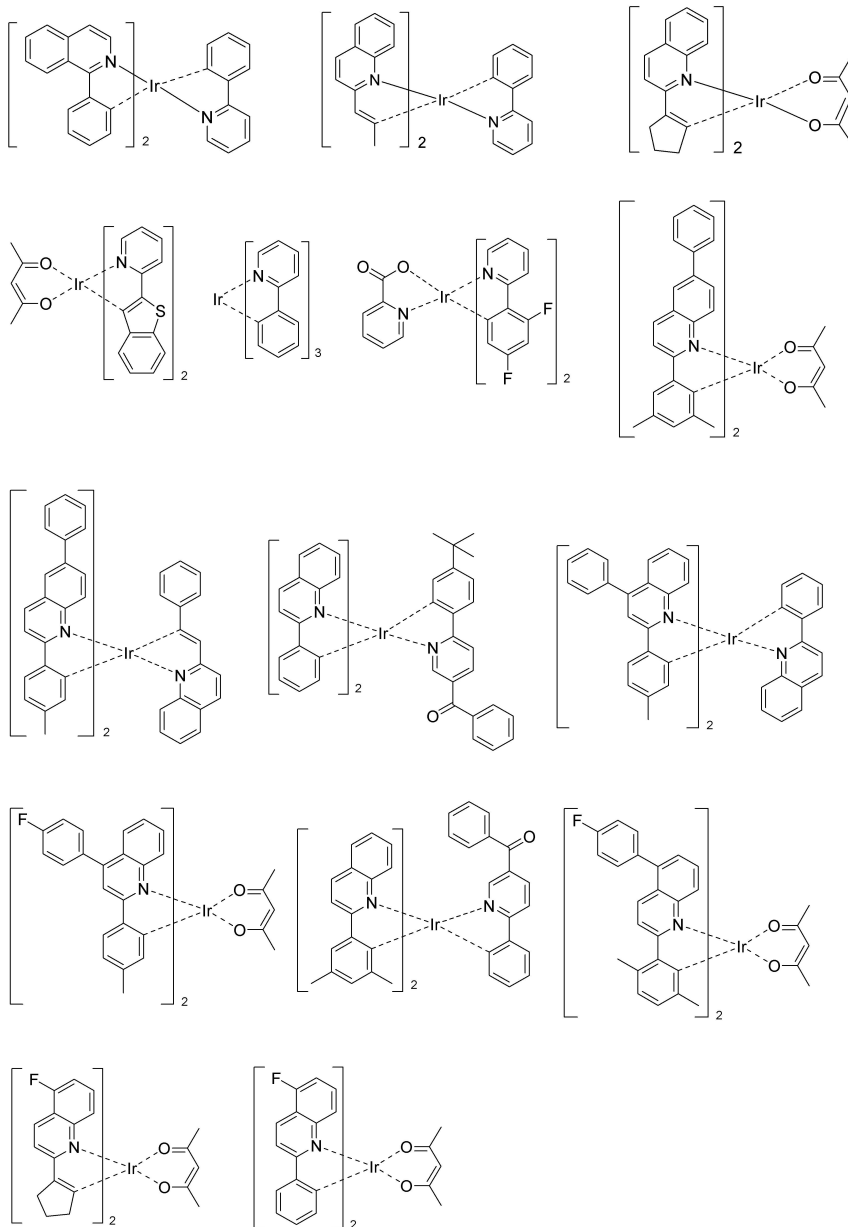
상기 R<sub>61</sub> 내지 R<sub>84</sub>의 알킬 또는 페닐은 (C1-C60)알킬 또는 할로젠으로 더 치환될 수 있다.]

### 청구항 12

제 11항에 있어서,

발광 도판트는 하기 화합물들로부터 선택되는 것을 특징으로 하는 전기 발광 소자.





**청구항 13**

제 9항에 있어서,

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

**청구항 14**

제 9항에 있어서,

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

**청구항 15**

제 9항에 있어서,

상기 발광층을 포함하는 전기 발광 소자를 서브픽셀로 하고, 아릴아민계 화합물 및 스티리아릴아민계 화합물로 이루어진 군으로부터 선택된 하나 이상의 화합물을 포함하는 서브픽셀 하나 이상을 동시에 병렬로 패터닝한 독립 발광 방식의 픽셀구조를 가진 전기 발광 소자.

**청구항 16**

제 9항에 있어서,

상기 발광층에 560nm 이하의 발광피크를 갖는 유기화합물 또는 유기금속화합물을 동시에 포함하는 것을 특징으로 하는 전기 발광 소자.

**청구항 17**

제 9항에 있어서,

상기 유기물층은 발광층 이외에 전하생성층을 동시에 포함하는 것을 특징으로 하는 전기 발광 소자.

**청구항 18**

제 9항에 있어서,

한 쌍의 전극중 하나 이상의 내측표면에 칼코제나이드(chalcogenide)층, 할로젠화 금속층 및 금속 산화물층으로 구성되는 군으로부터 선택되는 하나 이상의 층이 배치되는 것을 특징으로 하는 전기 발광 소자.

**청구항 19**

제 9항에 있어서,

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

**청구항 20**

제 1항 내지 제 6항에서 선택되는 어느 한 항에 따른 유기 발광 화합물을 포함하는 것을 특징으로 하는 유기 태양 전지.

**명세서**

**발명의 상세한 설명**

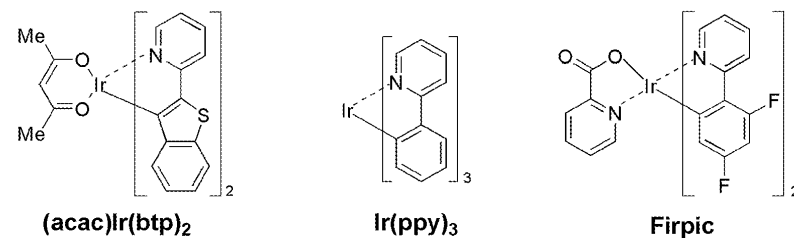
**기술분야**

<1> 본 발명은 전기전도특성이 뛰어나고, 고효율의 발광특성을 보이는 금속착물로 이루어진 전기 발광 화합물 및 이를 호스트 재료로 함유하는 전기발광소자에 관한 것이다.

**배경기술**

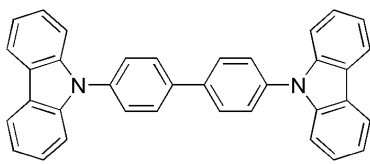
<2> OLED에서 발광 효율을 결정하는 가장 중요한 요인은 발광 재료이다. 발광 재료로는 현재까지 형광 재료가 널리 사용되고 있으나, 전기발광의 메커니즘 상 인광 재료의 개발은 이론적으로 4배까지 발광 효율을 개선시킬 수 있는 가장 좋은 방법 중 하나이다.

<3> 현재까지 이리듐(III)착물 계열이 인광 발광 재료로 널리 알려져 있으며, 각 RGB 별로 (acac)Ir(btp)<sub>2</sub>, Ir(ppy)<sub>3</sub> 및 Firpic 등의 재료가 알려져 있다. 특히, 최근 일본, 구미에서 많은 인광 재료들이 연구되어지고 있다.

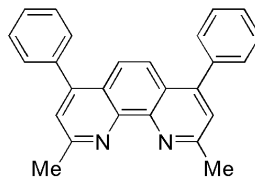


<4> 인광 발광체의 호스트 재료로는 현재까지 CBP가 가장 널리 알려져 있으며, BCP 및 BAlq 등의 정공차단층을 적용

한 고효율의 OLED가 공지되어 있으며, 일본의 파이오니어 등에서는 BAlq 유도체를 호스트로 이용한 고성능의 OLED가 공지되어 있다.

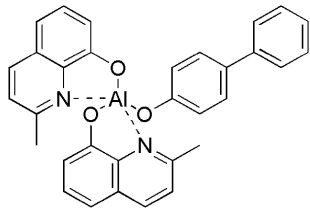


CBP

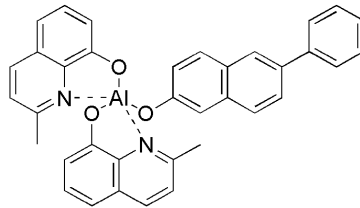


BCP

<6>



BAlq

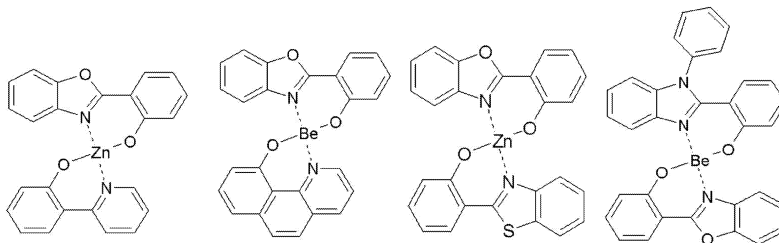


BAlq 유도체

<7>

<8> 그러나 기존의 재료들은 발광 특성 측면에서는 유리한 면이 있으나, 유리전이온도가 낮고 열적 안정성이 매우 좋지 않아서, 진공 하에서 고온 증착 공정을 거칠 때, 물질이 변하는 등 단점을 갖고 있다. OLED에서 전력효율 =  $(\pi/\text{전압}) \times \text{전류효율}$  이므로, 전력효율은 전압에 반비례하는데, OLED의 소비 전력이 낮으려면 전력 효율이 높아야한다. 실제 인광 발광 재료를 사용한 OLED는 형광 발광 재료를 사용한 OLED에 비해 전류 효율(cd/A)이 상당히 높으나, 인광 발광 재료의 호스트로 BAlq 나 CBP 등 종래의 재료를 사용할 경우, 형광재료를 사용한 OLED에 비해 구동 전압이 높아서 전력 효율(lm/w)면에서 큰 이점이 없었다.

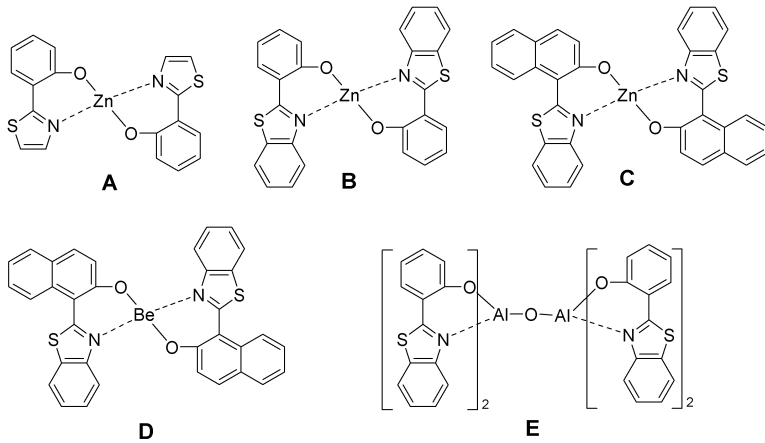
<9> 본 발명자들은 상기한 문제점들을 해결하기 위하여 기존의 유기물 호스트 재료 또는 알루미늄 착물들에 비하여 발광 특성 및 물성 측면에서 매우 우수한 혼합형 리간드 금속 착물을 골격으로 하는 하기 구조의 전기 발광 화합물을 발명하여 대한민국 특허출원 제2006-7467호로 출원한 바 있다.



<10>

<11> 기존의 이러한 부류의 착물은 이미 청색 등의 발광 재료로 1990년대 중반부터 많은 연구가 진행되어져 왔다. 그러나, 이들 재료는 단순히 발광 재료로만 적용되었을 뿐, 인광 발광 재료의 호스트 재료로 적용되는 예는 거의 알려져 있지 않았다.

<12> 한편, 일본특허공보 특개2002-305083호에는 하기의 화합물, 즉 티아졸 고리, 벤조티아졸 고리 및 벤젠 고리에 모두 수소가 치환된 화합물들에 대해서만 소자의 효율을 측정하고 있을 뿐, 다른 치환체가 치환된 화합물에 대해서는 공지되어 있지 않다. 한편, 화합물 B의 경우  $100\text{cd/m}^2$ 에서 전력효율 2.6lm/W, 발광효율 5.3cd/A 및 구동 전압 6.5V를 나타내는 것이 공지되어 있으나, 다른 치환기가 리간드에 치환되는 경우에 대해서는 기재되어 있지 않다.



<13>

<14> 본 발명에서는 기존의 재료들에 비하여 물질 안정성이 우수하며, 전기전도특성이 뛰어나고, 고효율의 발광특성을 보이는 금속착물재료를 개발하였다. 방향족 고리에 포함되었거나, 측쇄치환기로서 비공유전자쌍을 포함하는 헤테로 원자는 금속에 배위를 매우 잘하는 특성을 가지고 있는데, 이러한 배위결합은 전기화학적으로 매우 안정된 특성을 보이는 것은 이미 널리 알려져 있는 착물 특성이다. 본 발명에서는 이러한 특성을 이용하여 다양한 치환기가 치환되어 있는 리간드를 개발, 금속 착물을 제조하여, 호스트 재료로 적용하였다.

**발명의 내용**

**해결 하고자하는 과제**

<15> 본 발명의 목적은 상기한 문제점들을 해결하기 위하여 기존의 유기물 호스트 재료에 비하여 발광 특성 및 물성 측면에서 매우 우수한 신규한 리간드 금속 착물을 골격으로 하는 전기 발광 화합물을 제공하는 것이며, 또 다른 목적으로서 제조된 전기 발광 화합물을 호스트 재료로 함유하는 전기 발광 소자를 제공하는 것이다.

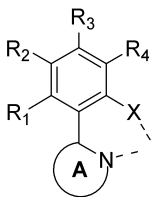
**과제 해결수단**

<16> 본 발명은 하기 화학식 1로 표시되는 전기 발광 화합물 및 이를 호스트 재료로 함유하는 전기 발광 소자에 관한 것이다.

<17> [화학식 1]



<19> [리간드  $L^1$ 은 하기 구조이고;



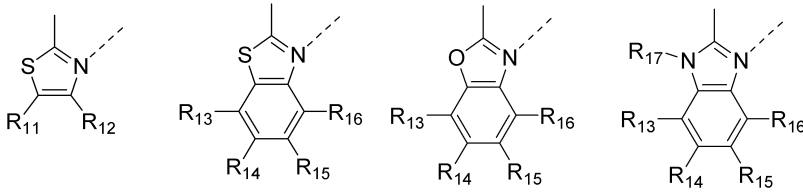
<20>

<21> M은 2가 또는 3가 금속이며;

<22> M이 2가 금속인 경우 m은 0이고, M이 3가 금속인 경우 m은 1이고;

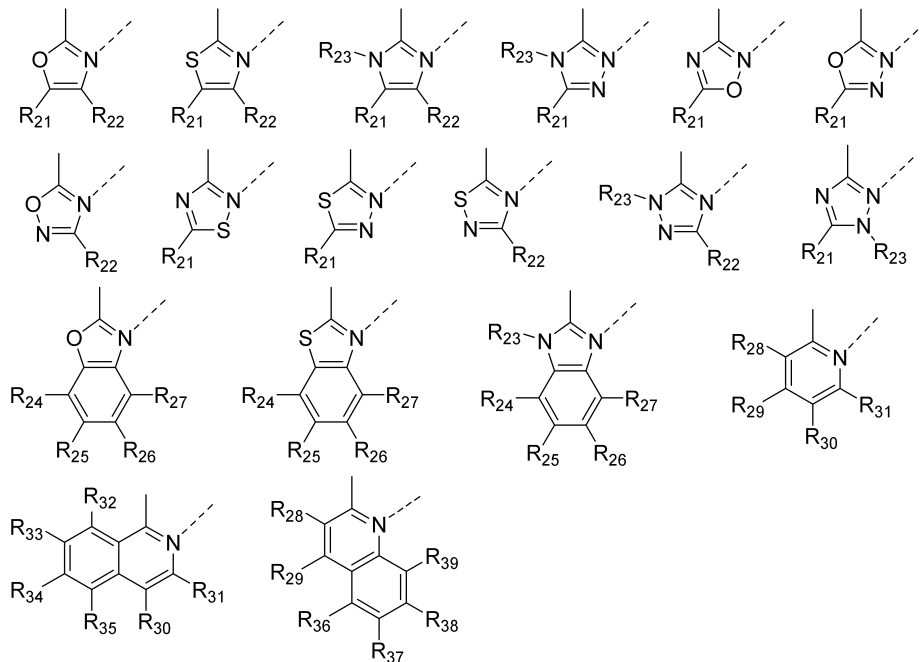
<23> Q는 (C6-C60)아릴옥시 또는 트리(C6-C30)아릴실릴이고, 상기 Q의 아릴옥시 및 트리아릴실릴은 직쇄 또는 분쇄의 (C1-C60)알킬 또는 (C6-C60)아릴이 더 치환될 수 있으며;

<24> X가 0인 경우 A 고리는 하기 구조로부터 선택되고,



<25>

<26> X가 S인 경우 A 고리는 하기 구조로부터 선택되고,



<27>

<28> R<sub>1</sub> 내지 R<sub>4</sub>는 서로 독립적으로 수소, (C1-C60)알킬, 할로젠, 시아노, (C3-C60)시클로알킬, (C6-C60)아릴, (C4-C60)헤테로아릴, 모노 또는 디(C1-C30)알킬아미노, 모노 또는 디(C6-C30)아릴아미노, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴 또는 트리(C6-C30)아릴실릴이거나, 인접한 치환체와 (C3-C12)알킬렌, 또는 (C3-C12)알케닐렌으로 결합되어 융합고리를 형성할 수 있으며;

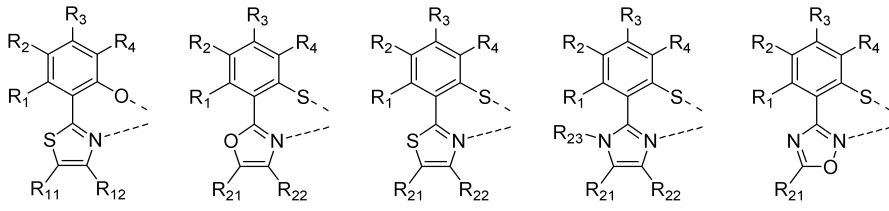
<29> R<sub>11</sub> 내지 R<sub>17</sub>은 서로 독립적으로 수소, (C1-C60)알킬, (C6-C60)아릴, (C4-C60)헤테로아릴, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴, 트리(C6-C30)아릴실릴, 모노 또는 디(C1-C30)알킬아미노, 모노 또는 디(C6-C30)아릴아미노, 시아노 또는 할로젠이거나, R<sub>13</sub> 내지 R<sub>16</sub>은 인접한 치환체와 (C3-C12)알킬렌, 또는 (C3-C12)알케닐렌으로 결합되어 융합고리를 형성할 수 있으며;

<30> R<sub>21</sub> 내지 R<sub>39</sub>는 서로 독립적으로 수소, (C1-C60)알킬, (C6-C60)아릴, (C4-C60)헤테로아릴, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴, 트리(C6-C30)아릴실릴, 모노 또는 디(C1-C30)알킬아미노, 모노 또는 디(C6-C30)아릴아미노, 시아노 또는 할로젠이며;

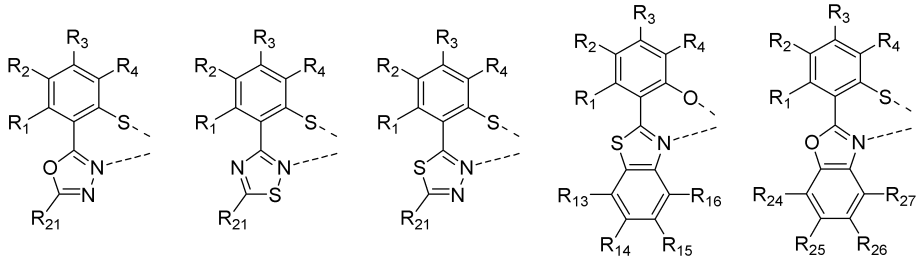
<31> 상기 R<sub>1</sub> 내지 R<sub>4</sub>의 알킬, 아릴, 헤테로아릴 또는 인접한 치환체와 (C3-C12)알킬렌, 또는 (C3-C12)알케닐렌으로 결합되어 형성된 융합고리는 (C1-C60)알킬, 할로젠이 치환된 (C1-C60)알킬, (C6-C60)아릴, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴, 트리(C6-C30)아릴실릴, 모노 또는 디(C1-C30)알킬아미노, 모노 또는 디(C6-C30)아릴아미노, 시아노 또는 할로젠으로부터 선택된 하나 이상이 더 치환될 수 있고;

<32> 상기 R<sub>11</sub> 내지 R<sub>17</sub> 및 R<sub>21</sub> 내지 R<sub>39</sub>의 알킬, 아릴 또는 헤테로아릴은 (C1-C60)알킬, 할로젠이 치환된 (C1-C60)알킬, 할로젠, (C6-C60)아릴, 모노 또는 디(C1-C30)알킬아미노, 모노 또는 디(C6-C30)아릴아미노, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴, 트리(C6-C30)아릴실릴 또는 시아노로부터 선택된 하나 이상이 더 치환될 수 있다.]

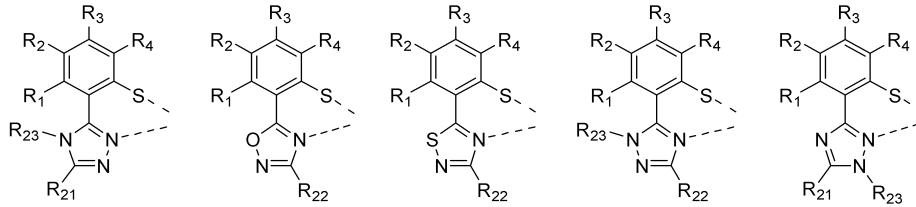
<33> 상기 리간드 L<sup>1</sup>은 하기 구조로부터 선택된다.



