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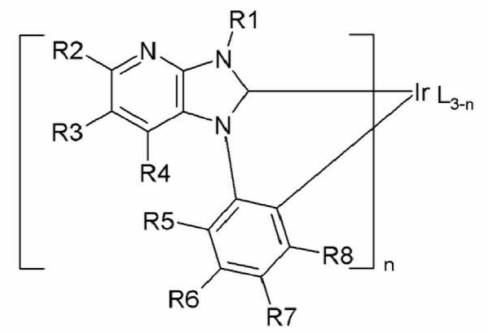
전체 청구항 수 : 총 7 항 심사관 : 송이화

(54) 발명의 명칭 **청색 인광 화합물 및 이를 이용하는 유기전계발광소자**

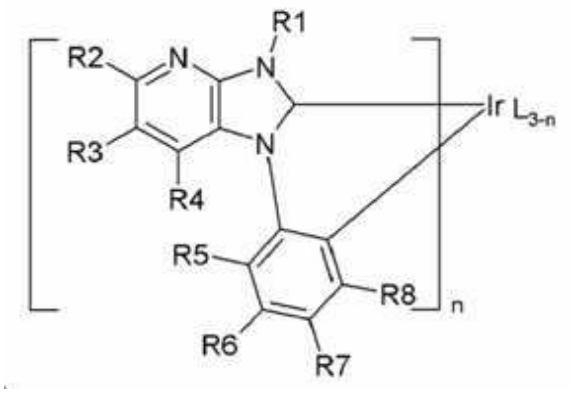
(57) 요 약

본 발명은 하기 화학식으로 표시되는 청색 인광 화합물을 제공한다.



위와 같은 청색 인광 도펀트는 고색순도 및 높은 발광효율의 효과를 갖는다.

대 표 도



(72) 발명자
윤대위
경기도 파주시 월롱면 덕은리 1007번지

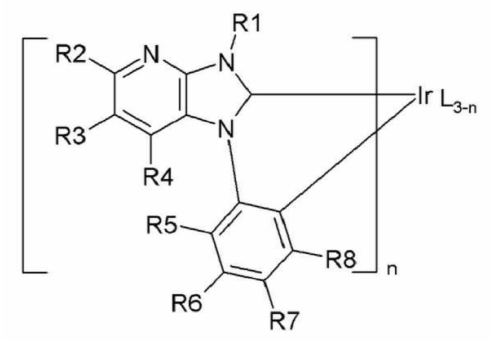
신인애
부산광역시 부산진구 엄광로282번길 10-1 (가야동)

명 세 서

청구범위

청구항 1

하기 화학식으로 표시되는 청색 인광 화합물.



(R1은 C1 내지 C6의 알킬기, C6 이상의 치환 또는 비치환된 방향족 그룹, C5 이상의 치환 또는 비치환된 이형고리 그룹으로부터 선택되고, R2 내지 R8 각각은 수소, 할로겐, 시아노기, 트리플루오로메틸기, C1 내지 C6의 알킬기, C1 내지 C6의 알콕시기, 실릴기, C6 이상의 치환 또는 비치환된 방향족 그룹, C5 이상의 치환 또는 비치환된 이형고리 그룹, C1 내지 C6의 아민기, C6 이상의 방향족 그룹이 치환된 아민기, C5 이상의 이형고리 그룹이 치환된 아민기로부터 선택되고, L은 두자리 결합 리간드이며, n은 1 내지 3이고, 상기 R5 내지 R8 중 적어도 하나는 메틸기이다.)

청구항 2

삭제

청구항 3

제 1 항에 있어서,

상기 실릴기는 C1 내지 C6의 알킬기 또는 C6 이상의 치환 또는 비치환된 방향족 그룹으로 치환되는 것을 특징으로 하는 청색 인광 화합물.

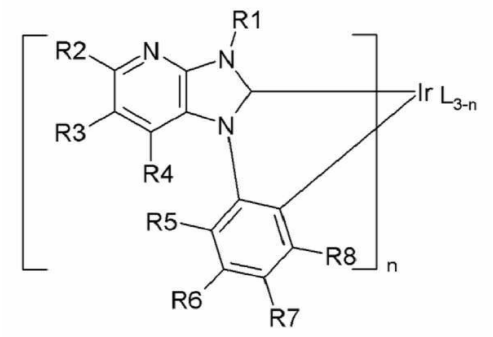
청구항 4

제 1 전극과;

상기 제 1 전극과 마주보는 제 2 전극과;

상기 제 1 및 제 2 전극 사이에 위치하는 발광물질층을 포함하고,

상기 발광물질층은 하기 화학식으로 표시되는 청색 인광 화합물을 포함하여 이루어지는 것이 특징인 유기전계발광소자.