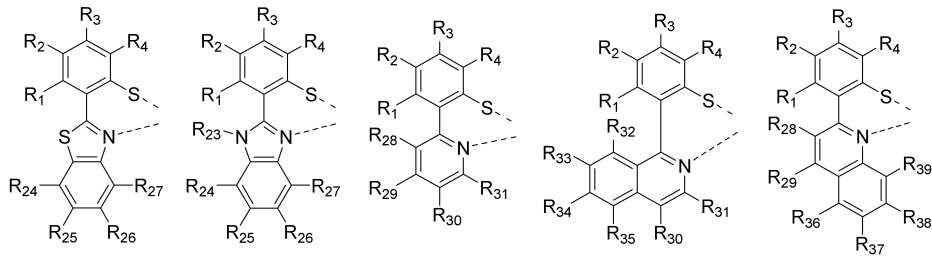
<34>



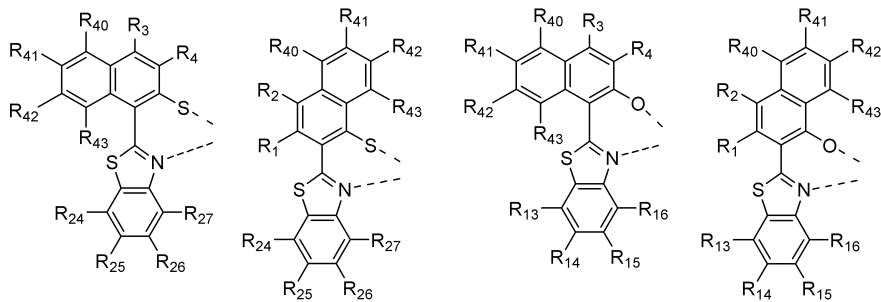
<35>



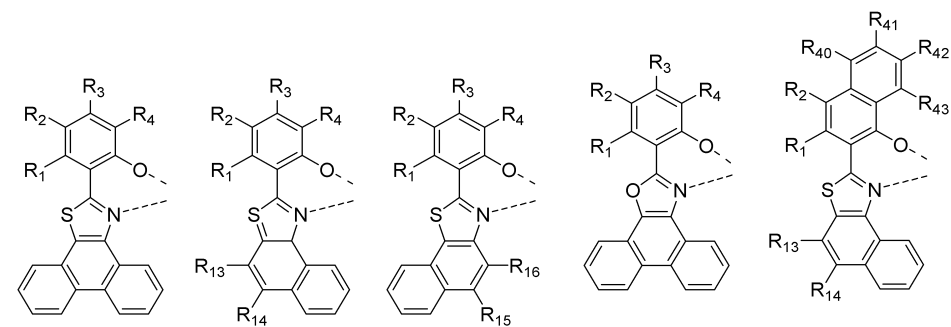
<36>



<37>

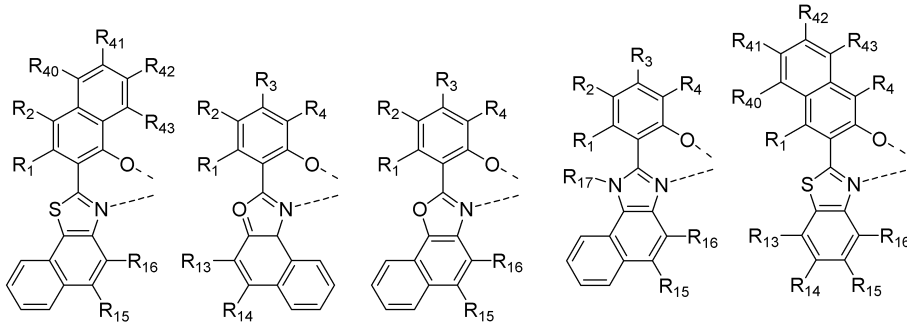


<38>

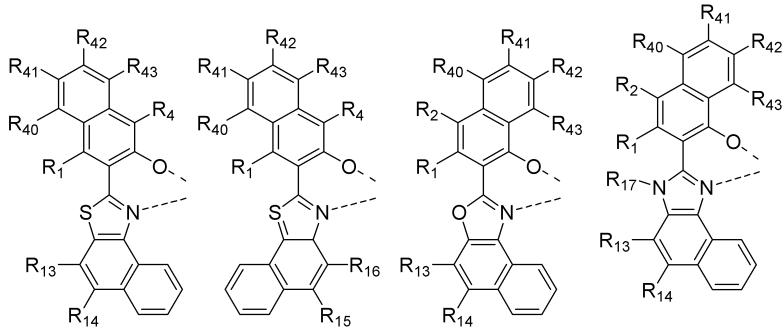


<39>

<40>



<41>



<42>

[상기 리간드에서, R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub> 및 R<sub>4</sub>는 상기 화학식 1에서 정의한 바와 동일하며;

<43>

R<sub>11</sub> 내지 R<sub>16</sub>은 서로 독립적으로 수소, (C1-C60)알킬, 할로젠, 할로젠이 치환된 (C1-C60)알킬, 페닐, 나프틸, 비페닐, 플루오레닐, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴, 트리(C6-C30)아릴실릴, 디(C1-C30)알킬아미노, 디(C6-C30)아릴아미노, 싸이오펜일 또는 퓨란일이며;

<44>

R<sub>17</sub>은 (C1-C60)알킬, 페닐 또는 나프틸이며;

<45>

R<sub>21</sub> 및 R<sub>22</sub>는 서로 독립적으로 수소, (C1-C60)알킬, 할로젠, 할로젠이 치환된 (C1-C60)알킬, 페닐, 나프틸, 비페닐, 플루오레닐, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴, 트리(C6-C30)아릴실릴, 디(C1-C30)알킬아미노, 디(C6-C30)아릴아미노, 싸이오펜일 또는 퓨란일이며;

<46>

R<sub>23</sub>은 (C1-C60)알킬, 페닐 또는 나프틸이며;

<47>

R<sub>24</sub> 내지 R<sub>39</sub>는 서로 독립적으로 수소, (C1-C60)알킬, 할로젠, 할로젠이 치환된 (C1-C60)알킬, 페닐, 나프틸, 비페닐, 플루오레닐, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴, 트리(C6-C30)아릴실릴, 디(C1-C30)알킬아미노, 디(C6-C30)아릴아미노, 싸이오펜일 또는 퓨란일이며;

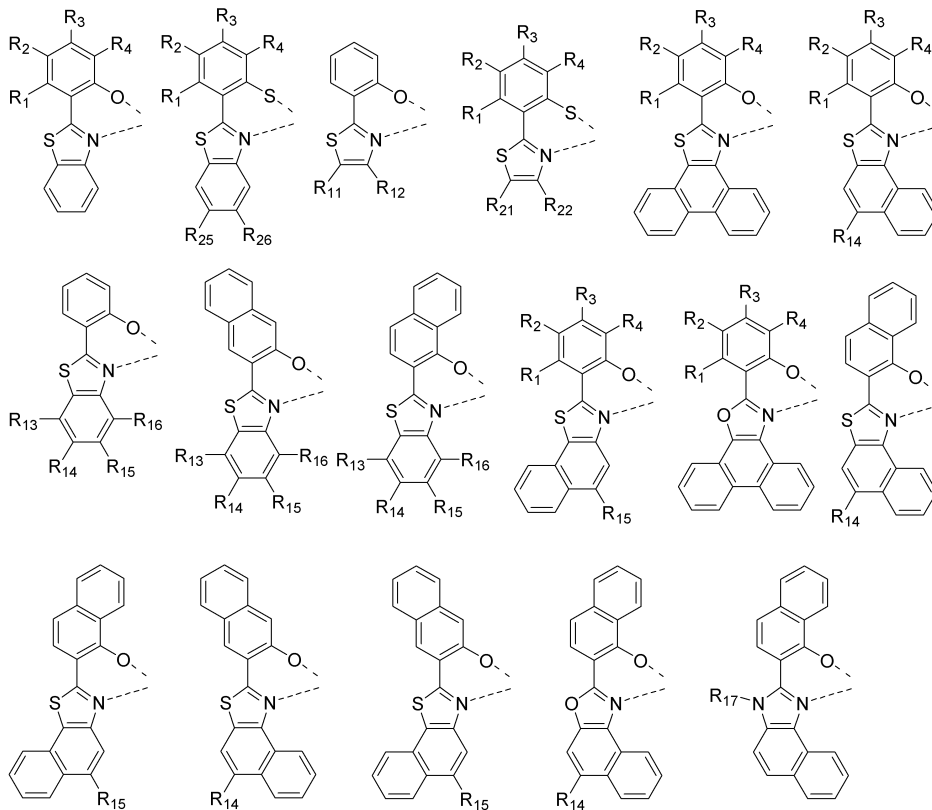
<48>

R<sub>40</sub> 내지 R<sub>43</sub>은 서로 독립적으로 수소, (C1-C60)알킬, 할로젠이 치환된 (C1-C60)알킬, 페닐, 나프틸, 비페닐, 플루오레닐, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴, 트리(C6-C30)아릴실릴, 디(C1-C30)알킬아미노, 디(C6-C30)아릴아미노 또는 할로젠이고;

<49>

상기 R<sub>11</sub> 내지 R<sub>17</sub>, R<sub>21</sub> 내지 R<sub>39</sub> 및 R<sub>40</sub> 내지 R<sub>43</sub>의 페닐, 나프틸, 비페닐, 플루오레닐, 싸이오펜일 또는 퓨란일은 (C1-C60)알킬, 할로젠, 페닐, 나프틸, 플루오레닐, 트리(C1-C30)알킬실릴, 디(C1-C30)알킬(C6-C30)아릴실릴, 트리(C6-C30)아릴실릴, 디(C1-C30)알킬아미노 또는 디(C6-C30)아릴아미노로부터 선택된 하나 이상이 더 치환될 수 있다.]

<50> 상기 리간드 L<sup>1</sup>은 바람직하게는 하기 구조로부터 선택된다.



<51>

<52> [상기 리간드에서, R<sub>1</sub> 내지 R<sub>4</sub>는 서로 독립적으로 수소, 메틸, 에틸, n-프로필, i-프로필, n-부틸, i-부틸, t-부틸, 염소, 플루오르, 페닐, 비페닐, 나프틸, 플루오레닐, 싸이오펜일, 트리메틸실릴, 트리페닐실릴, t-부틸디메틸실릴, 디메틸아미노, 디에틸아미노 또는 디페닐아미노이며;

<53> R<sub>11</sub> 및 R<sub>12</sub>는 서로 독립적으로 메틸, 에틸, n-프로필, i-프로필, n-부틸, i-부틸, t-부틸, 트리메틸실릴, 트리페닐실릴, 페닐, 비페닐, 나프틸 또는 플루오레닐이고;

<54> R<sub>13</sub> 내지 R<sub>16</sub>는 서로 독립적으로 메틸, 에틸, n-프로필, i-프로필, n-부틸, i-부틸, t-부틸, 트리메틸실릴, 트리페닐실릴, 페닐, 비페닐, 나프틸 또는 플루오레닐이고;

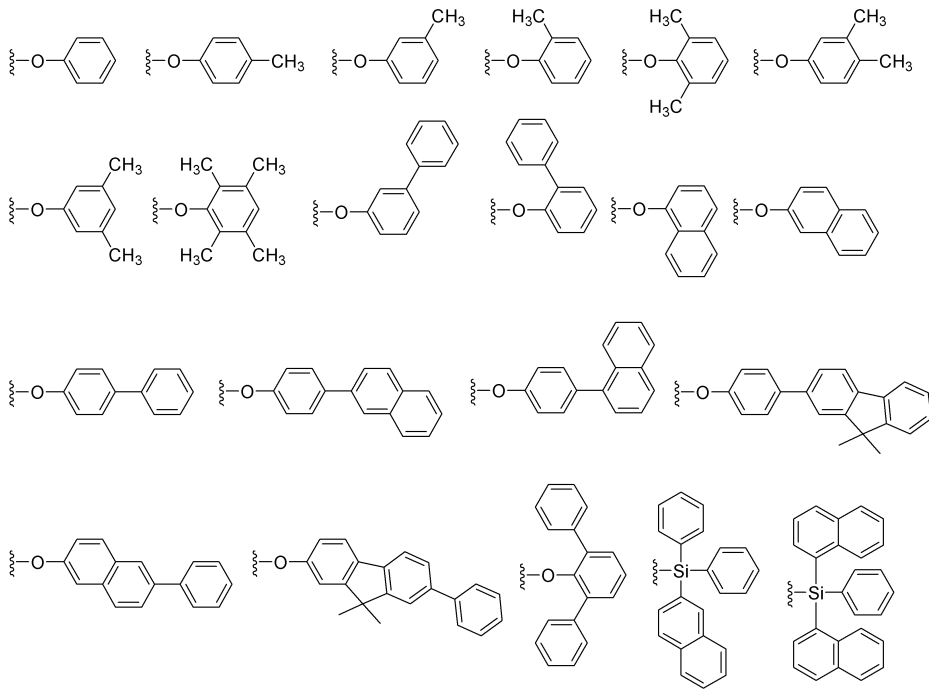
<55> R<sub>17</sub>은 메틸, 에틸, n-프로필, i-프로필, n-부틸, i-부틸, t-부틸, 페닐 또는 나프틸이며;

<56> R<sub>21</sub> 및 R<sub>22</sub>은 서로 독립적으로 수소, 메틸, 에틸, n-프로필, i-프로필, n-부틸, i-부틸, t-부틸, 플루오르, 트리플루오르메틸, 페닐, 나프틸, 비페닐, 트리메틸실릴, 트리페닐실릴, 디메틸아미노, 디페닐아미노, 싸이오펜일 또는 퓨란일이며;

<57> R<sub>25</sub> 및 R<sub>26</sub>은 서로 독립적으로 수소, 메틸, 에틸, n-프로필, i-프로필, n-부틸, i-부틸, t-부틸, 플루오르, 트리플루오르메틸, 페닐, 나프틸, 비페닐, 트리메틸실릴, 트리페닐실릴, 디메틸아미노, 디페닐아미노, 싸이오펜일 또는 퓨란일이며;

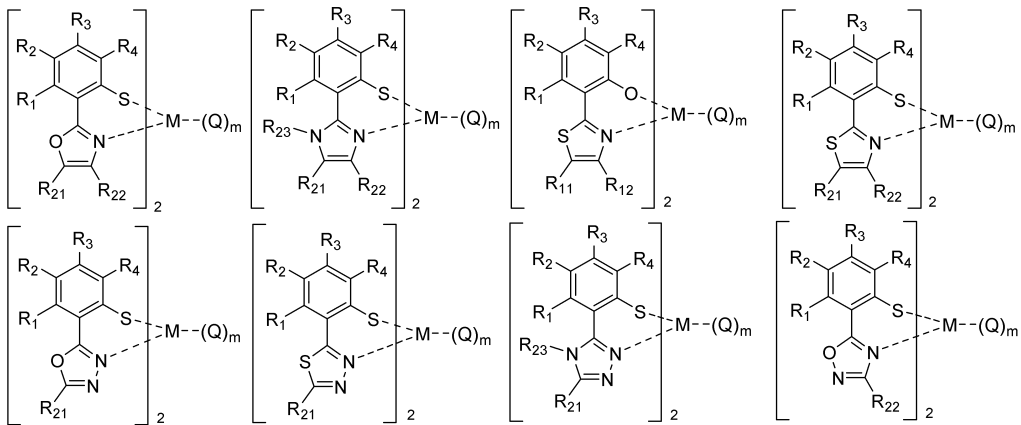
<58> 상기 R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>, R<sub>11</sub>, R<sub>12</sub>, R<sub>13</sub>, R<sub>14</sub>, R<sub>15</sub>, R<sub>16</sub>, R<sub>17</sub>, R<sub>21</sub>, R<sub>22</sub>, R<sub>25</sub> 및 R<sub>26</sub>의 페닐, 비페닐, 나프틸, 플루오레닐 및 싸이오펜일은 플루오르, 메틸, 에틸, n-프로필, i-프로필, n-부틸, i-부틸, t-부틸, 트리메틸실릴, 트리페닐실릴, t-부틸디메틸실릴, 페닐, 나프틸, 플루오레닐, 디메틸아미노, 디에틸아미노 또는 디페닐아미노로부터 선택된 하나 이상이 더 치환될 수 있다.]

<59> 상기 화학식 1에서 M은 Be, Zn, Mg, Cu 및 Ni로 이루어진 군에서 선택되는 2가 금속이거나 Al, Ga, In 및 B로 이루어진 군에서 선택되는 3가 금속이고, Q는 하기 구조로부터 선택된다.

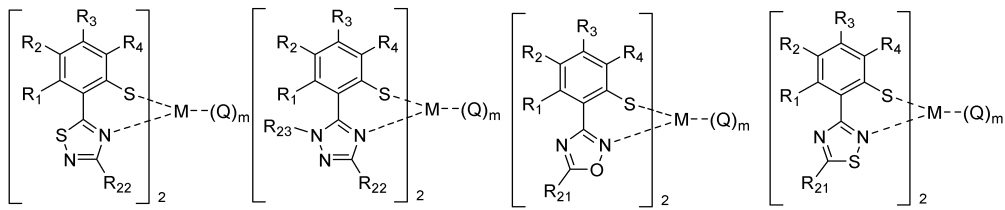


<60>

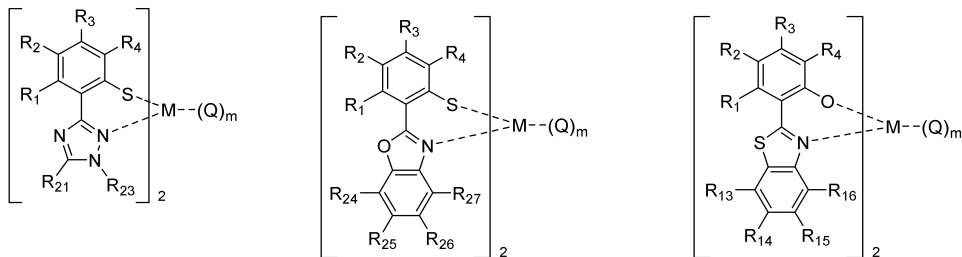
<61> 상기 화학식 1의 화합물은 구체적으로 하기 화합물들로 예시될 수 있으나, 이에 한정되는 것은 아니다.



<62>

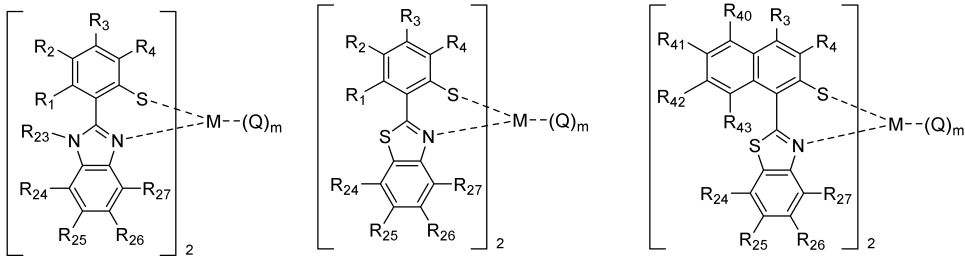


<63>

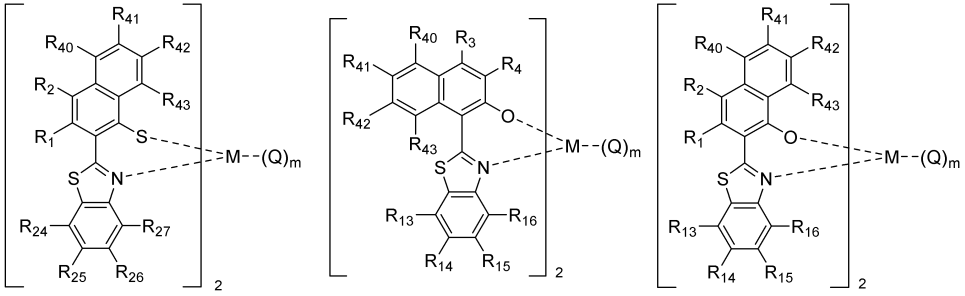


<64>

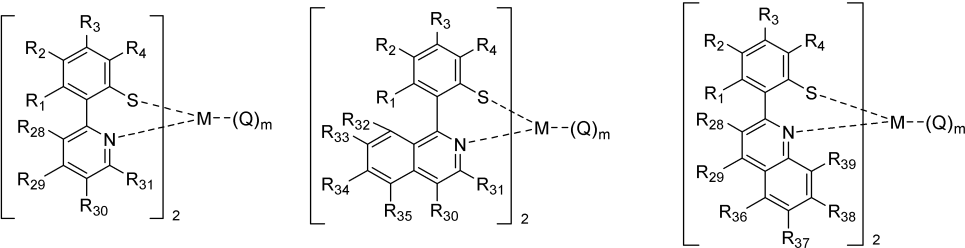
<65>



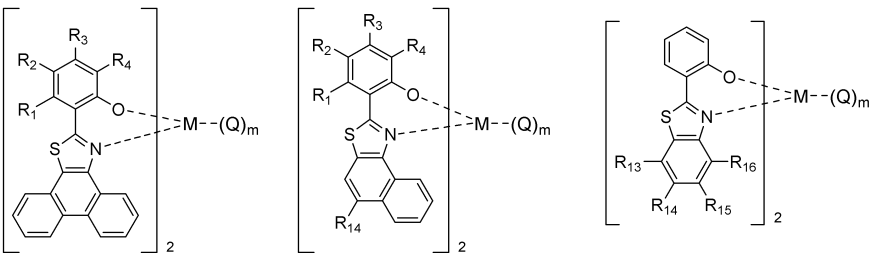
<66>



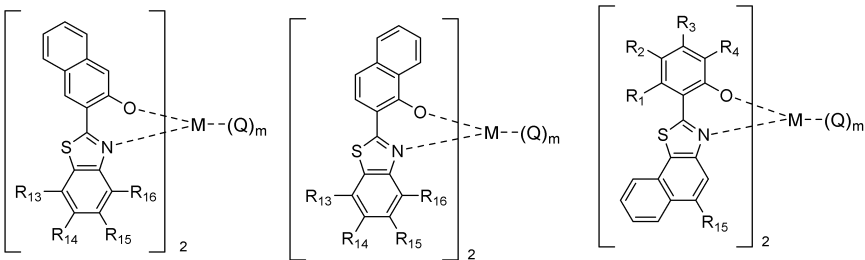
<67>



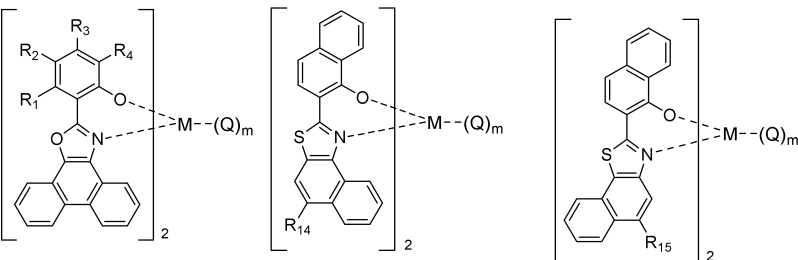
<68>

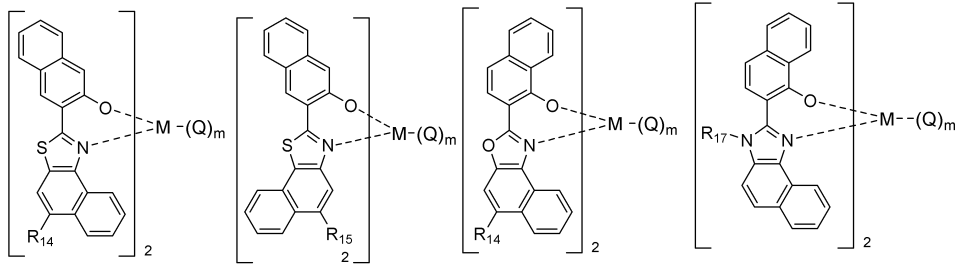


<69>



<70>





<71>

<72>

[M은 Be, Zn, Mg, Cu 또는 Ni로부터 선택되는 2가 금속이거나 Al, Ga, In 또는 B로부터 선택되는 3가 금속이고; Q는 상기 화학식 1에서의 정의와 동일하고; M이 2가 금속인 경우 m은 0이고, M이 3가 금속인 경우 m은 1이고;

<73>

R<sub>1</sub> 내지 R<sub>4</sub>는 서로 독립적으로 수소, 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, 플루오르, 클로로, 트리플루오르메틸, 퍼플루오르에틸, 트리플루오르에틸, 퍼플루오르프로필, 퍼플루오르부틸, 트리메틸실릴, 트리에틸실릴, 트리프로필실릴, 트리(t-부틸)실릴, t-부틸디메틸실릴, 디메틸페닐실릴, 트리페닐실릴, 페닐, 비페닐, 나프틸, 안트릴, 플루오레닐, 피리딜, 퀴놀릴, 퓨란일, 싸이오펜일, 티아졸릴, 이미다졸릴, 옥사졸릴, 벤조퓨란일, 벤조티아졸릴, 벤조이미다졸릴, 벤조옥사졸릴, 디메틸아미노, 디에틸아미노 또는 디페닐아미노이며;

<74>

R<sub>11</sub> 내지 R<sub>17</sub> 및 R<sub>21</sub> 내지 R<sub>39</sub>는 서로 독립적으로 수소, 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, 플루오르, 클로로, 트리플루오르메틸, 퍼플루오르에틸, 트리플루오르에틸, 퍼플루오르프로필, 퍼플루오르부틸, 트리메틸실릴, 트리에틸실릴, 트리프로필실릴, 트리(t-부틸)실릴, t-부틸디메틸실릴, 디메틸페닐실릴, 트리페닐실릴, 페닐, 비페닐, 나프틸, 플루오레닐, 싸이오펜일, 퓨란일, 디메틸아미노, 디에틸아미노 또는 디페닐아미노이며;

<75>

R<sub>40</sub> 내지 R<sub>43</sub>은 서로 독립적으로 수소, 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, 플루오르, 클로로, 트리플루오르메틸, 퍼플루오르에틸, 트리플루오르에틸, 퍼플루오르프로필, 퍼플루오르부틸, 트리메틸실릴, 트리에틸실릴, 트리프로필실릴, 트리(t-부틸)실릴, t-부틸디메틸실릴, 디메틸페닐실릴, 트리페닐실릴, 페닐, 비페닐, 나프틸, 플루오레닐, 디메틸아미노, 디에틸아미노 또는 디페닐아미노이며;

<76>



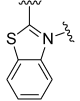

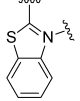

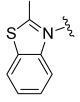

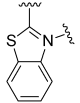

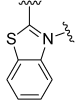

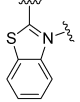

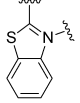

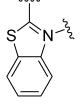
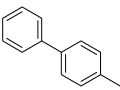
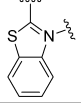
상기 R<sub>1</sub> 내지 R<sub>4</sub>, R<sub>11</sub> 내지 R<sub>17</sub>, R<sub>21</sub> 내지 R<sub>39</sub> 및 R<sub>40</sub> 내지 R<sub>43</sub>의 페닐, 비페닐, 나프틸, 안트릴, 플루오레닐, 피리딜, 퀴놀릴, 퓨란일, 싸이오펜일, 티아졸릴, 이미다졸릴, 옥사졸릴, 벤조퓨란일, 벤조티아졸릴, 벤조이미다졸릴 또는 벤조옥사졸릴은 메틸, 에틸, n-프로필, i-프로필, n-부틸, i-부틸, t-부틸, n-펜틸, i-펜틸, n-헥실, n-헵틸, n-옥틸, 2-에틸헥실, n-노닐, 데실, 도데실, 헥사데실, 플루오르, 클로로, 시아노, 트리플루오르메틸, 퍼플루오르에틸, 트리플루오르에틸, 퍼플루오르프로필, 퍼플루오르부틸, 페닐, 비페닐, 나프틸, 플루오레닐, 트리메틸실릴, 트리에틸실릴, 트리프로필실릴, 트리(t-부틸)실릴, t-부틸디메틸실릴, 디메틸페닐실릴, 트리페닐실릴, 디메틸아미노, 디에틸아미노 또는 디페닐아미노로부터 선택되는 하나 이상이 더 치환될 수 있다.]

<77>

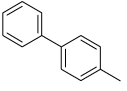
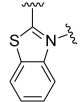
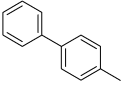
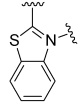
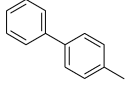
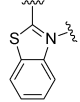
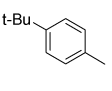
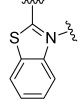
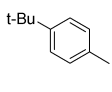
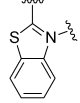
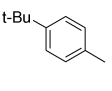
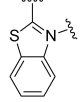
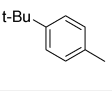
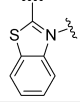
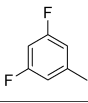
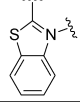
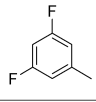
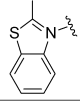
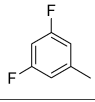
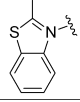
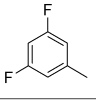
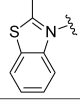
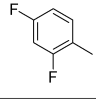
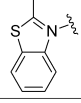
본 발명에 따른 전기 발광 화합물은 구체적으로는 하기 표 1 내지 표 3의 화합물로서 예시될 수 있으나, 이에 특별히 한정되는 것은 아니다. 하기 표 1 및 표 3의 화합물은 M이 2가 금속인 화합물이며, 표 2의 화합물은 M이 3가 금속인 화합물이다.

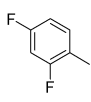
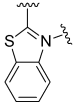
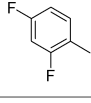
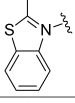
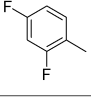
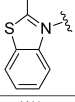
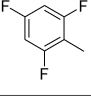
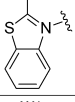
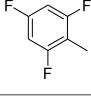
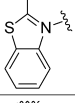
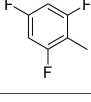
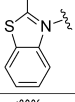
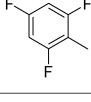
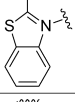

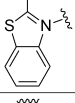

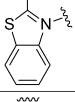

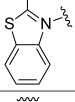

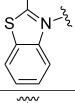

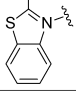
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
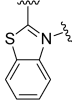

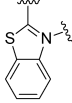

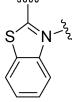

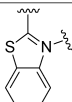

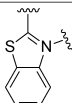

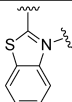

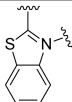
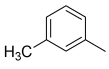
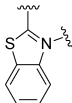
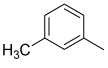
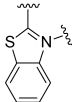
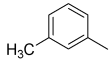
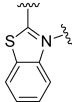
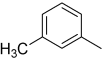
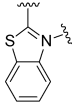
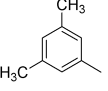
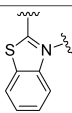
[표 1]

L <sup>1</sup> L <sup>1</sup> M							M
화학물 번호	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>		X	
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2		H	H	H		O	Zn
3	H	H		H		O	Zn
4	H	H	H			O	Zn
5	H		H	H		O	Zn
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9	H		H	H		O	Zn

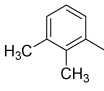
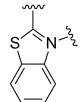
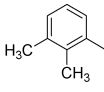
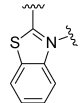
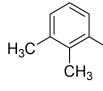
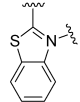

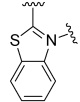

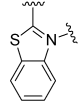

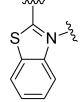

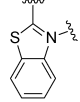
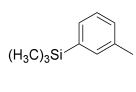
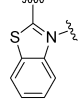
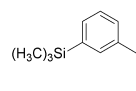
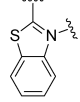
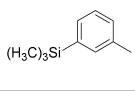
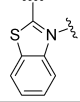
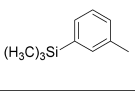
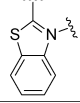
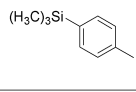
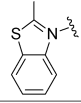
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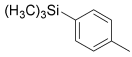
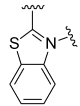
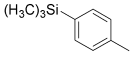
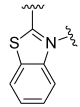
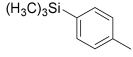
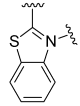

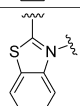

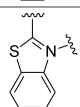

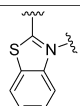

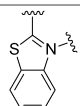
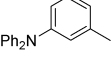
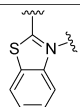
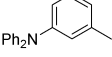
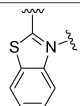
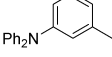
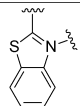
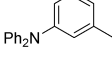
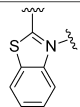
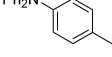
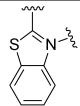
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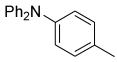
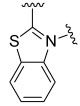
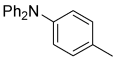
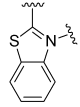
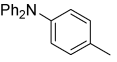
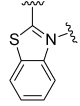
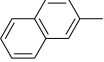
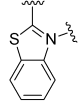
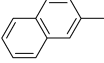
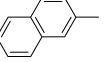
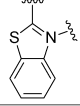
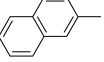
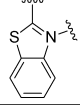

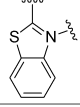

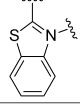

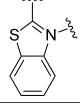

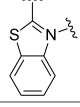
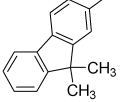
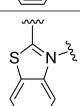
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27	H	H	H			O	Zn
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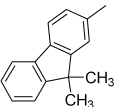
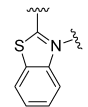
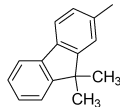
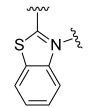
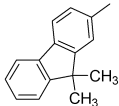
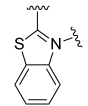

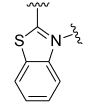

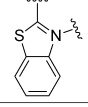

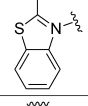

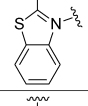
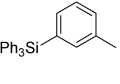
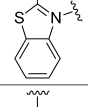
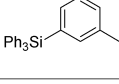
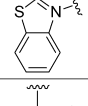
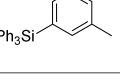
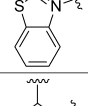
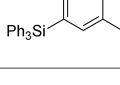
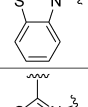
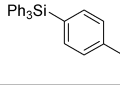
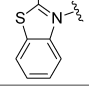
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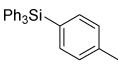
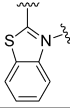
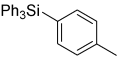
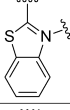
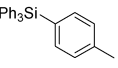
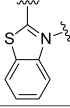
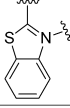
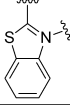
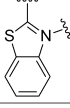
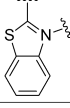
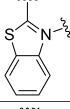
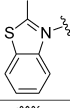
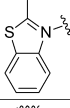
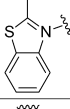
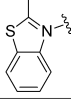
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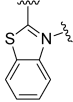
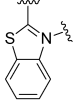
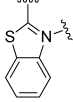
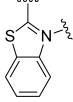
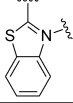
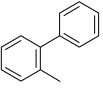
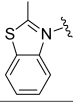
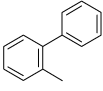
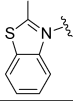
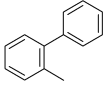
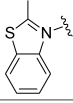
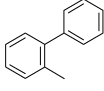
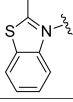
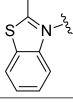
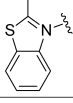

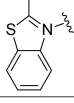
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
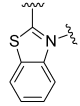

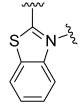

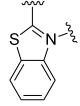

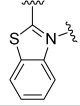

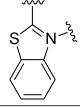
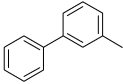
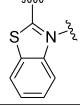
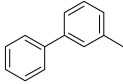
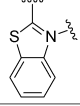
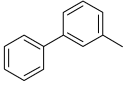
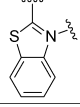
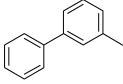
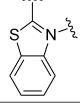
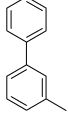
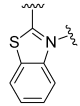
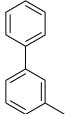
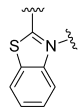
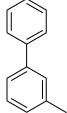
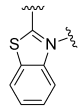
70		H	H	H		O	Zn
71	H	H		H		O	Zn
72	H	H	H			O	Zn
73	H	H		H		O	Zn
74	H		H	H		O	Zn
75	H	H	H			O	Zn
76		H	H	H		O	Zn
77		H	H	H		O	Zn
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79	H	H		H		O	Zn
80	H	H	H			O	Zn
81	H	H		H		O	Zn

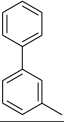
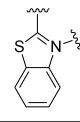
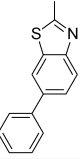
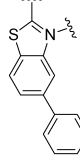
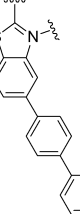
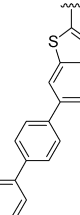
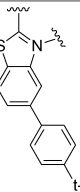
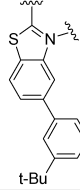
82	H		H	H		O	Zn
83	H	H	H			O	Zn
84		H	H	H		O	Zn
85	H		H	H		O	Zn
86	H	H		H		O	Zn
87		H	H	H		O	Zn
88	H	H	H			O	Zn
89	H	H		H		O	Zn
90	H	H	H			O	Zn
91	H		H	H		O	Zn
92		H	H	H		O	Zn
93	H		H	H		O	Zn

94	H	H		H		O	Zn
95		H	H	H		O	Zn
96	H	H	H			O	Zn
97	H		H	H		O	Zn
98	H	H		H		O	Zn
99		H	H	H		O	Zn
100	H	H	H			O	Zn
101	H	H		H		O	Zn
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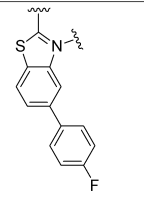
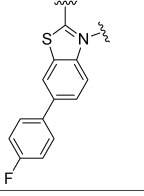
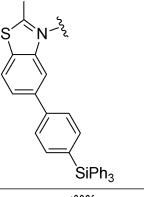
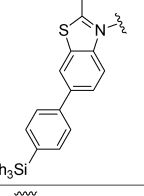
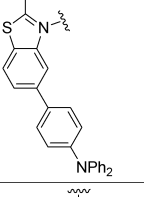
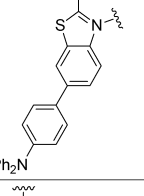
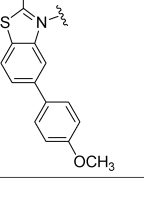
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108	H	H	H			O	Zn
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110	H	-CH <sub>3</sub>	H	H		O	Zn
111	H	H	H	-CH <sub>3</sub>		O	Zn
112	-CH <sub>3</sub>	H	H	H		O	Zn
113	H	-CH <sub>3</sub>	H	-CH <sub>3</sub>		O	Zn
114	-CH <sub>3</sub>	H	-CH <sub>3</sub>	H		O	Zn
115	H	-CH <sub>3</sub>	-CH <sub>3</sub>	H		O	Zn
116	H	H	-CH <sub>3</sub>	-CH <sub>3</sub>		O	Zn
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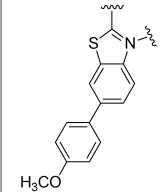
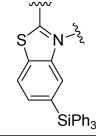
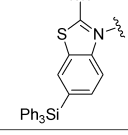
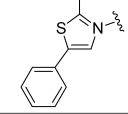

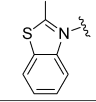

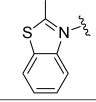

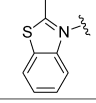

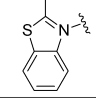

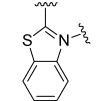

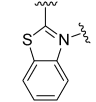

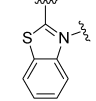
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119	-C(CH <sub>3</sub> ) <sub>3</sub>	H	H	H		O	Zn
120	H	-C(CH <sub>3</sub> ) <sub>3</sub>	H	H		O	Zn
121	H	H	-C(CH <sub>3</sub> ) <sub>3</sub>	H		O	Zn
122	H	H	H	-C(CH <sub>3</sub> ) <sub>3</sub>		O	Zn
123		H	H	H		O	Zn
124	H	H		H		O	Zn
125	H	H	H			O	Zn
126	H		H	H		O	Zn
127	H	-C(CH <sub>3</sub> ) <sub>3</sub>	H	-CH <sub>3</sub>		O	Zn
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129	H		H	H		O	Zn


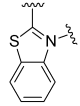
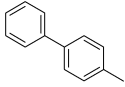
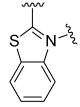
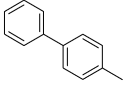
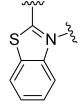
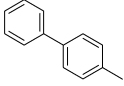
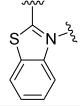
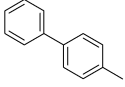
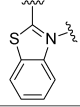
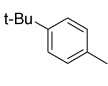
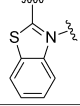
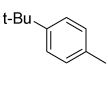
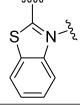
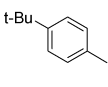
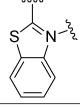
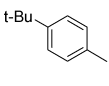
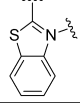

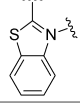

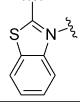

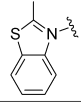
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135		H	H	H		O	Zn
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
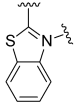

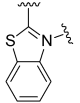

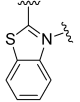

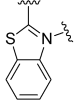

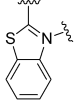

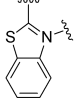

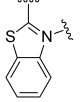

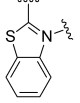

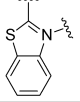

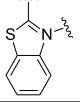

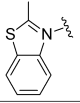

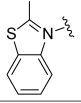
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
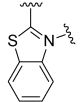

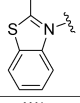

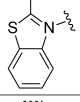

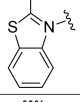

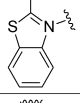

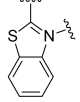

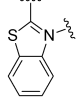

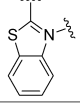

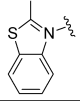
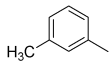
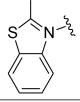
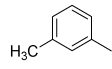
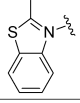
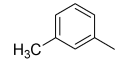
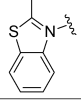
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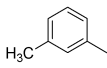
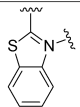
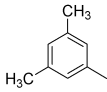
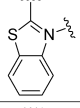
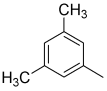
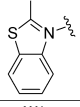
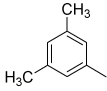
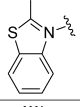
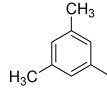
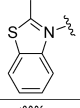
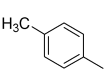
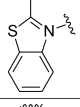
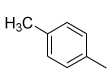
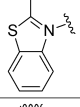
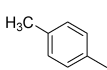
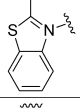
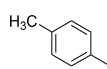
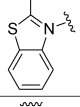
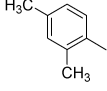
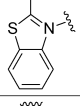
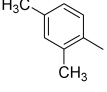
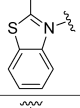
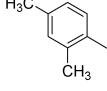
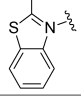
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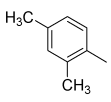
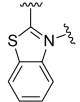
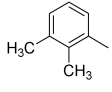