(R1은 C1 내지 C6의 알킬기, C6 이상의 치환 또는 비치환된 방향족 그룹, C5 이상의 치환 또는 비치환된 이형고리 그룹으로부터 선택되고, R2 내지 R8 각각은 수소, 할로겐, 시아노기, 트리플루오로메틸기, C1 내지 C6의 알킬기, C1 내지 C6의 알콕시기, 실릴기, C6 이상의 치환 또는 비치환된 방향족 그룹, C5 이상의 치환 또는 비치환된 이형고리 그룹, C1 내지 C6의 아민기, C6 이상의 방향족 그룹이 치환된 아민기, C5 이상의 이형고리 그룹이 치환된 아민기로부터 선택되고, L은 두자리 결합 리간드이며, n은 1 내지 3이고, 상기 R5 내지 R8 중 적어도 하나는 메틸기이다.)

청구항 5

제 4 항에 있어서,

상기 제 1 전극과 상기 발광물질층 사이에 위치하는 정공주입층과;

상기 정공주입층과 상기 발광물질층 사이에 위치하는 정공수송층과;

상기 발광물질층과 상기 제 2 전극 사이에 위치하는 전자주입층과;

상기 전자주입층과 상기 발광물질층 사이에 위치하는 전자수송층을 포함하는 것을 특징으로 하는 유기전계발광소자.

청구항 6

삭제

청구항 7

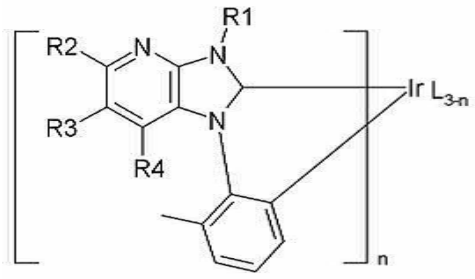
제 4 항에 있어서,

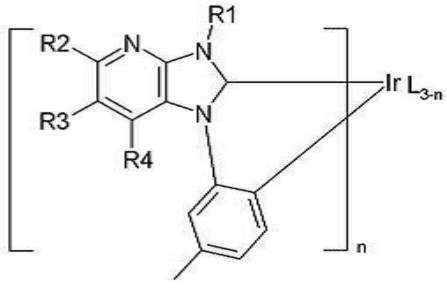
상기 실릴기는 C1 내지 C6의 알킬기 또는 C6 이상의 치환 또는 비치환된 방향족 그룹으로 치환되는 것을 특징으로 하는 유기전계발광소자.

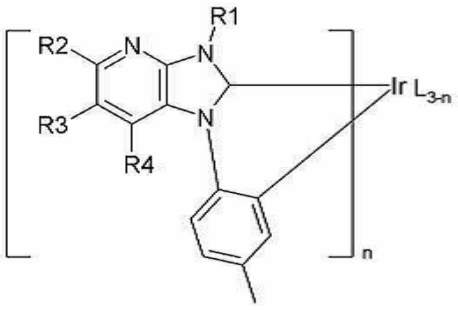
청구항 8

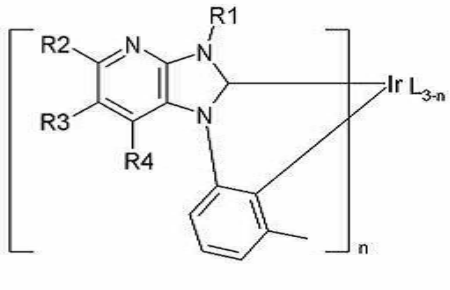
제 1 항에 있어서,

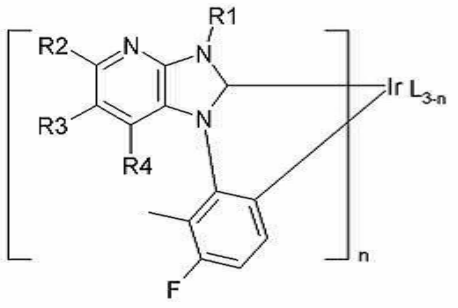
상기 화학식 물질은 하기 물질들 중 어느 하나인 청색 인광 화합물.