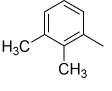

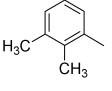

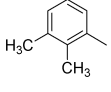









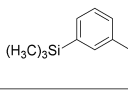

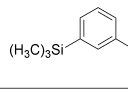

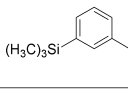

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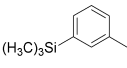
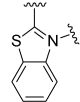
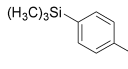
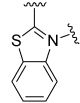
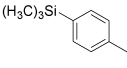
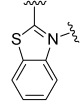
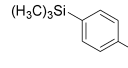
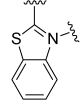
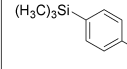
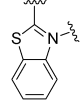

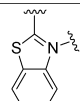

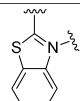

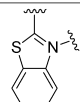

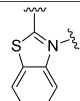
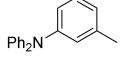
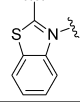
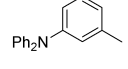
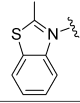
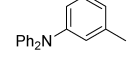
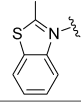
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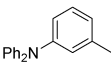
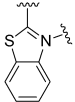
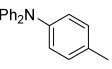
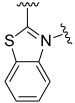
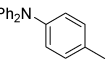
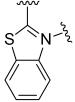
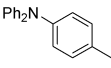
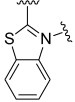
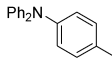
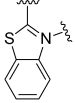
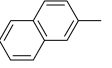
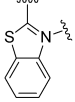
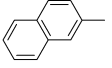
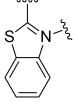
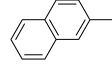
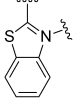
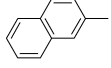
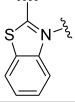
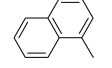
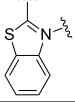
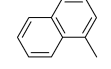
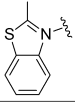
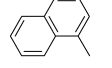
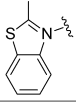
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
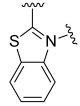
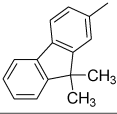
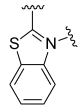
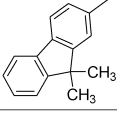
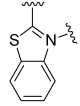
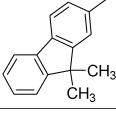
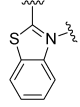
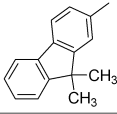
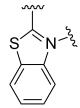

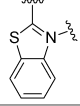

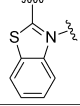

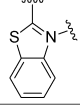

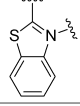
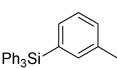
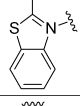
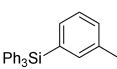
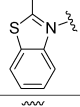
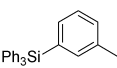
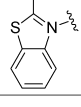
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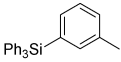
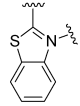
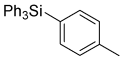
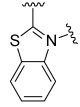
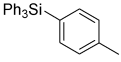
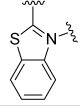
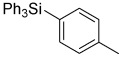
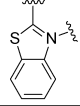
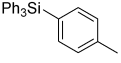
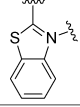
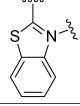
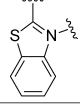
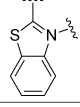
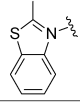
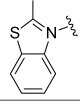
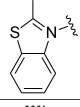
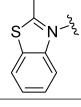
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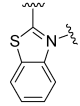
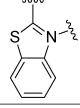
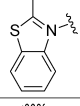
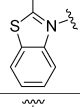
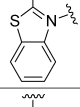
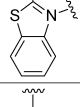
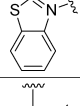
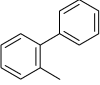
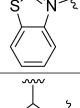
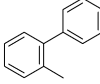
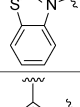
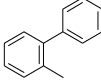
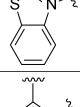
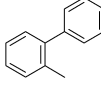
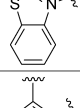
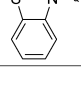
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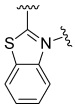

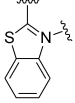

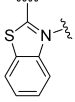

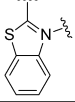

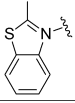

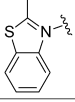

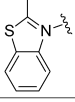
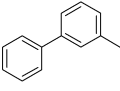
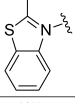
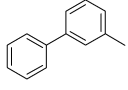
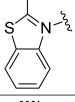
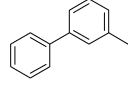
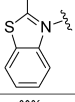
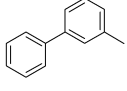
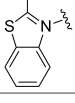
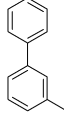
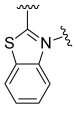
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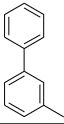
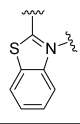
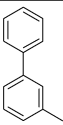
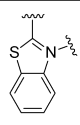
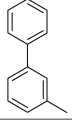
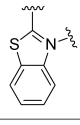
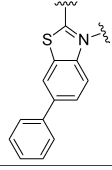
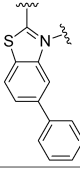
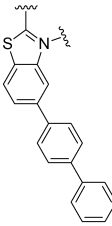
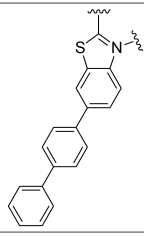
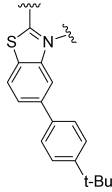
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244	H		H	H		S	Zn
245	H	H		H		S	Zn
246		H	H	H		S	Zn
247	H	H	H			S	Zn
248	H	H		H		S	Zn
249	H	H	H			S	Zn
250	H		H	H		S	Zn

251		H	H	H		S	Zn
252	H		H	H		S	Zn
253	H	H		H		S	Zn
254		H	H	H		S	Zn
255	H	H	H			S	Zn
256	H		H	H		S	Zn
257	H	H		H		S	Zn
258		H	H	H		S	Zn
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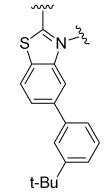
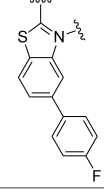
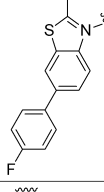
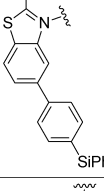
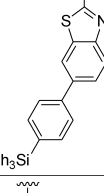
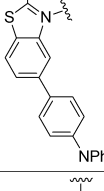
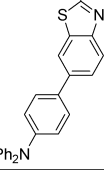
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268	H	H	-CH <sub>3</sub>	H		S	Zn
269	H	-CH <sub>3</sub>	H	H		S	Zn
270	H	H	H	-CH <sub>3</sub>		S	Zn
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272	H	-CH <sub>3</sub>	H	-CH <sub>3</sub>		S	Zn
273	-CH <sub>3</sub>	H	-CH <sub>3</sub>	H		S	Zn
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275	H	H	-CH <sub>3</sub>	-CH <sub>3</sub>		S	Zn
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277	-CH <sub>3</sub>	H	H	-CH <sub>3</sub>		S	Zn
278	-C(CH <sub>3</sub> ) <sub>3</sub>	H	H	H		S	Zn
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280	H	H	-C(CH <sub>3</sub> ) <sub>3</sub>	H		S	Zn
281	H	H	H	-C(CH <sub>3</sub> ) <sub>3</sub>		S	Zn
282		H	H	H		S	Zn
283	H	H		H		S	Zn
284	H	H	H			S	Zn
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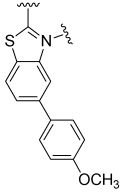
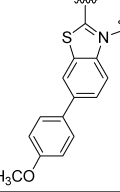
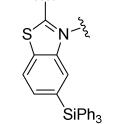
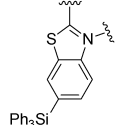
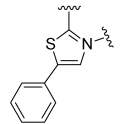
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290	H		H	H		S	Zn
291	H	H		H		S	Zn
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293	H	-CH <sub>3</sub>	H			S	Zn
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295	H		H	H		S	Zn
296	H	H		H		S	Zn
297	H	H	H			S	Zn
298	H	H		H		S	Zn

299	H		H	H		S	Zn
300	H	H	H			S	Zn
301		H	H	H		S	Zn
302	H	H	H	H		S	Zn
303	H	H	H	H		S	Zn
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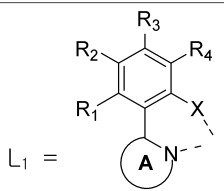



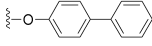


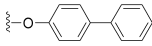
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

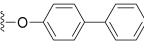


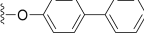


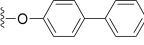


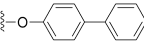


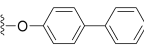


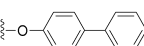


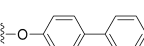


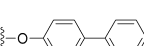


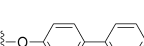


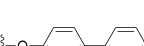












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

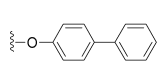


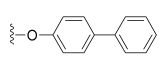


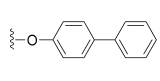


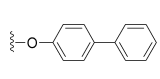


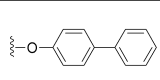


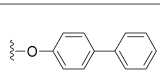


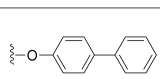


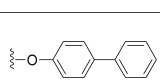


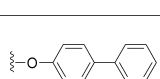


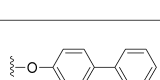


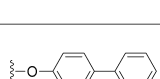


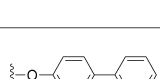





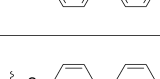
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

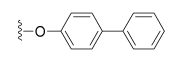


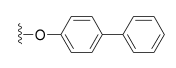


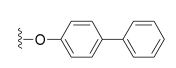


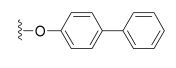


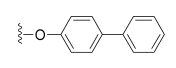


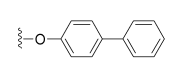


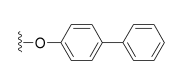


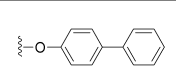


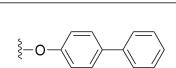


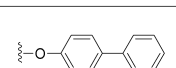


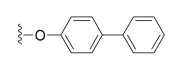


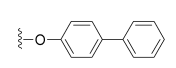


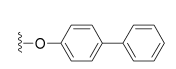


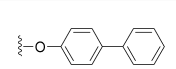
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

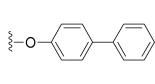


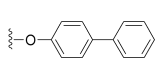


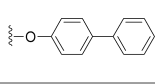


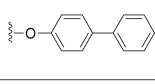
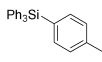

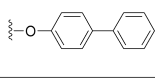
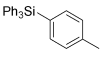

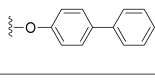
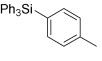

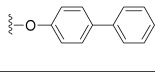
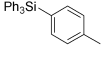

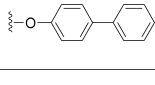


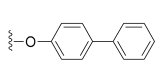


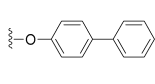


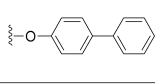


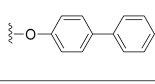



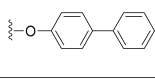


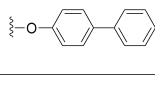
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
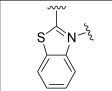
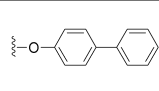

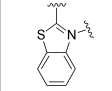
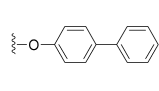

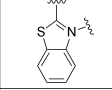
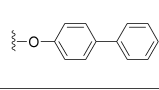

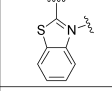
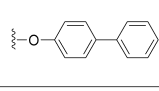

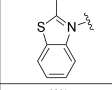
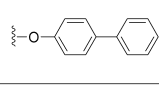

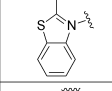
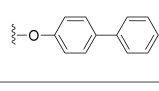
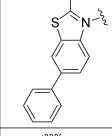
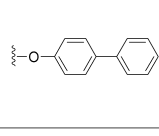
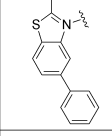
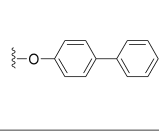
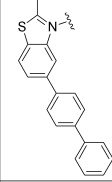
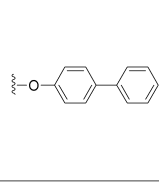
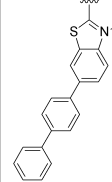
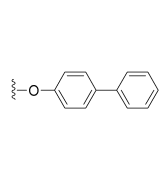
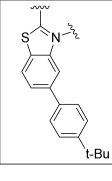
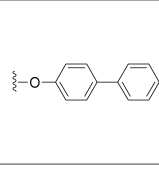
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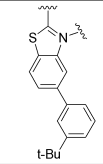
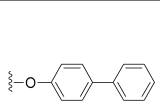
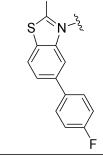
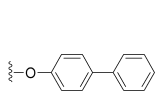
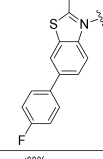
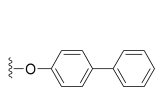
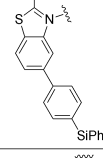
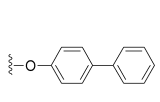
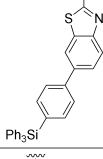
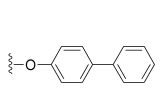
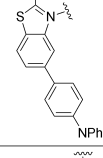
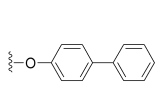
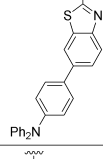
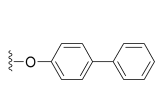
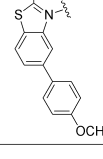
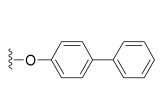
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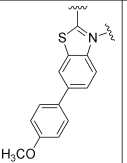
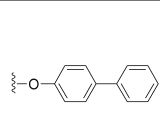
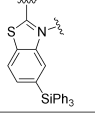
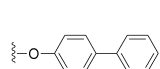
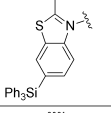
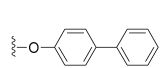

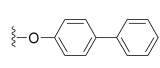
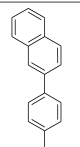
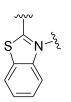
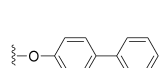
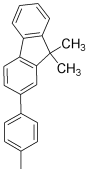
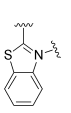
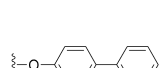
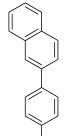
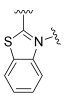
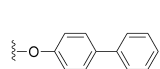
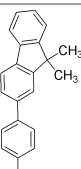
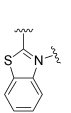
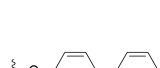


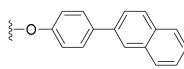


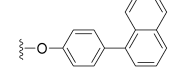
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

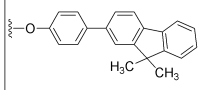


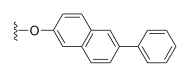


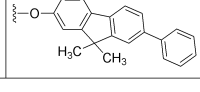
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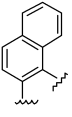
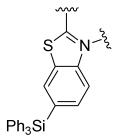

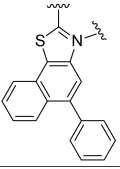
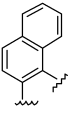
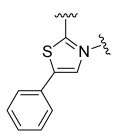

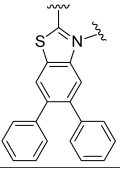
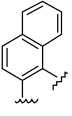
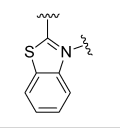

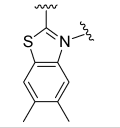
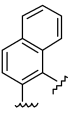
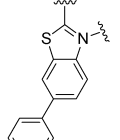

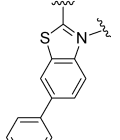
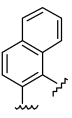
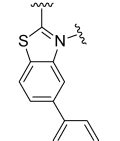

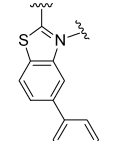
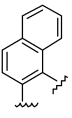
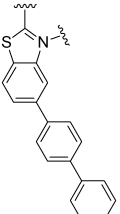

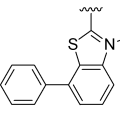
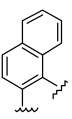
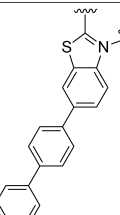

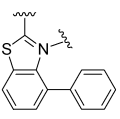
[표 3]

L <sup>1</sup> L <sup>1</sup> M									
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410			O	Zn	470			S	Zn
411			O	Zn	471			S	Zn

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414			O	Zn	474			S	Zn
415			O	Zn	475			S	Zn
416			O	Zn	476			S	Zn
417			O	Zn	477			S	Zn

418			O	Zn	478			S	Zn
419			O	Zn	479			S	Zn
420			O	Zn	480			S	Zn
421			O	Zn	481			O	Zn
422			O	Zn	482			O	Zn
423			O	Zn	483			O	Zn
424			O	Zn	484			O	Zn

425			O	Zn	485			O	Zn
426			O	Zn	486			O	Zn
427			S	Zn	487			O	Zn
428			S	Zn	488			O	Zn
429			S	Zn	489			O	Zn
430			S	Zn	490			O	Zn
431			S	Zn	491			O	Zn

432			S	Zn	492			O	Zn
433			S	Zn	493			O	Zn
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435			S	Zn	495			O	Zn
436			S	Zn	496			O	Zn
437			S	Zn	497			O	Zn
438			S	Zn	498			O	Zn

439			S	Zn	499			O	Zn
440			S	Zn	500			O	Zn
441			S	Zn	501			O	Zn
442			S	Zn	502			O	Zn
443			S	Zn	503			O	Zn
444			S	Zn	504			O	Zn
445			O	Zn	505			O	Be
446			O	Zn	506			O	Be

447			O	Zn	507			O	Be
448			O	Zn	508			O	Be
449			O	Zn	509			O	Be
450			O	Zn	510			O	Be
451			O	Zn	511			O	Be
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459			O	Zn	519			O	Be

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462			O	Zn	522			O	Be
463			S	Zn	523			O	Be
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465			S	Zn	525			O	Be
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467			S	Zn	527			O	Be

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468			S	Zn	528			O	Be
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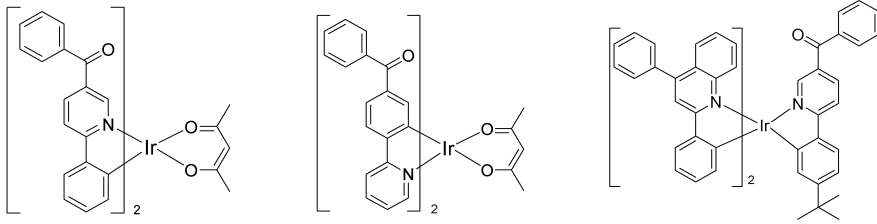
<129> 또한 본 발명은 유기 태양 전지를 제공하며, 본 발명에 따른 유기 태양 전지는 상기 화학식 1의 전기 발광 화합물을 하나 이상 포함하는 것을 특징으로 한다.

<130> 본 발명은 또한 전기 발광 소자를 제공하며, 본 발명에 따른 전기 발광 소자는 제1전극; 제2전극; 및 상기 제1전극 및 제2전극 사이에 개재되는 1층 이상의 유기물층으로 이루어진 전기 발광 소자에 있어서, 상기 유기물층은 상기 화학식 1로 표시되는 화합물을 하나 이상 포함하는 것을 특징으로 한다.

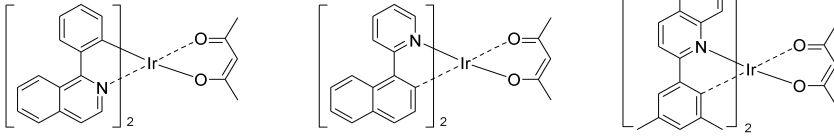
<131> 본 발명에 따른 전기 발광 소자는 상기 유기물층이 발광층을 포함하며, 상기 발광층은 상기 화학식 1로 표시되는 하나 이상의 화합물을 발광호스트로 2 내지 30 중량% 사용하여 하나 이상의 발광 도판트를 포함하는 것을 특



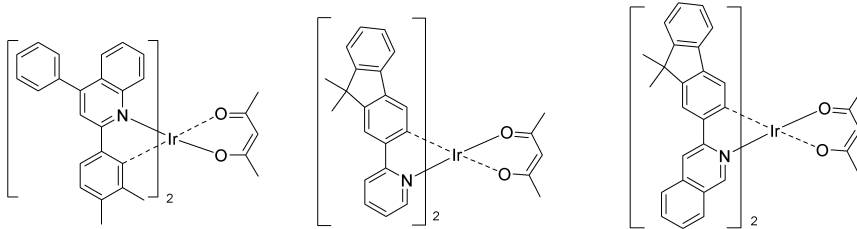
<145> 상기 화학식 2의 화합물은 구체적으로 하기 구조의 화합물로 예시될 수 있으나 이를 한정하는 것은 아니다.



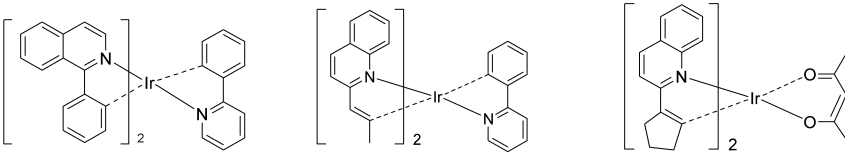
<146>



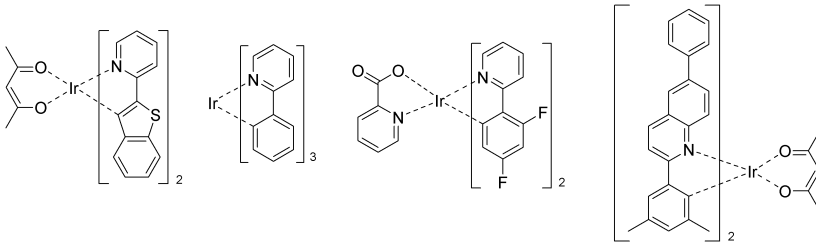
<147>



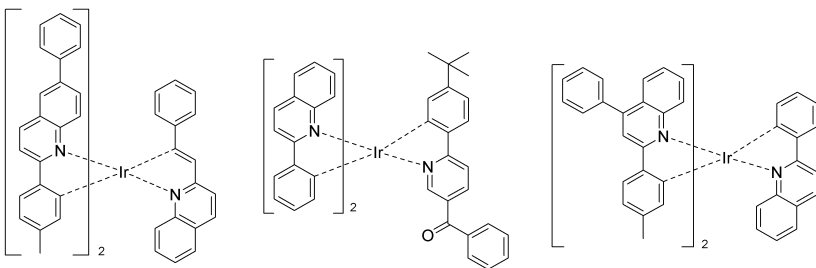
<148>



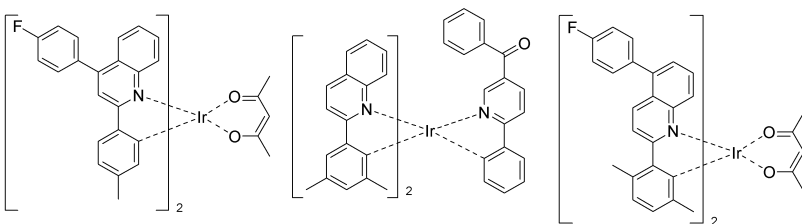
<149>



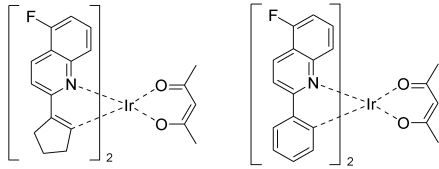
<150>



<151>



<152>



<153>

<154>

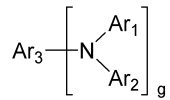
상기 발광층의 의미는 발광이 이루어지는 층으로서 단일 층일 수 있으며, 또한 2개 이상의 층이 적층된 복수의 층일 수 있다. 본 발명의 구성에서의 호스트-도판트를 혼합하여 사용하는 경우, 본 발명의 발광 호스트에 의한 발광 효율의 현저한 개선을 확인할 수 있었다. 이는 기존의 다른 호스트 재료에 비하여 정공, 전자에 대한 전도성이 매우 뛰어나며, 물질 안정성을 매우 우수하여 발광효율 뿐만 아니라, 수명도 현저히 개선시키는 특성을 보여 주고 있다.

<155>

본 발명의 전기 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 3의 화합물이 있으나, 이에 한정되는 것을 아니다.

<156>

[화학식 3]



<157>

<158>

[상기 화학식 3에서, Ar<sub>1</sub> 및 Ar<sub>2</sub>은 서로 독립적으로 (C1-C60)알킬, (C6-C60)아릴, (C4-C60)헤테로아릴, (C6-C60)아릴아미노, (C1-C60)알킬아미노, 모폴리노 또는 티오모폴리노, N, 0 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬이거나, Ar<sub>1</sub> 및 Ar<sub>2</sub>은 융합고리를 포함하거나 포함하지 않는 (C<sub>3</sub>-C<sub>60</sub>)알킬렌 또는 (C<sub>3</sub>-C<sub>60</sub>)알케닐렌으로 연결되어 치환족 고리 및 단일환 또는 다환의 방향족 고리를 형성할 수 있고, 상기 Ar<sub>1</sub> 및 Ar<sub>2</sub>의 아릴, 헤테로아릴, 아릴아미노 또는 헤테로시클로알킬은 할로젠, (C1-C60)알킬, (C2-C60)알케닐, (C2-C60)알키닐, (C6-C60)아릴, (C4-C60)헤테로아릴, N, 0 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, (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, 카르복실산, 나이트로 및 하이드록시로부터 선택된 하나 이상이 더 치환될 수 있고;

<159>

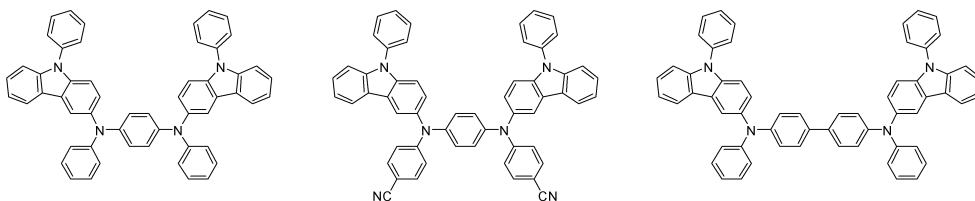
Ar<sub>3</sub>은 (C6-C60)아릴, (C5-C60)헤테로아릴 또는 (C6-C60)아릴아미노이고, 상기 Ar<sub>3</sub>의 아릴, 헤테로아릴 또는 아릴아미노는 할로젠, (C1-C60)알킬, (C6-C60)아릴, (C4-C60)헤테로아릴, N, 0 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴, 트리(C6-C60)아릴실릴, 아다만틸, (C7-C60)바이시클로알킬, (C2-C60)알케닐, (C2-C60)알키닐, (C1-C60)알콕시기, 시아노, (C1-C60)알킬아미노, (C6-C60)아릴아미노, (C6-C60)아르(C1-C60)알킬, (C6-C60)아릴옥시, (C6-C60)아릴티오, (C1-C60)알콕시카보닐, 카르복실산, 나이트로 및 하이드록시로부터 선택된 하나 이상이 더 치환될 수 있고;

<160>

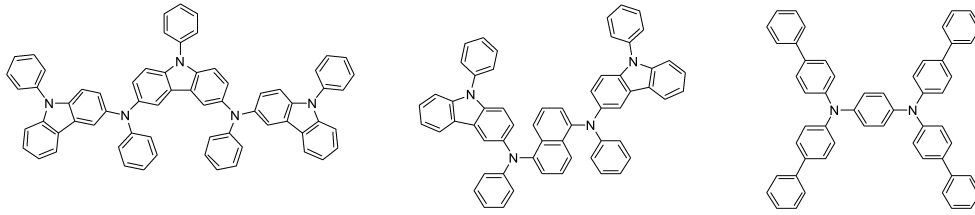
g는 1 내지 4의 정수이다.]

<161>

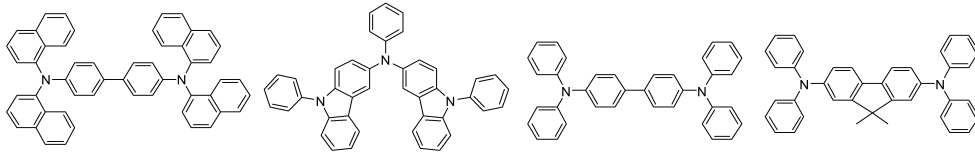
상기 아릴아민계 화합물 또는 스티릴아릴아민계 화합물은 보다 구체적으로 하기의 화합물로서 예시될 수 있으나, 하기 화합물로 한정되는 것은 아니다.



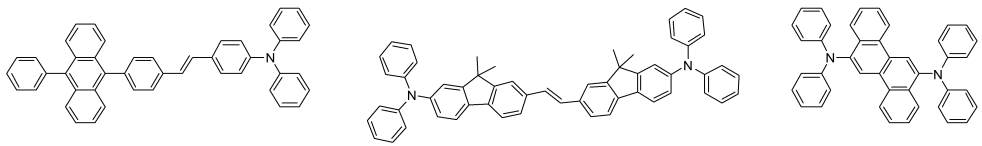
<162>



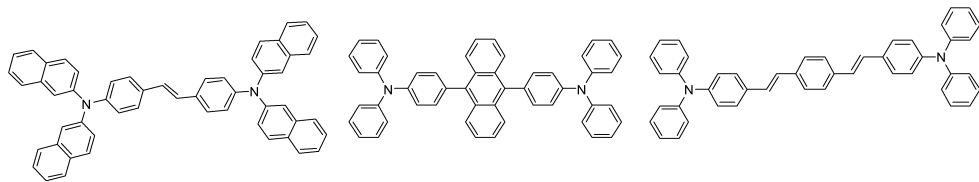
<163>



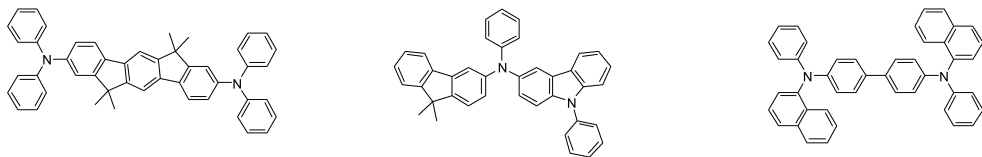
<164>



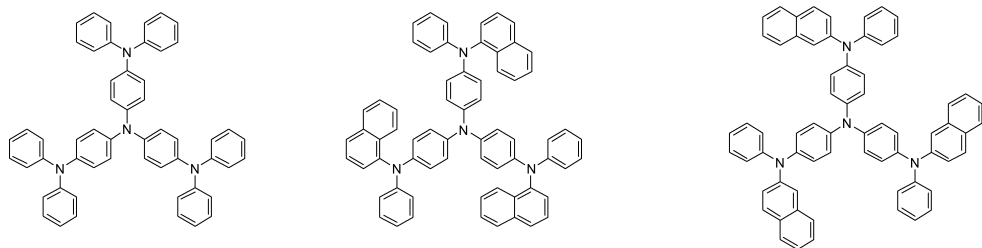
<165>



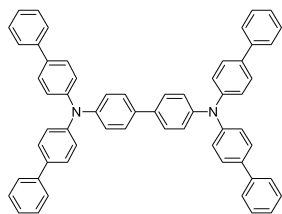
<166>



<167>



<168>



<169>

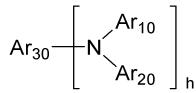
<170> 또한, 본 발명의 전기 발광 소자에 있어서, 발광층에 상기 화학식 1의 유기 발광 화합물 이외에 1족, 2족, 4주기, 5주기 전이금속, 란타넘계열금속 및 d-전이원소의 유기금속으로 이루어진 군으로부터 선택되는 하나 이상의 금속을 더 포함할 수도 있고, 상기 유기물층은 발광층 이외에 전하생성층을 동시에 포함할 수 있다.

<171> 본 발명의 화학식 1을 포함하는 유기 전기 발광 소자를 서브픽셀로 하고, 아릴아민계화합물 및 스티아릴아민계 화합물로 이루어진 군으로부터 선택된 하나이상의 화합물을 포함하는 서브픽셀 하나 이상을 동시에 병렬로 패터닝한 독립발광방식의 픽셀구조를 가진 유기 전기 발광 소자를 구현할 수도 있다.

<172> 또한, 상기 발광층에 560nm이하의 파장을 발광피크로 갖는 유기화합물 또는 유기금속화합물을 동시에 포함할 수

있으며, 하기 화학식 4 내지 화학식 9로 예시될 수 있으나 이에 한정되는 것은 아니다.

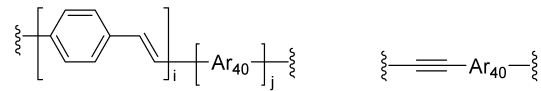
<173> [화학식 4]



<174> [상기 화학식 4에서, Ar<sub>10</sub> 및 Ar<sub>20</sub>은 서로 독립적으로 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, 카르복실산, 나이트로 또는 하이드록시이거나 Ar<sub>10</sub> 및 Ar<sub>20</sub>은 인접한 치환체와 융합고리를 포함하거나 포함하지 않는 (C<sub>3</sub>-C<sub>60</sub>)알킬렌 또는 (C<sub>3</sub>-C<sub>60</sub>)알케닐렌으로 연결되어 지환족 고리 및 단일환 또는 다환의 방향족 고리를 형성할 수 있고;

<176> 상기 Ar<sub>10</sub> 및 Ar<sub>20</sub>의 알킬, 알케닐, 알키닐, 시클로알킬, 헤테로시클로알킬, 아릴, 헤테로아릴, 아릴실릴, 알킬실릴, 알킬아미노, 아릴아미노 및 인접한 치환체와 융합고리를 포함하거나 포함하지 않는 (C<sub>3</sub>-C<sub>60</sub>)알킬렌 또는 (C<sub>3</sub>-C<sub>60</sub>)알케닐렌으로 연결되어 지환족 고리 및 단일환 또는 다환의 방향족 고리는 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, 카르복실산, 나이트로 또는 하이드록시로부터 선택된 하나 이상이 더 치환될 수 있고,

<177> Ar<sub>30</sub>은 (C6-C60)아릴아미노, (C6-C60)아릴렌, (C4-C60)헤테로아릴렌 또는 하기 구조의 아릴렌이고,



<179> Ar<sub>40</sub>은 (C6-C60)아릴렌 또는 (C4-C60)헤테로아릴렌이고,

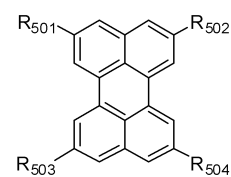
<180> 상기 Ar<sub>30</sub> 및 Ar<sub>40</sub>의 아릴렌, 헤테로아릴렌 및 아릴아미노는 할로젠, (C1-C60)알킬, (C6-C60)아릴, (C4-C60)헤테로아릴, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C3-C60)시클로알킬, 트리(C1-C60)알킬실릴, 디(C1-C60)알킬(C6-C60)아릴실릴, 트리(C6-C60)아릴실릴, 아다만틸, (C7-C60)바이시클로알킬, (C2-C60)알케닐, (C2-C60)알키닐, (C1-C60)알콕시, 시아노, (C1-C60)알킬아미노, (C6-C60)아릴아미노, (C6-C60)아르(C1-C60)알킬, (C6-C60)아릴옥시, (C6-C60)아릴티오, (C1-C60)알콕시카보닐, 카르복실산, 나이트로, 하이드록시로 이루어진 군에서 선택되는 하나 이상의 치환기가 더 치환될 수 있고;

<181> h는 1 내지 4의 정수이고,

<182> i는 1 내지 4의 정수이고,

<183> j는 0 또는 1의 정수이다.]

<184> [화학식 5]

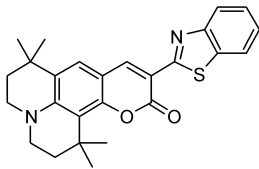


<186> [상기 화학식 5에서, R<sub>501</sub> 내지 R<sub>504</sub>는 서로 독립적으로 수소, 할로젠, (C1-C60)알킬, (C6-C60)아릴, (C4-C60)헤테

테로아릴, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C<sub>3</sub>-C<sub>60</sub>)시클로알킬, 트리(C<sub>1</sub>-C<sub>60</sub>)알킬실릴, 디(C<sub>1</sub>-C<sub>60</sub>)알킬(C<sub>6</sub>-C<sub>60</sub>)아릴실릴, 트리(C<sub>6</sub>-C<sub>60</sub>)아릴실릴, 아다만틸, (C<sub>7</sub>-C<sub>60</sub>)바이시클로알킬, (C<sub>2</sub>-C<sub>60</sub>)알케닐, (C<sub>2</sub>-C<sub>60</sub>)알키닐, (C<sub>1</sub>-C<sub>60</sub>)알콕시, 시아노, (C<sub>1</sub>-C<sub>60</sub>)알킬아미노, (C<sub>6</sub>-C<sub>60</sub>)아릴아미노, (C<sub>6</sub>-C<sub>60</sub>)아르(C<sub>1</sub>-C<sub>60</sub>)알킬, (C<sub>6</sub>-C<sub>60</sub>)아릴옥시, (C<sub>6</sub>-C<sub>60</sub>)아릴티오, (C<sub>1</sub>-C<sub>60</sub>)알콕시카보닐, 카르복실산, 나이트로 또는 하이드록시이거나 R<sub>501</sub> 내지 R<sub>504</sub>은 인접한 치환체와 융합고리를 포함하거나 포함하지 않는 (C<sub>3</sub>-C<sub>60</sub>)알킬렌 또는 (C<sub>3</sub>-C<sub>60</sub>)알케닐렌으로 연결되어 지환족 고리 및 단일환 또는 다환의 방향족 고리를 형성할 수 있고,

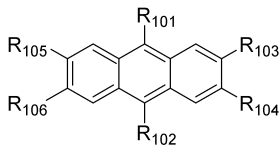
<187> 상기 R<sub>501</sub> 내지 R<sub>504</sub>의 알킬, 알케닐, 알키닐, 시클로알킬, 헤테로시클로알킬, 아릴, 헤테로아릴, 아릴실릴, 알킬실릴, 알킬아미노, 아릴아미노 및 인접한 치환체와 융합고리를 포함하거나 포함하지 않는 (C<sub>3</sub>-C<sub>60</sub>)알킬렌 또는 (C<sub>3</sub>-C<sub>60</sub>)알케닐렌으로 연결되어 지환족 고리 및 단일환 또는 다환의 방향족 고리는 할로젠, (C<sub>1</sub>-C<sub>60</sub>)알킬, (C<sub>6</sub>-C<sub>60</sub>)아릴, (C<sub>4</sub>-C<sub>60</sub>)헤테로아릴, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬, (C<sub>3</sub>-C<sub>60</sub>)시클로알킬, 트리(C<sub>1</sub>-C<sub>60</sub>)알킬실릴, 디(C<sub>1</sub>-C<sub>60</sub>)알킬(C<sub>6</sub>-C<sub>60</sub>)아릴실릴, 트리(C<sub>6</sub>-C<sub>60</sub>)아릴실릴, 아다만틸, (C<sub>7</sub>-C<sub>60</sub>)바이시클로알킬, (C<sub>2</sub>-C<sub>60</sub>)알케닐, (C<sub>2</sub>-C<sub>60</sub>)알키닐, (C<sub>1</sub>-C<sub>60</sub>)알콕시, 시아노, (C<sub>1</sub>-C<sub>60</sub>)알킬아미노, (C<sub>6</sub>-C<sub>60</sub>)아릴아미노, (C<sub>6</sub>-C<sub>60</sub>)아르(C<sub>1</sub>-C<sub>60</sub>)알킬, (C<sub>6</sub>-C<sub>60</sub>)아릴옥시, (C<sub>6</sub>-C<sub>60</sub>)아릴티오, (C<sub>1</sub>-C<sub>60</sub>)알콕시카보닐, 카르복실산, 나이트로 또는 하이드록시로부터 선택된 하나 이상이 더 치환될 수 있다.]

<188> [화학식 6]



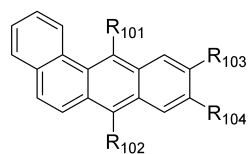
<189>

<190> [화학식 7]



<191>

<192> [화학식 8]

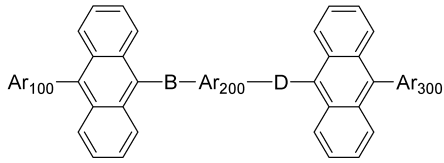


<193>

<194> [상기 화학식 7 및 8에서, R<sub>101</sub> 및 R<sub>102</sub>는 서로 독립적으로 (C<sub>6</sub>-C<sub>60</sub>)아릴, (C<sub>4</sub>-C<sub>60</sub>)헤테로아릴, N, O 및 S로부터 선택된 하나 이상을 포함하는 5원 내지 6원의 헤테로시클로알킬 또는 (C<sub>3</sub>-C<sub>60</sub>)시클로알킬이며, 상기 R<sub>101</sub> 및 R<sub>102</sub>의 아릴 또는 헤테로아릴은 (C<sub>1</sub>-C<sub>60</sub>)알킬, 할로(C<sub>1</sub>-C<sub>60</sub>)알킬, (C<sub>1</sub>-C<sub>60</sub>)알콕시, (C<sub>3</sub>-C<sub>60</sub>)시클로알킬, (C<sub>6</sub>-C<sub>60</sub>)아릴, (C<sub>4</sub>-C<sub>60</sub>)헤테로아릴, 할로젠, 시아노, 트리(C<sub>1</sub>-C<sub>60</sub>)알킬실릴, 디(C<sub>1</sub>-C<sub>60</sub>)알킬(C<sub>6</sub>-C<sub>60</sub>)아릴실릴 또는 트리(C<sub>6</sub>-C<sub>60</sub>)아릴실릴로 이루어지는 군에서 선택되는 하나 이상의 치환기가 더 치환될 수 있으며;

<195> R<sub>103</sub> 내지 R<sub>106</sub>는 수소, (C<sub>1</sub>-C<sub>60</sub>)알킬, (C<sub>1</sub>-C<sub>60</sub>)알콕시, 할로젠, (C<sub>4</sub>-C<sub>60</sub>)헤테로아릴, (C<sub>5</sub>-C<sub>60</sub>)시클로알킬 또는 (C<sub>6</sub>-C<sub>60</sub>)아릴이며, 상기 R<sub>103</sub> 내지 R<sub>106</sub>의 헤테로아릴, 시클로알킬 또는 아릴은 할로젠이 치환되거나 치환되지 않은 (C<sub>1</sub>-C<sub>60</sub>)알킬, (C<sub>1</sub>-C<sub>60</sub>)알콕시, (C<sub>3</sub>-C<sub>60</sub>)시클로알킬, 할로젠, 시아노, 트리(C<sub>1</sub>-C<sub>60</sub>)알킬실릴, 디(C<sub>1</sub>-C<sub>60</sub>)알킬(C<sub>6</sub>-C<sub>60</sub>)아릴실릴 또는 트리(C<sub>6</sub>-C<sub>60</sub>)아릴실릴로 이루어지는 군에서 선택되는 하나 이상의 치환기가 더 치환될 수 있다.]