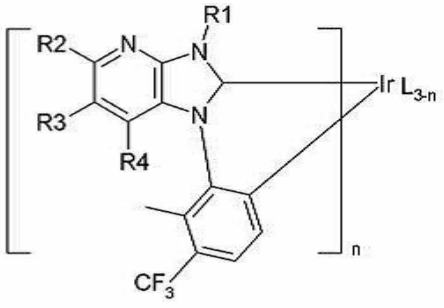


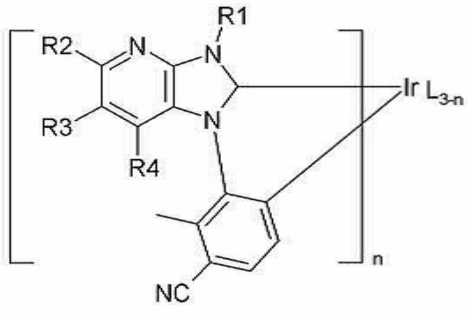


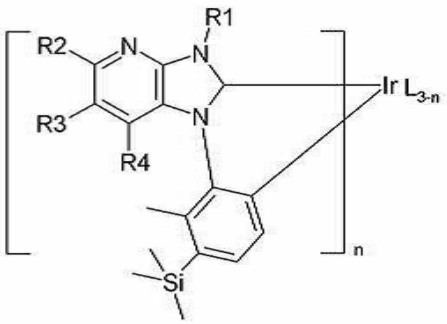

R1
R2
N
N
R3
N
R4
Ir L3-n
n

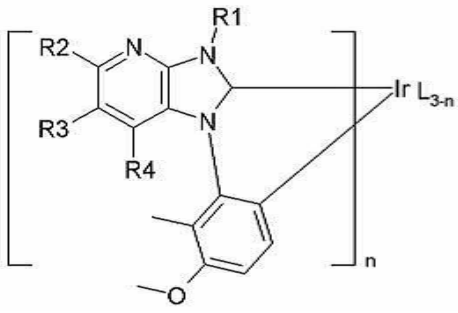

R1
R2
N
N
R3
N
R4
Ir L3-n
n

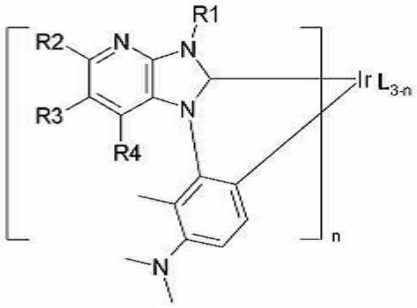

R1
R2
N
N
R3
N
R4
Ir L3-n
n
F


R1
R2
N
N
R3
N
R4
Ir L3-n
n
CF3


R1
R2
N
N
R3
N
R4
Ir L3-n
n
NC


R1
R2
N
N
R3
N
R4
Ir L3-n
n
Si


R1
R2
N
N
R3
N
R4
Ir L3-n
n
O


R1
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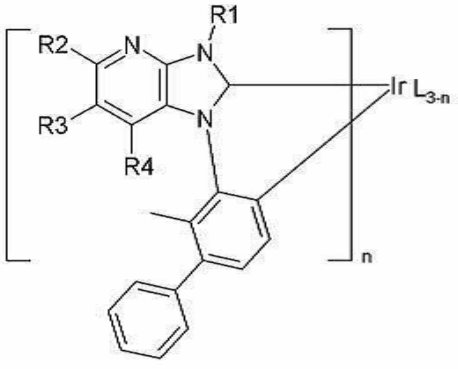
N
R3
N
R4
Ir L3-n
n
N


R1
R2
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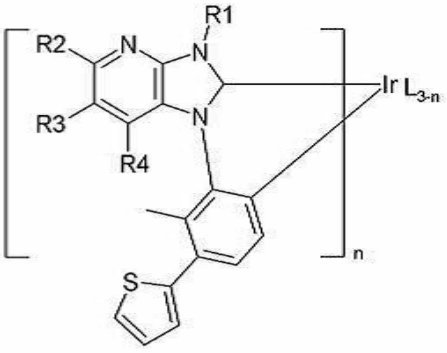
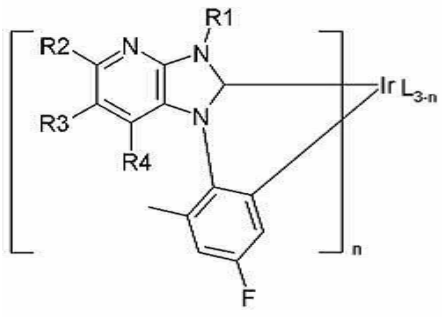
N
R3
N
R4
Ir L3-n
n