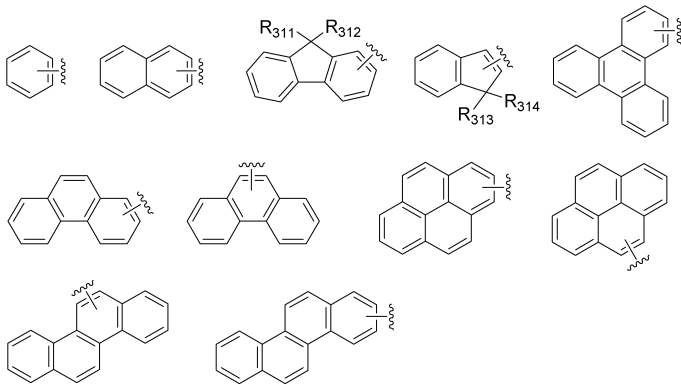
<196> [화학식 9]



<197>

<198> [화학식 9에서, B 및 D는 서로 독립적으로 화합결합이거나 (C1-C60)알킬, (C1-C60)알콕시, (C6-C60)아릴, (C4-C60)헤테로아릴 또는 할로겐으로부터 선택된 하나 이상이 치환되거나 치환되지 않은 (C6-C60)아릴렌이며, ;

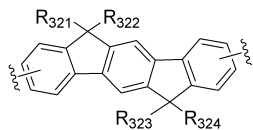
<199> Ar<sub>100</sub> 및 Ar<sub>300</sub>는 서로 독립적으로 하기 구조에서 선택되는 아릴 또는 (C4-C60)헤테로아릴이며, 상기 Ar<sub>100</sub> 및 Ar<sub>300</sub>의 아릴 또는 헤테로아릴은 (C1-C60)알킬, (C1-C60)알콕시, (C6-C60)아릴 또는 (C4-C60)헤테로아릴로부터 선택된 치환기가 하나이상 치환될 수 있고;



<200>

<201> R<sub>311</sub>, R<sub>312</sub>, R<sub>313</sub> 및 R<sub>314</sub>는 서로 독립적으로 수소, (C1-C60)알킬 또는 (C6-C60)아릴이거나, 인접한 치환체와 융합 고리를 포함하거나 포함하지 않는 (C<sub>3</sub>-C<sub>60</sub>)알킬렌 또는 (C<sub>3</sub>-C<sub>60</sub>)알케닐렌으로 연결되어 치환족 고리 및 단일환 또는 다환의 방향족 고리를 형성할 수 있으며,

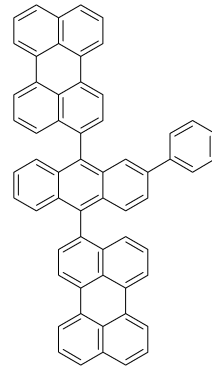
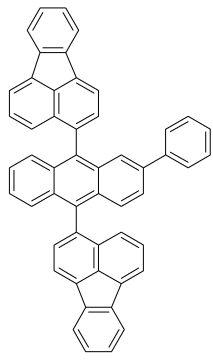
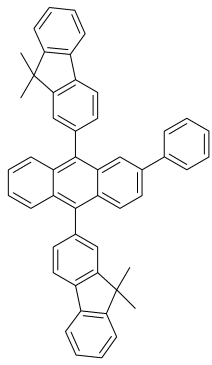
<202> Ar<sub>200</sub>는 (C6-C60)아릴렌 또는 (C4-C60)헤테로아릴렌이고, 바람직하게는 페닐렌, 나프틸렌, 안트릴렌, 플루오레닐렌, 페난트릴렌, 테트라세닐렌, 나프타세닐렌, 크라이세닐렌, 펜타세닐렌, 피레닐렌, 헤테로아릴렌 또는 하기 구조의 화합물로부터 선택되며, 상기 Ar<sub>200</sub>의 아릴렌 또는 헤테로아릴렌은 (C1-C60)알킬, (C1-C60)알콕시, (C6-C60)아릴, (C4-C60)헤테로아릴 또는 할로겐으로부터 선택된 하나 이상이 치환될 수 있으며;



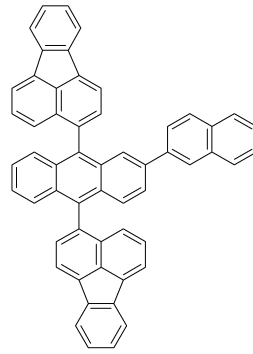
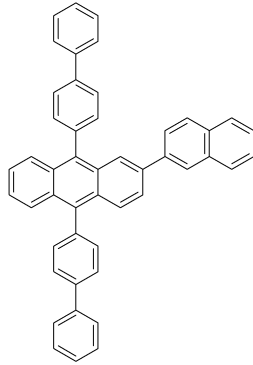
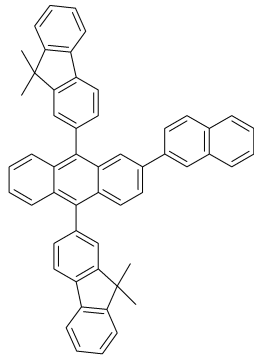
<203>

<204> R<sub>321</sub>, R<sub>322</sub>, R<sub>323</sub> 및 R<sub>324</sub>는 서로 독립적으로 수소, (C1-C60)알킬, (C1-C60)알콕시, (C6-C60)아릴, (C4-C60)헤테로아릴 또는 할로겐이거나, 인접한 치환체와 융합고리를 포함하거나 포함하지 않는 (C<sub>3</sub>-C<sub>60</sub>)알킬렌 또는 (C<sub>3</sub>-C<sub>60</sub>)알케닐렌으로 연결되어 치환족 고리 및 단일환 또는 다환의 방향족 고리를 형성할 수 있다.]

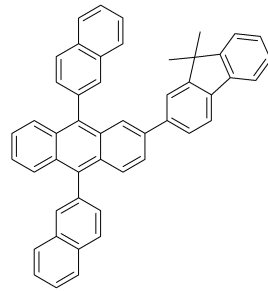
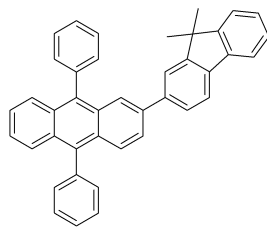
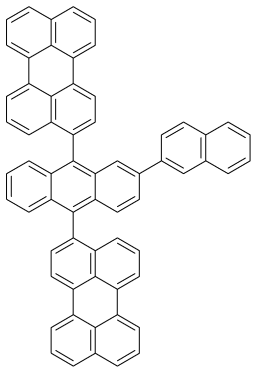
<205> 상기 560nm이하의 파장을 발광피크로 갖는 유기화합물 또는 유기금속화합물은 보다 구체적으로 하기의 화합물로서 예시될 수 있으나, 하기 화합물로 한정되는 것은 아니다.



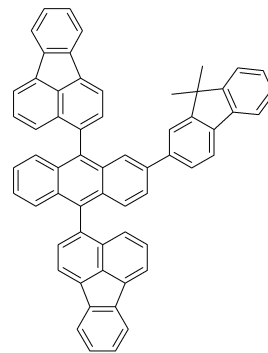
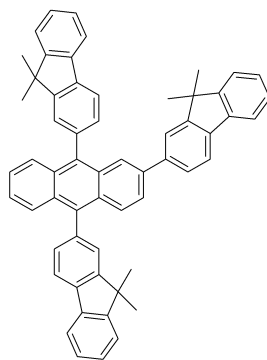
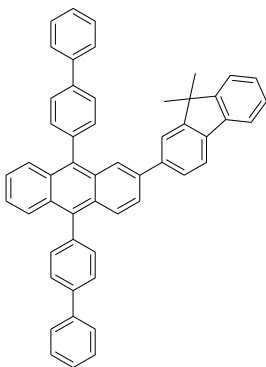
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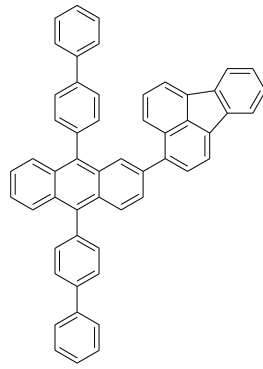
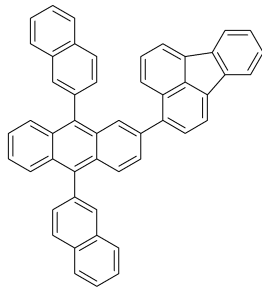
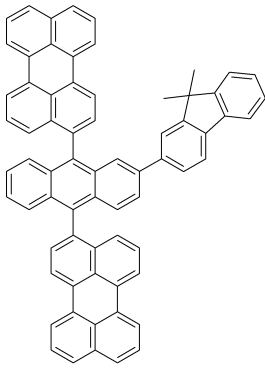
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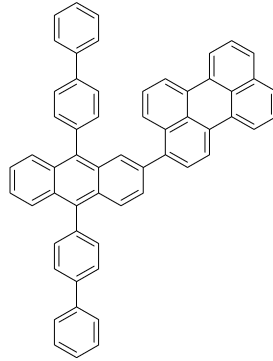
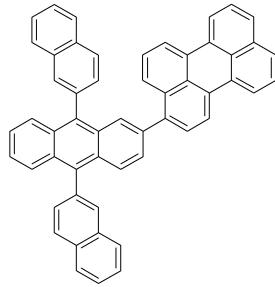
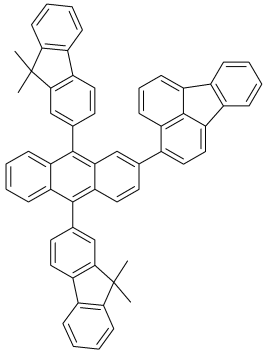
<208>



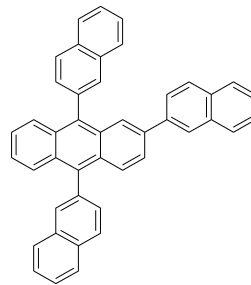
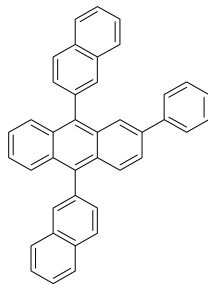
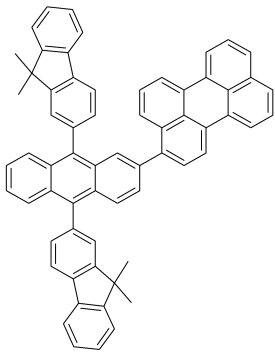
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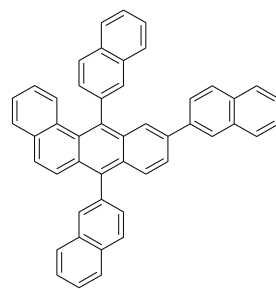
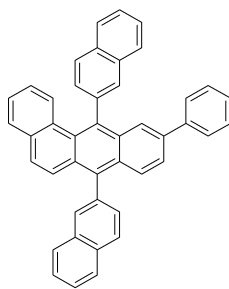
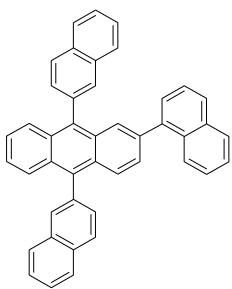
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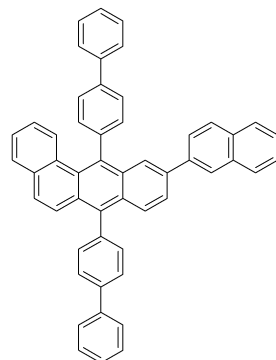
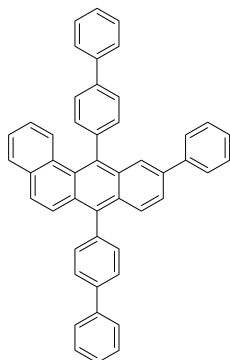
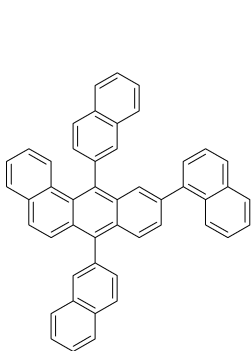
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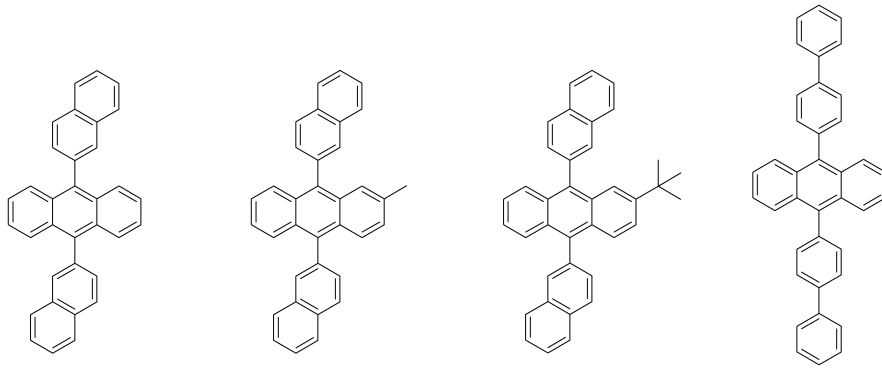
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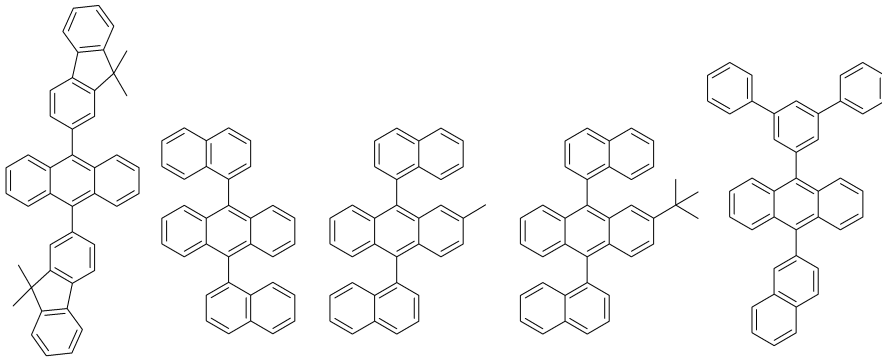
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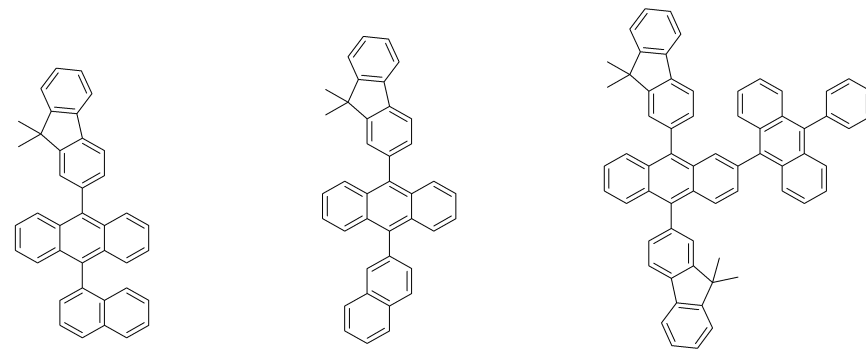
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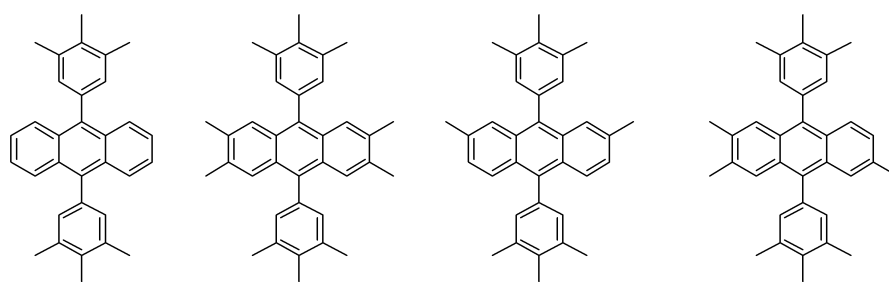
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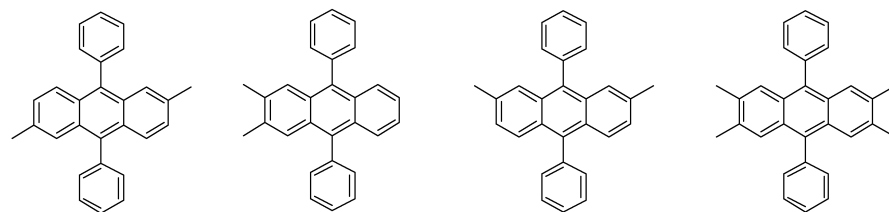
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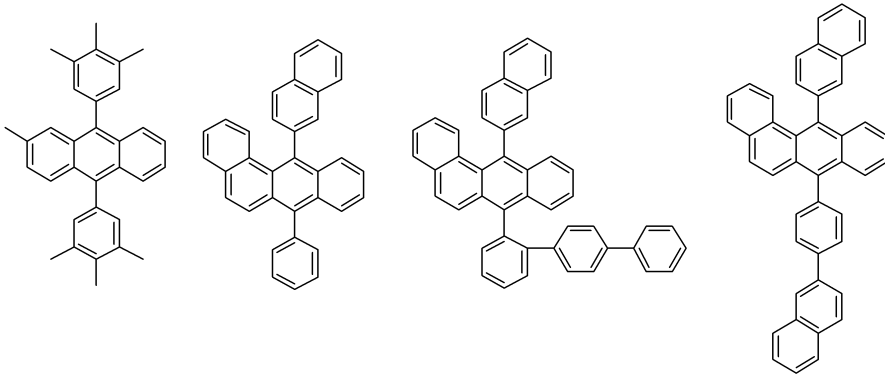
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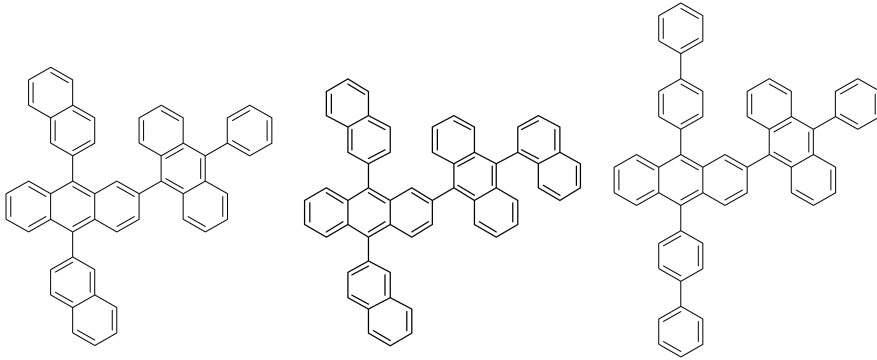
<218>



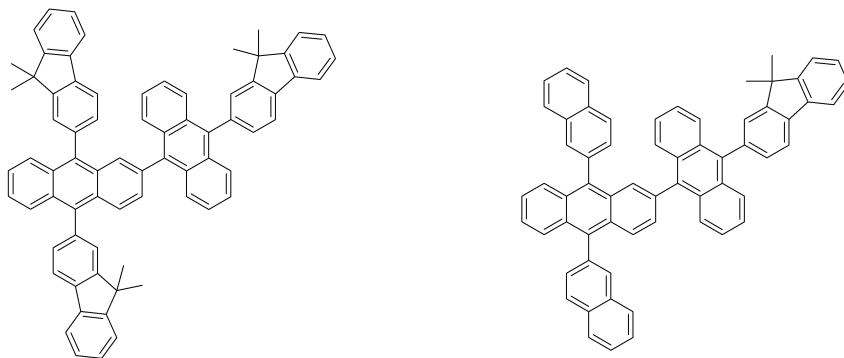
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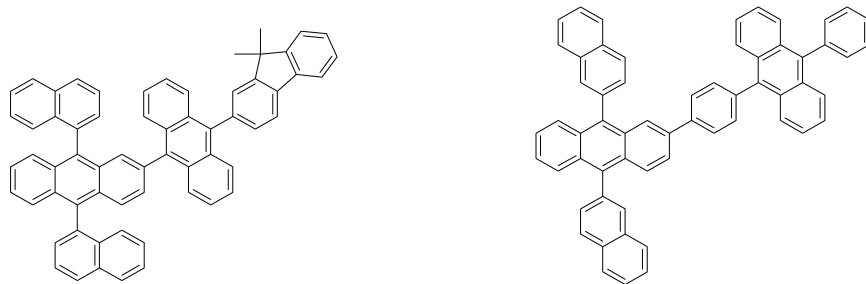
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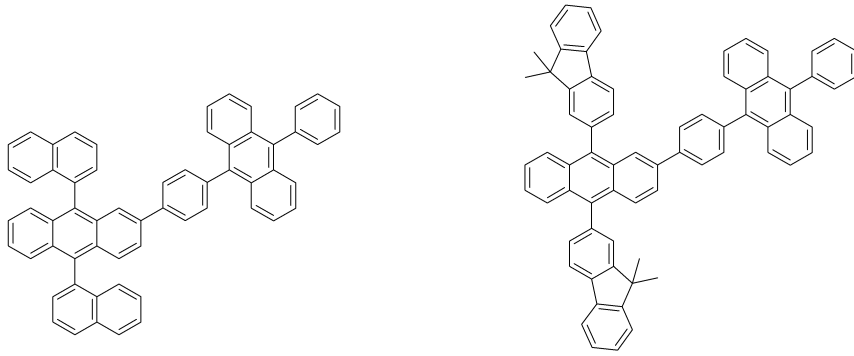
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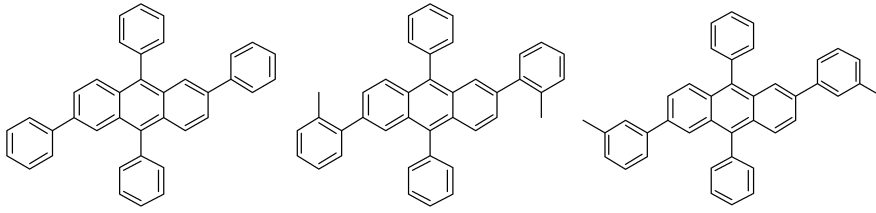
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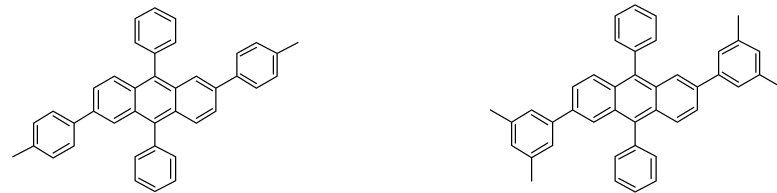
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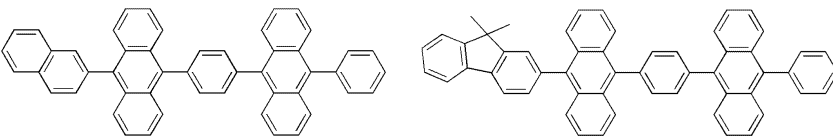
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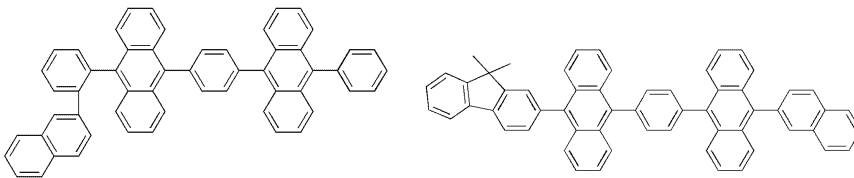
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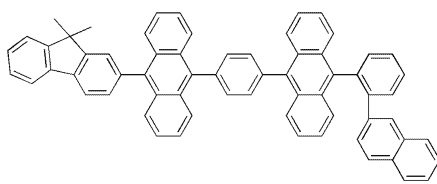
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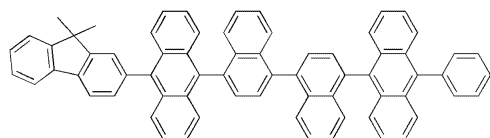
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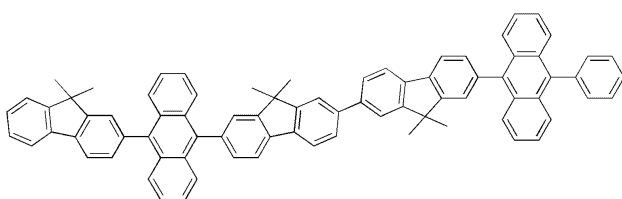
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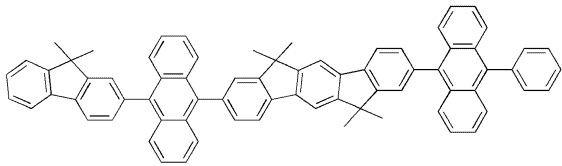
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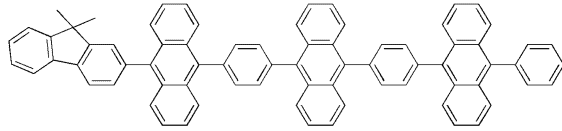
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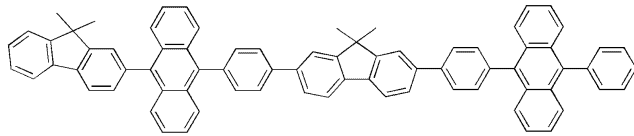
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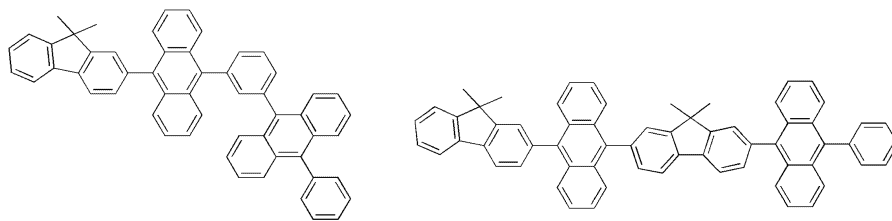
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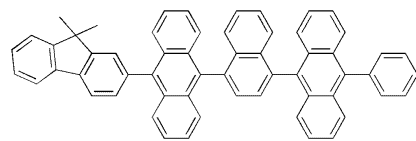
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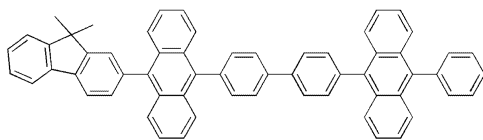
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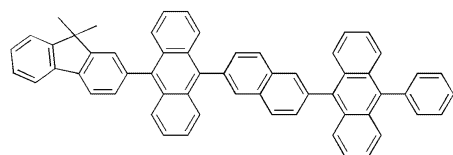
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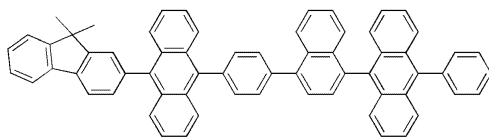
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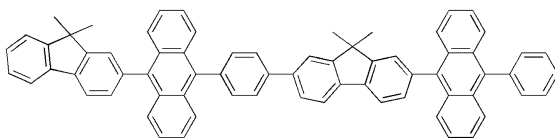
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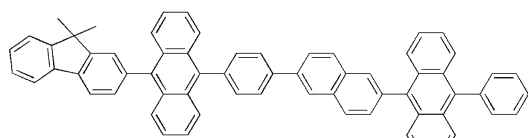
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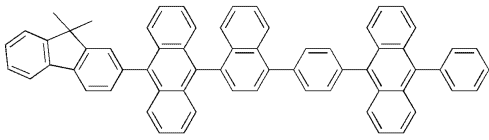
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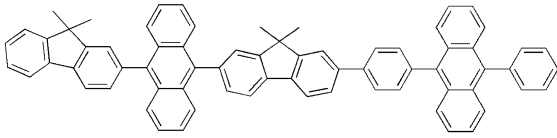
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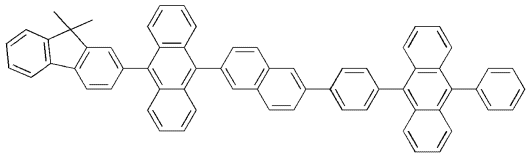
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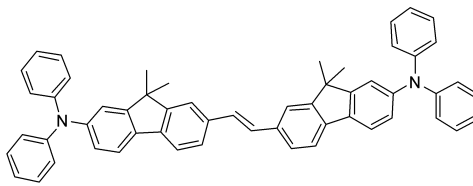
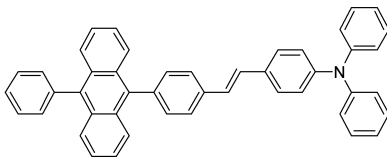
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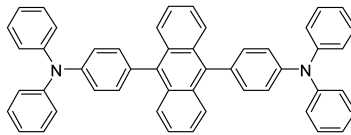
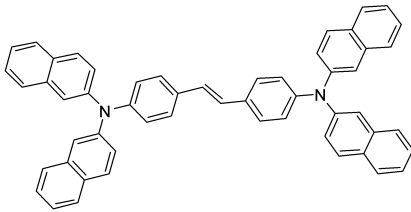
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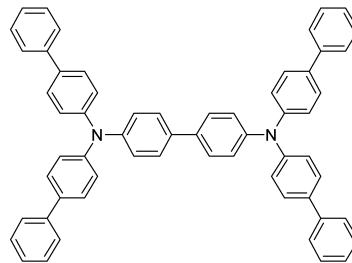
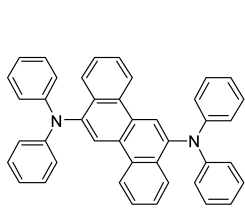
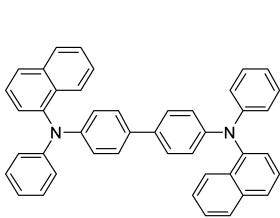
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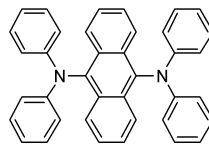
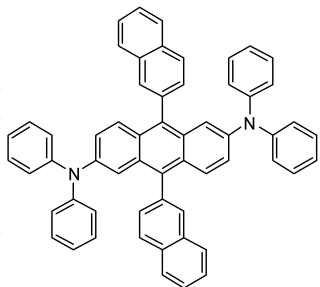
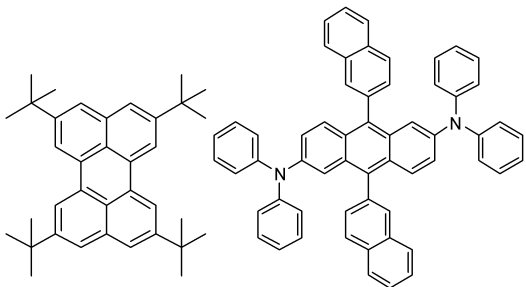
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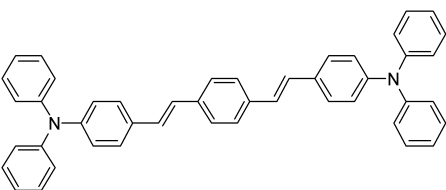
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<250> 본 발명의 전기 발광 소자에 있어서, 한 쌍의 전극의 적어도 한쪽의 내측표면에,

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

<251> 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.

<252> 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.

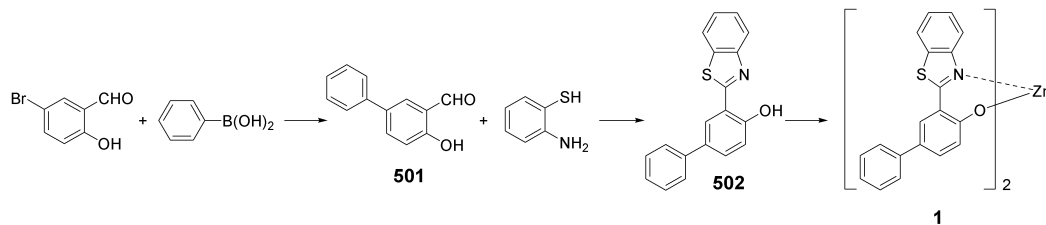
**효과**

<253> 본 발명에 따른 전기 발광 화합물은 OLED 소자에서 인광 발광 재료의 호스트 재료로 사용하면, 기존 호스트 재료에 비해 구동전압을 현저히 낮추고, 전류 효율을 높임으로써 전력효율을 상당히 개선할 수 있는 장점이 있다.

**발명의 실시를 위한 구체적인 내용**

<254> 이하, 본 발명을 제조에 및 실시예에 의거하여 본 발명에 따른 신규한 전기 발광 화합물, 이의 제조방법 및 소자의 발광특성을 예시하나, 하기의 실시예들은 본 발명에 대한 이해를 돕기 위한 것으로서, 본 발명의 범위가 하기의 실시예에 한정되는 것은 아니다.

<255> [제조예 1] 화합물 1의 제조



화합물 501의 제조

<258> 5-브로모-2-히드록시벤즈알데하이드(5-bromo-2-hydroxybenzaldehyde) (20.0 g, 99.5 mmol), 페닐 보론산 (13.4 g, 109.5 mmol), 테트라키스 팔라듐(0) 트리페닐포스핀( $Pd(PPh_3)_4$ ) (5.8 g, 5.0 mmol)를 디메틸에틸렌글리콜 (200 mL) 와 에탄올 (100 mL)에 녹인 다음 2M 탄산칼륨수용액 (132 mL)을 가하고 90°C에서 4시간 동안 환류 교반하였다. 반응이 완결되면 물 (100 mL)로 quenching하고 에틸아세테이트 (200 mL)로 추출, 감압 건조하였다. 이를 실리카겔 컬럼 크로마토그래피(n-Hexane : MC = 1:5)로 분리하여 화합물 501 (12.0 g, 61.0 mmol)을 얻었다.

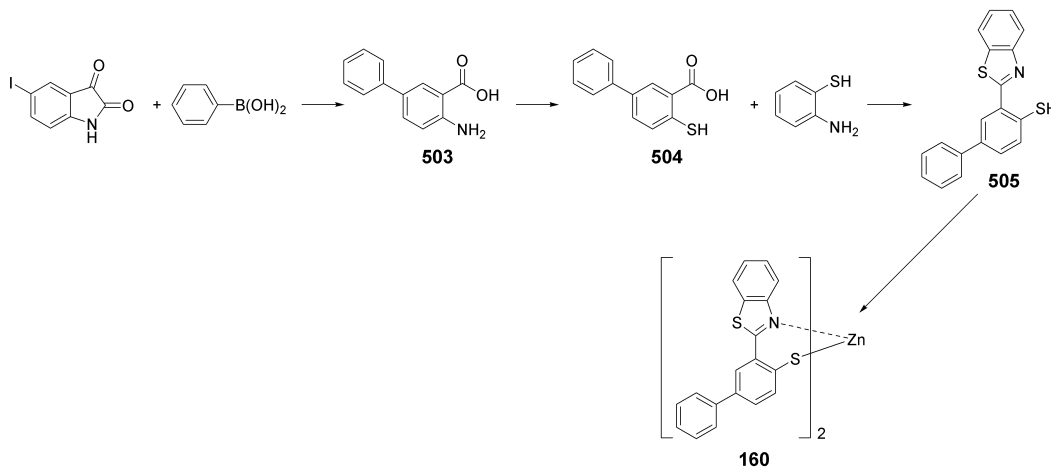
화합물 502의 제조

<261> 2-아미노벤젠싸이올(2-aminobenzenethiol) (3.8 g, 30.2 mmol), 화합물 501 (5.0 g, 25.2 mmol)을 1,4-다이옥산 (12 mL)에 녹이고 100°C에서 12시간 동안 가압 교반하였다. 반응이 완결되면 실온으로 식히고 디클로로메탄 (100 mL)와 물 (100 mL) 로 추출, 감압 건조하였다. 이를 실리카겔 컬럼 크로마토그래피(n-Hexane : MC = 3 : 1)로 분리하여 화합물 502 (4.5 g, 4.8 mmol)를 얻었다.

화합물 1의 제조

<263> 화합물 **502** (4.5 g, 14.8 mmol)과 수산화나트륨 (0.6 g, 14.8 mmol)을 넣고 에탄올 (100 mL)에 용해시킨 후 30분간 교반하고,  $Zn(CH_3COO)_2 \cdot 2H_2O$  (1.8 g, 8.2 mmol)을 천천히 첨가하였다. 그런다음 실온에서 12시간 동안 교반하였다. 반응이 완료된 후 물 (200 mL), 에탄올 (200 mL) 및 헥산 (200 mL)로 각각 세척하고 감압 건조하여 표제화합물 **1** (4.5 g, 6.7 mmol, 45%)을 얻었다.

<264> [제조예 2] 화합물 **160**의 제조



<265>

<266> 화합물 **503**의 제조

<267> 5-아이오도인돌-2,3-디온(5-iodoindoline-2,3-dione) (10.0 g, 36.6 mmol)과 페닐보론산 (5.4 g, 43.9 mmol)을 디메틸글리콜(600 mL)에 용해시킨 후 테트라키스 팔라듐(0) 트리페닐포스핀( $Pd(PPh_3)_4$ ) (2.1 g, 1.8 mmol), 2M 소듐 하이드로카보네이트 수용액 (120 mL)을 첨가하였다. 이 혼합물을 12시간동안 환류 교반 한 다음 반응이 완료되면 용매를 제거하고 나머지 여액에 5% 수산화나트륨 수용액 120 mL를 넣고 실온에서 교반해 주었다. 이 수용액을 디클로로메탄으로 추출하고 물층을 모은 다음, 30% 과산화수소수 120 mL를 첨가하고 50℃까지 온도를 올려 30분간 교반 하였다. 실온으로 식힌 후, 수용액에 1N 염산 수용액을 천천히 첨가 하여 pH 4까지 맞추었다. 이때 고체가 생성되는데 이를 감압 여과 건조하여 화합물 **503** (5.5 g, 26.0 mmol)을 얻었다.

<268> 화합물 **504**의 제조

<269> 화합물 **503** (7.1 g, 33.3 mmol)을 물 (18 mL)와 진한 염산 (7 mL)에 용해시킨 후 실온에서 교반하였다. 10분 후, 온도를 0℃로 내리고 물 (10 mL)에 녹아있는 소듐나이트레이트(sodium nitrate :  $NaNO_3$ ) (2.3 g, 33.3 mmol)를 천천히 첨가하였다. 그런다음 0℃를 유지하면서 교반하였다. 다른 반응용기에 소듐설파이드노나하이드레이트(sodium sulfide nonahydrate :  $Na_2S \cdot 9H_2O$ ) (9.6 g, 39.9 mmol)과 황 (1.3 g, 39.9 mmol)을 물 (10 mL)에 녹인 후 10M 수산화 나트륨 수용액 4mL를 첨가하였다. 이를 0℃에서 반응 혼합물에 첨가해 준 다음 실온으로 올려 gas가 발생하지 않을 때까지 교반해 주었다. 반응이 완료되면 고체가 생성될 때까지 진한 염산을 첨가한 다음 이를 감압 여과하여 얻었다. 얻어진 고체를 소듐하이드로카보네이트( $NaHCO_3$ ) 수용액 (85 mL)에 넣고 20분간 환류 교반하고 실온으로 식힌 후, 녹지 않은 고체(불순물)를 제거한 다음, 수용액에 진한 염산을 넣어 다시 고체를 형성하였다. 이를 감압여과하여 얻은 고체를 다시 에탄올 (30 mL)에 넣고 20분간 환류 교반하였다. 녹지 않은 고체(불순물)를 제거하고 여액을 농축시켰다. 여기에 아연 (2.2 g, 33.3 mmol)과 빙초산 (30 mL)를 넣고 48시간동안 환류 교반하였다. 반응이 종료되면 실온으로 식힌 후, 생성된 고체를 모아 5M 수산화나트륨 수용액 (63 mL)에 넣고 30분간 환류 교반하였다. 녹지 않은 고체를 제거(불순물)하고 수용액에 진한 염산을 조금씩 넣어 산성화시켰다. 이때 고체가 생성되는데 이를 모아 다시 에탄올 (20 mL)에 넣고 30분간 환류 교반하였다. 녹지 않은 고체(불순물)를 제거하고 여액을 농축하여 화합물 **504** (1.8 g, 7.6 mmol)을 얻었다.

<270> 화합물 **505**의 제조

<271> 화합물 **504** (5.0 g, 21.7 mmol), 2-아미노벤젠싸이올(2-aminobenzenethiol) (2.1 mL, 19.5 mmol) 과 폴리인산 (20 g)을 넣고 140℃에서 24시간동안 환류 교반하였다. 반응이 완료되면 실온으로 식힌 후, 포화 수산화나트륨 수용액을 천천히 첨가하여 pH를 중성으로 맞추었다. 이때 고체가 생성되는데 이를 감압 여과하여 고체를 얻었다. 얻어진 고체를 에탄올로 세척, 건조하여 화합물 **505** (5.4 g, 17.1 mmol)을 얻었다.

<272> 화합물 160의 제조

<273> 화합물 505 (5.0 g, 15.6 mmol)과 수산화나트륨 (0.6 g, 15.6 mmol)을 에탄올 (100 mL)에 용해시킨 후 30분간 교반하고, Zn(CH<sub>3</sub>COO)<sub>2</sub> · 2H<sub>2</sub>O (1.9 g, 8.7 mmol)을 천천히 가하고 실온에서 12시간 동안 교반하였다. 교반이 완료된 후 물 (200 mL), 에탄올 (200 mL) 및 헥산 (200 mL)로 각각 세척하고 감압건조하여 표제화합물 160 (7.1 g, 10.1 mmol, 65 %)을 수득하였다.

<274> [제조예 3] 화합물 319의 제조

<275> 화합물 502 (4.5 g, 14.8 mmol)과 알루미늄 아이소프로폭사이드 (3.0 g, 14.8 mmol)을 클로로포름(50 mL)/아이소프로필알코올(150 mL)에 용해시킨후 60℃에서 3시간동안 교반하여 용액이 투명해지면 여기에 4-페닐페놀 (3.0 g, 17.8 mmol)을 첨가하고 80℃에서 3시간동안 환류 교반해 주었다. 그리고 다시 화합물 502 (4.5 g, 14.8 mmol)을 더 첨가하고 12시간동안 환류 교반해 주었다. 반응이 완료된 후 실온에서 식히고 생성된 고체를 감압여과해서 얻고 이를 다시 아이소프로필알코올 (500 mL), 메탄올 (300 mL) 및 에틸에테르 (250 mL)로 각각 세척하여 표제화합물 319 (3.8 g, 7.6 mmol, 51%)을 수득하였다.

<276> 상기 제조예 1 내지 3과 동일한 방법으로 화합물 1 내지 화합물 480 을 제조하였으며, 하기 표 4에 제조된 화합물의 <sup>1</sup>H NMR 및 MS/FAB를 나타내었다.