R1
R2
N
N
R3
N
R4
Ir L3-n
n
S


R1
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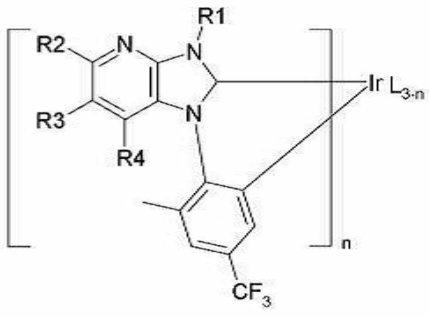
N
R3
N
R4
Ir L3-n
n
F


R1
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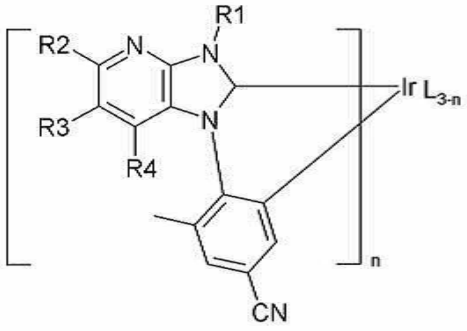
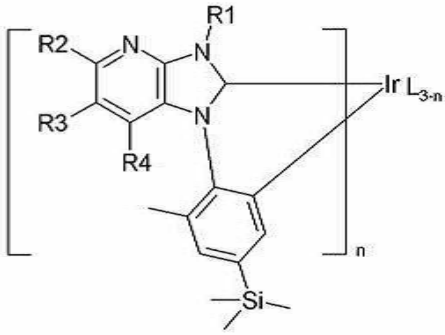
N
R3
N
R4
Ir L3-n
n
CF3


R1
R2
N
N
R3
N
R4
Ir L3-n
n
CN


R1
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R3
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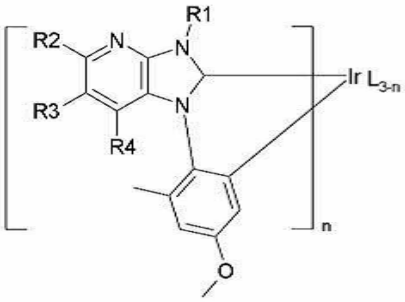
R4
Ir L3-n
n
Si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R4
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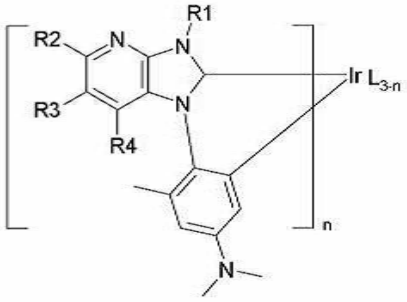
O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R4
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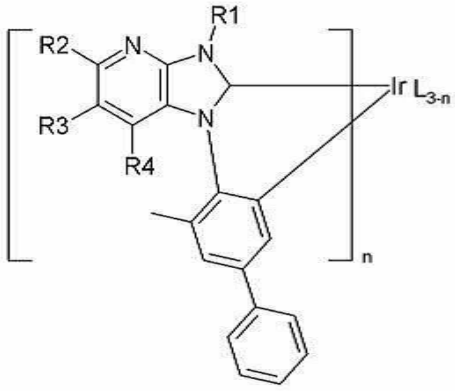
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R3
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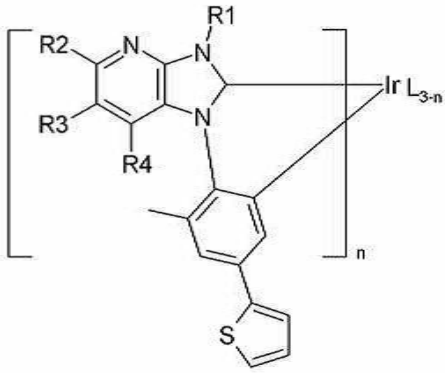
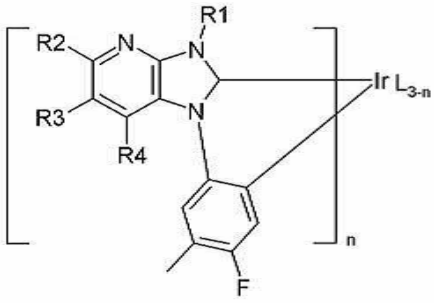
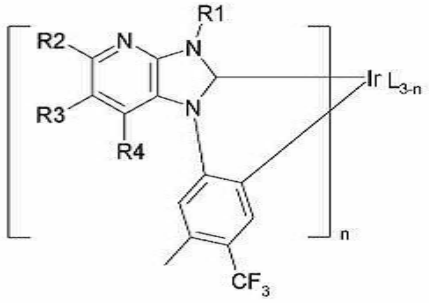
R4
Ir L3-n
n