<277> [표 4]

화합물 번호	<sup>1</sup> H NMR(CDCl <sub>3</sub> , 200 MHz)	MS/FAB	
		found	calculated
1	δ = 6.85(d, 2H), 7.22-7.32(m, 8H), 7.48-7.55(m, 10H), 8.12-8.23(dd, 4H)	668.1	670.1
3	δ = 6.85(m, 2H), 7.27-7.38(m, 8H), 7.54-7.67(m, 14H), 8.13-8.25(m, 4H)	668.1	670.1
5	δ = 6.85(m, 2H), 7.27-7.32(m, 8H), 7.48-7.55(m, 18H), 8.12-8.23(m, 4H)	704.0	706.1
7	δ = 7.03-7.10(m, 8H), 7.37(m, 2H), 7.46-7.55(m, 8H), 8.12-8.25(m, 4H)	704.0	706.1
9	δ = 6.85(m, 2H), 7.27-7.32(m, 8H), 7.48-7.55(m, 18H), 8.12-8.23(m, 4H)	820.1	822.3

<278>

11	$\delta = 7.05(m, 2H), 7.10(m, 2H), 7.22(m, 2H), 7.32-7.37(m, 6H), 7.46-7.56(m, 16H), 8.12(d, 2H), 8.23(d, 2H)$	820.1	822.3
14	$\delta = 1.34(s, 18H), 6.85(m, 2H), 7.27(m, 2H), 7.35-7.40(m, 8H), 7.53-7.56(m, 6H), 8.12-8.23(dd, 4H)$	780.2	782.3
15	$\delta = 1.34(s, 18H), 7.01-7.10(m, 4H), 7.35-7.40(m, 10H), 7.55(m, 4H), 8.14-8.25(m, 4H)$	780.2	782.3
18	$\delta = 6.64(m, 2H), 6.85(m, 2H), 6.96(m, 4H), 7.27(m, 2H), 7.53-7.55(m, 6H), 8.24-8.25(m, 4H)$	740.0	742.1
21	$\delta = 6.74-6.85(m, 6H), 7.27(m, 2H), 7.44(m, 2H), 7.53-7.55(m, 6H), 8.12-8.23(m, 4H)$	740.0	742.1
26	$\delta = 6.51(m, 4H), 6.85(m, 2H), 7.27(m, 2H), 7.52-7.54(m, 6H), 8.12(m, 2H), 8.24(m, 2H)$	776.0	778.1
81	$\delta = 6.46-6.52(m, 12H), 6.62(m, 4H), 7.01(m, 12H), 7.23(m, 4H), 7.37(m, 2H), 7.55(m, 4H), 8.12(m, 2H), 8.23(m, 2H)$	1002.2	1004.5
82	$\delta = 6.46-6.52(m, 12H), 6.62(m, 4H), 6.85(m, 2H), 7.01(m, 8H), 7.23-7.27(m, 6H), 7.53-7.55(m, 6H), 8.23-8.25(m, 4H)$	1002.2	1004.5
85	$\delta = 6.85(m, 2H), 7.27-7.32(m, 6H), 7.52-7.56(m, 8H), 7.67-7.73(m, 6H), 7.89(m, 2H), 8.12-8.23(m, 4H)$	768.1	770.2
91	$\delta = 6.85(m, 2H), 7.27-7.38(m, 8H), 7.54-7.67(m, 14H), 8.13-8.25(m, 4H)$	768.1	770.2
93	$\delta = 1.67(s, 12H), 7.27-7.28(m, 4H), 7.38(m, 2H), 7.55-7.60(m, 10H), 7.77(m, 2H), 7.84-7.90(m, 4H), 8.13-8.25(m, 4H)$	900.2	902.4
106	$\delta = 6.85(m, 2H), 7.27(m, 2H), 7.36(m, 18H), 7.53-7.60(m, 26H), 8.15-8.25(m, 4H)$	1184.2	1186.9
107	$\delta = 7.01(s, 2H), 7.10(m, 2H), 7.36-7.37(m, 20H), 7.54-7.60(m, 24H), 8.12(d, 2H), 8.24(d, 2H)$	1184.2	1186.9
143	$\delta = 6.79-6.88(m, 4H), 7.05(m, 2H), 7.22-7.32(m, 8H), 7.48(m, 4H), 7.77(m, 2H), 8.29-8.34(m, 4H)$	668.1	670.1
144	$\delta = 6.79-6.88(m, 4H), 7.05(m, 2H), 7.22-7.32(m, 8H), 7.48(m, 4H), 7.77(m, 2H), 8.18(m, 2H), 8.45(m, 2H)$	668.1	670.1
145	$\delta = 7.79(m, 2H), 6.88(m, 2H), 7.05(m, 2H), 7.31-7.32(m, 8H), 7.48-7.54(m, 12H), 7.77(m, 2H), 8.18(m, 2H), 8.43(m, 2H)$	820.1	822.3
146	$\delta = 6.78-6.80(m, 4H), 7.04(m, 2H), 7.22(m, 2H), 7.31-7.32(m, 6H), 7.48-7.54(m, 12H), 7.77(m, 2H), 8.30-8.33(m, 4H)$	820.1	822.3
147	$\delta = 1.36(s, 18H), 6.78-6.89(m, 4H), 7.05(m, 2H), 7.31-7.40(m, 10H), 7.78(m, 2H), 8.20(m, 2H), 8.50(m, 2H)$	780.2	782.3
148	$\delta = 1.34(s, 18H), 6.70(m, 2H), 6.88(m, 2H), 7.07(m, 2H), 7.31-7.40(m, 10H), 7.77(m, 2H), 8.28-8.32(m, 4H)$	780.2	782.3
149	$\delta = 6.80-6.90(m, 4H), 7.03-7.05(m, 6H), 7.31(m, 2H), 7.46(m, 4H), 7.77(m, 2H), 8.18(m, 2H), 8.45(m, 2H)$	704.0	706.1
150	$\delta = 6.80-6.90(m, 4H), 7.03-7.08(m, 6H), 7.31(m, 2H), 7.46(m, 4H), 7.77(m, 2H), 8.29-8.34(m, 4H)$	704.0	706.1
151	$\delta = 6.79(m, 2H), 6.88(m, 2H), 7.05(m, 2H), 7.31-7.36(m, 20H), 7.54-7.60(m, 20H), 7.77(m, 2H), 8.18(m, 2H), 8.46(m, 2H)$	1184.2	1186.9

152	$\delta = 6.79(\text{m}, 2\text{H}), 6.88(\text{m}, 2\text{H}), 7.05(\text{m}, 2\text{H}), 7.31-7.36(\text{m}, 20\text{H}), 7.54-7.60(\text{m}, 20\text{H}), 7.77(\text{m}, 2\text{H}), 8.30-8.34(\text{m}, 4\text{H})$	1184.2	1186.9
153	$\delta = 6.46-6.52(\text{m}, 12\text{H}), 6.62(\text{m}, 4\text{H}), 6.79(\text{m}, 2\text{H}), 6.88(\text{m}, 2\text{H}), 7.01-7.05(\text{m}, 10\text{H}), 7.23-7.31(\text{m}, 6\text{H}), 7.77(\text{m}, 2\text{H}), 8.18(\text{m}, 2\text{H}), 8.46(\text{m}, 2\text{H})$	1002.2	1004.5
154	$\delta = 6.46-6.52(\text{m}, 12\text{H}), 6.62(\text{m}, 4\text{H}), 6.79-6.88(\text{m}, 4\text{H}), 7.01-7.05(\text{m}, 10\text{H}), 7.23(\text{m}, 4\text{H}), 7.31(\text{m}, 2\text{H}), 7.77(\text{m}, 2\text{H}), 8.30-8.34(\text{m}, 4\text{H})$	1002.2	1004.5
160	$\delta = 8.23(\text{d}, 2\text{H}), 8.13(\text{d}, 2\text{H}), 7.55-7.20(\text{m}, 20\text{H})$	700.1	700.0
173	$\delta = 1.34(\text{s}, 18\text{H}), 7.28-7.30(\text{m}, 4\text{H}), 7.35-7.40(\text{m}, 4\text{H}), 7.54(\text{m}, 6\text{H}), 8.12(\text{m}, 2\text{H}), 8.23(\text{m}, 2\text{H})$	814.1	812.1
176	$\delta = 6.64(\text{m}, 2\text{H}), 6.96(\text{m}, 4\text{H}), 7.32-7.38(\text{m}, 4\text{H}), 7.55(\text{m}, 4\text{H}), 8.12(\text{m}, 2\text{H}), 8.23(\text{m}, 2\text{H})$	773.9	771.9
205	$\delta = 2.35(\text{s}, 12\text{H}), 6.82(\text{d}, 2\text{H}), 7.09(\text{s}, 4\text{H}), 7.28-7.30(\text{m}, 4\text{H}), 7.55(\text{m}, 6\text{H}), 8.15-8.24(\text{m}, 4\text{H})$	758.0	756.1
241	$\delta = 6.46-6.52(\text{m}, 12\text{H}), 6.62(\text{m}, 4\text{H}), 7.02(\text{m}, 8\text{H}), 7.24-7.30(\text{m}, 8\text{H}), 7.56(\text{m}, 6\text{H}), 8.13(\text{t}, 2\text{H}), 8.23(\text{t}, 2\text{H})$	1035.1	1034.2
265	$\delta = 7.30-7.36(\text{m}, 22\text{H}), 7.54-7.60(\text{m}, 26\text{H}), 8.12(\text{m}, 2\text{H}), 8.24(\text{m}, 2\text{H})$	1219.2	1216.3
269	$\delta = 2.34(\text{s}, 6\text{H}), 6.86(\text{m}, 2\text{H}), 7.12(\text{d}, 4\text{H}), 7.57(\text{m}, 4\text{H}), 8.13-8.25(\text{m}, 4\text{H})$	577.9	575.9
273	$\delta = 2.36(\text{s}, 12\text{H}), 6.70(\text{s}, 2\text{H}), 6.85(\text{s}, 2\text{H}), 7.55(\text{m}, 4\text{H}), 8.14-8.25(\text{m}, 4\text{H})$	606.0	604.5
293	$\delta = 2.36(\text{s}, 6\text{H}), 7.08(\text{s}, 4\text{H}), 7.22(\text{m}, 2\text{H}), 7.32(\text{m}, 4\text{H}), 7.48(\text{m}, 8\text{H}), 8.20(\text{m}, 4\text{H})$	730.0	728.4
302	$\delta = 7.06-7.10(\text{m}, 4\text{H}), 7.24-7.32(\text{m}, 10\text{H}), 7.48(\text{m}, 4\text{H}), 7.77(\text{m}, 2\text{H}), 8.29-8.34(\text{m}, 4\text{H})$	702.1	700.1
318	$\delta = 7.06-7.12(\text{m}, 4\text{H}), 7.22-7.34(\text{m}, 10\text{H}), 7.48(\text{m}, 4\text{H}), 8.00(\text{s}, 2\text{H})$	601.9	599.9
319	$\delta = 6.79-6.85(\text{m}, 4\text{H}), 7.27-7.32(\text{m}, 18\text{H}), 7.48-7.56(\text{m}, 12\text{H}), 8.12-8.25(\text{m}, 4\text{H})$	801.2	800.2
323	$\delta = 6.79-6.85(\text{m}, 4\text{H}), 7.03(\text{m}, 4\text{H}), 7.22-7.32(\text{m}, 7\text{H}), 7.46-7.56(\text{m}, 12\text{H}), 8.14-8.25(\text{m}, 4\text{H})$	837.2	836.2
332	$\delta = 1.37(\text{s}, 18\text{H}), 6.79-6.90(\text{m}, 4\text{H}), 7.22-7.40(\text{m}, 15\text{H}), 7.48-7.55(\text{m}, 8\text{H}), 8.14-8.25(\text{m}, 4\text{H})$	913.3	912.3
341	$\delta = 2.37(\text{s}, 6\text{H}), 6.79(\text{d}, 2\text{H}), 6.94-7.02(\text{m}, 4\text{H}), 7.20-7.32(\text{m}, 15\text{H}), 7.48-7.55(\text{m}, 6\text{H}), 8.15-8.23(\text{m}, 4\text{H})$	829.2	828.2
344	$\delta = 2.38(\text{s}, 12\text{H}), 6.79-6.84(\text{m}, 6\text{H}), 7.09(\text{s}, 4\text{H}), 7.19-7.34(\text{m}, 7\text{H}), 7.48-7.54(\text{m}, 8\text{H}), 8.13-8.26(\text{m}, 4\text{H})$	857.2	856.2
347	$\delta = 2.24(\text{s}, 6\text{H}), 6.85(\text{m}, 4\text{H}), 7.12(\text{m}, 4\text{H}), 7.28-7.32(\text{m}, 11\text{H}), 7.49-7.55(\text{m}, 8\text{H}), 8.21(\text{m}, 4\text{H})$	829.2	828.2
380	$\delta = 6.46-6.52(\text{m}, 12\text{H}), 6.62(\text{m}, 4\text{H}), 6.80(\text{m}, 4\text{H}), 7.01(\text{m}, 8\text{H}), 7.20-7.33(\text{m}, 11\text{H}), 7.50-7.54(\text{m}, 8\text{H}), 8.10-8.20(\text{m}, 4\text{H})$	1135.3	1134.3
383	$\delta = 6.79(\text{m}, 4\text{H}), 6.88(\text{m}, 2\text{H}), 7.05(\text{m}, 2\text{H}), 7.20-7.35(\text{m}, 13\text{H}), 7.48(\text{m}, 6\text{H}), 7.77(\text{m}, 2\text{H}), 8.29-8.34(\text{m}, 4\text{H})$	800.9	800.1

398	$\delta$ =6.79(m, 4H), 6.88(m, 2H), 7.05(m, 2H), 7.22(m, 1H), 7.31-7.36(m, 11H), 7.48-7.54(m, 14H), 7.83(m, 2H), 8.33(dd, 2H), 8.46(m, 2H)	1165.5	1164.2
399	$\delta$ =6.79(m, 4H), 6.88(m, 2H), 7.05(m, 2H), 7.22-7.32(m, 13H), 7.48(m, 6H), 8.01(s, 2H)	700.8	700.1
404	$\delta$ =6.79-6.85(m, 4H), 7.21-7.33(m, 12H), 7.50-7.55(m, 11H), 7.67-7.73(m, 3H), 7.89(s, 1H), 8.12-8.23(m, 4H)	851.1	850.1
405	$\delta$ =6.79-7.85(m, 4H), 7.25-7.38(m, 13H), 7.49-7.67(m, 14H), 8.13-8.21(m, 4H)	851.1	850.1
406	$\delta$ =1.67(s, 6H), 6.79-6.85(m, 4H), 7.22-7.38(m, 12H), 7.49-7.56(m, 12H), 7.77(d, 1H), 7.84-7.90(m, 2H), 8.12(m, 2H), 8.23(m, 2H)	917.0	916.2
407	$\delta$ =6.85(m, 2H), 6.97-6.98(m, 2H), 7.23-7.32(m, 11H), 7.48-7.62(m, 15H), 7.85(d, 1H), 8.13-8.25(m, 4H)	850.9	850.1
408	$\delta$ =1.68(s, 6H), 6.85(t, 3H), 7.02(d, 1H), 7.22-7.32(m, 11H), 7.48-7.67(m, 14H), 7.77(d, 1H), 7.90(d, 1H), 8.13-8.26(m, 4H)	917.0	916.2

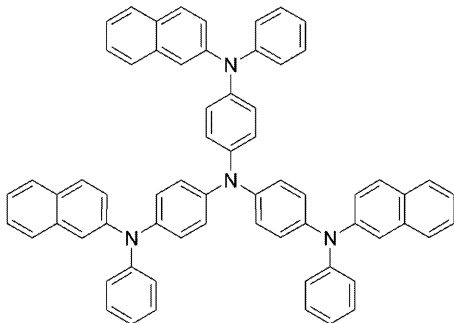
<281>

<282> [실시예 1-23] 본 발명에 따른 전기 발광 화합물을 이용한 OLED 소자의 제조

<283> 본 발명의 전기발광화합물을 호스트 재료로 사용하여 OLED 소자를 제작하였다. OLED 소자의 단면도는 도1 과 같다.

<284> 우선, OLED용 글래스(1)로부터 얻어진 투명전극 ITO 박막(15  $\Omega/\square$ , 삼성-코닝사 제조, 2)을, 트리클로로에틸렌, 아세톤, 에탄올, 증류수를 순차적으로 사용하여 초음파 세척을 실시한 후, 이소프로판올에 넣어 보관한 후 사용하였다.

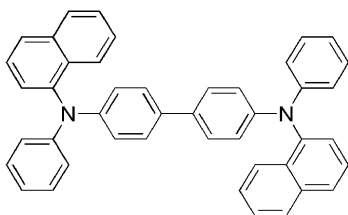
<285> 다음으로, 진공 증착 장비의 기관 폴더에 ITO 기관을 설치하고, 진공 증착 장비 내의 셀에 4,4',4"-tris(N,N-(2-naphthyl)-phenylamino)triphenylamine (2-TNATA)을 넣고, 챔버 내의 진공도가  $10^{-6}$  torr에 도달할 때까지 배기시킨 후, 셀에 전류를 인가하여 2-TNATA를 증발시켜 ITO 기관 상에 60 nm 두께의 정공주입층(3)을 증착하였다.



2-TNATA

<286>

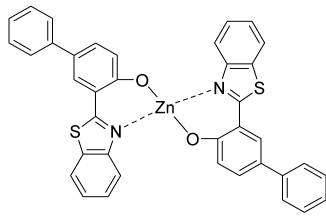
<287> 이어서, 진공 증착 장비 내의 다른 셀에 N,N'-bis( $\alpha$ -naphthyl)-N,N'-diphenyl-4,4'-diamine (NPB)을 넣고, 셀에 전류를 인가하여 NPB를 증발시켜 정공주입층 위에 20 nm 두께의 정공전달층(4)을 증착하였다.



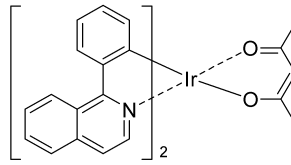
NPB

<288>

<289> 진공 증착 장비 내의 한쪽 셀에 호스트 재료로  $10^{-6}$  torr하에서 진공 승화 정제된 본 발명에 따른 화합물(예 : 화합물 1)을 넣고, 다른쪽 셀에는 발광 도판트(예 : 화합물 (piq)<sub>2</sub>Ir(acac))를 각각 넣은 후, 두 물질을 다른 속도로 증발시켜 4 내지 10mol%로 도핑함으로써 상기 정공 전달층 위에 30 nm 두께의 발광층(5)을 증착하였다.



화합물1

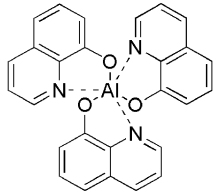


(piq)<sub>2</sub>Ir(acac)

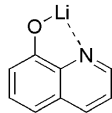
<290>

<291>

이어서 전자전달층(6)으로써 tris(8-hydroxyquinoline)-aluminum(III) (Alq)을 20 nm 두께로 증착하였다. 다음으로 전자주입층(7)으로 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

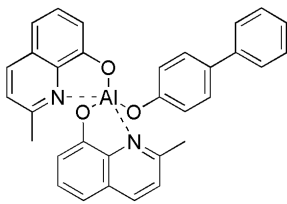
<292>

<293>

[비교예 1] 종래의 발광재료를 이용한 OLED 소자의 제조

<294>

진공 증착 장비 내의 다른 셀에 발광 호스트 재료로서 본 발명에 따른 전기 발광 화합물 대신에 Bis(2-methyl-8-quinolinato)(*p*-phenylphenolato)aluminum(III) (BALq)을 넣은 것 이외에는 실시예 1과 동일하게 OLED 소자를 제작하였다.



BALq

<295>

<296>

[실험예 1] 제조된 OLED 소자의 특성 확인

<297>

본 발명에 따른 전기 발광 화합물을 함유하는 실시예 1 내지 실시예 23의 OLED 소자와 비교예 1에서 제조된 본 발명에 따른 종래의 발광 화합물을 함유하는 OLED 소자의 구동전압 및 전력효율을 1,000 cd/m<sup>2</sup> 에서 측정하여 하기 표 5에 나타내었다.

<298>

본 발명에서 개발한 전기 발광 화합물들의 발광 특성들이 나타난 하기의 표 5로부터, 본 발명에서 개발한 전기 발광 화합물들이 성능 측면에서 종래의 재료 대비 우수한 특성을 보이는 것을 확인할 수 있다.

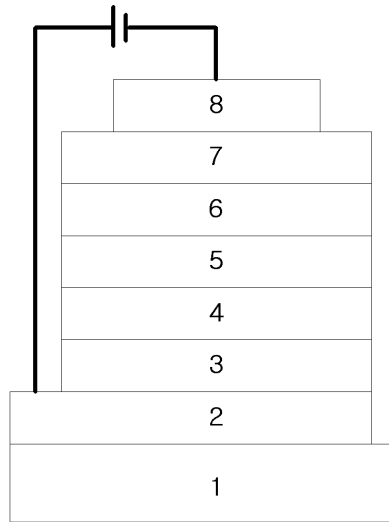


<307> 5 - 발광층 6 - 전자전달층

<308> 7 - 전자주입층 8 - Al 음극

도면

도면1



专利名称(译)	用于电致发光的有机金属化合物和使用它作为发光材料的显示元件		
公开(公告)号	<a href="#">KR100850886B1</a>	公开(公告)日	2008-08-07
申请号	KR1020080026187	申请日	2008-03-21
申请(专利权)人(译)	宇预支給显示器材料有限公司		
当前申请(专利权)人(译)	宇预支給显示器材料有限公司		
[标]发明人	KIM HYUN 김현 CHO YOUNG JUN 조영준 KWON HYUCK JOO 권혁주 KIM BONG OK 김봉옥 KIM SUNG MIN 김성민 YOON SEUNG SOO 윤승수		
发明人	김현 조영준 권혁주 김봉옥 김성민 윤승수		
IPC分类号	C09K11/06		
CPC分类号	H05B33/14 H01L51/006 C09K2211/186 H01L51/0085 H01L51/0092 C09K2211/1037 H01L51/0058 C09K11/06 Y02E10/549		
代理人(译)	昌熙园		
优先权	1020070091104 2007-09-07 KR 1020070142004 2007-12-31 KR		
外部链接	<a href="#">Espacenet</a>		

摘要(译)

本发明涉及由下式(1)表示的电致发光化合物和包含其作为主体材料的电致发光器件。[化学式1]根据本发明的电致发光化合物用作OLED器件中的主体材料，从而显著降低驱动电压并提高功率效率。