R1
R2
N
N
R3
N
R4
Ir L3-n
n
S


R1
R2
N
N
R3
N
R4
Ir L3-n
n
F


R1
R2
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N
R3
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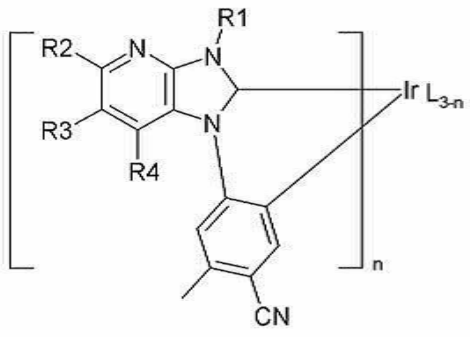
R4
Ir L3-n
n
CF3


R1
R2
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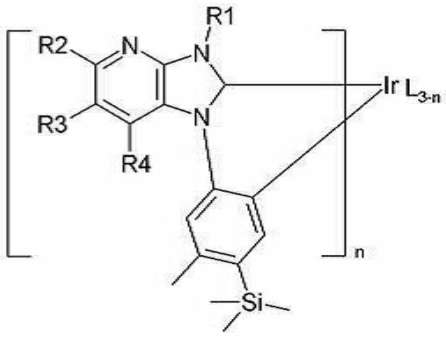
N
R3
N
R4
Ir L3-n
n
CN


R1
R2
N
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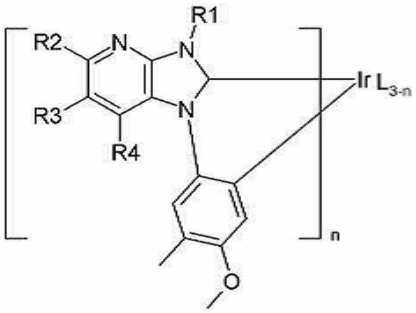
R3
N
R4
Ir L3-n
n
Si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R3
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R4
Ir L3-n
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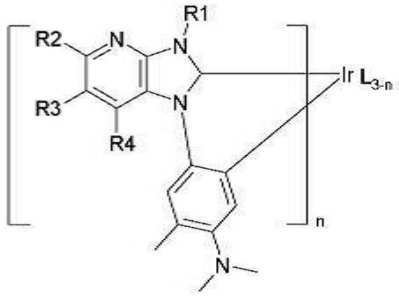
O


R1
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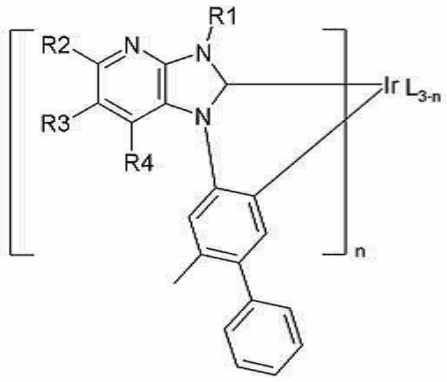
R3
N
R4
Ir L3-n
n
N


R1
R2
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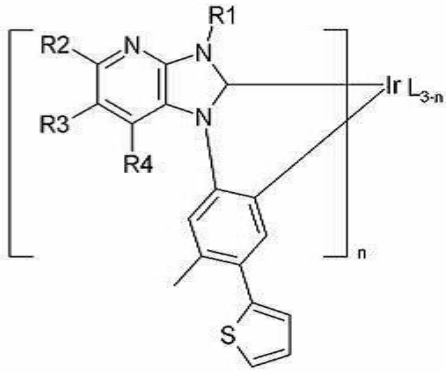
R3
N
R4
Ir L3-n
n


R1
R2
N
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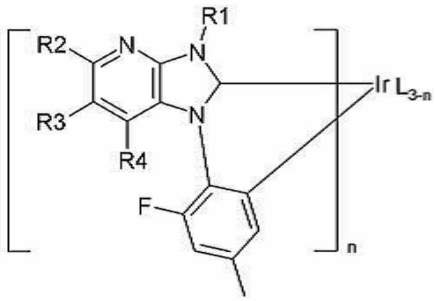
R3
N
R4
Ir L3-n
n
S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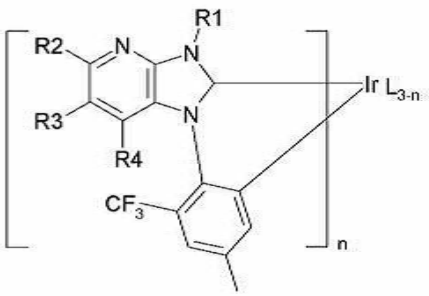
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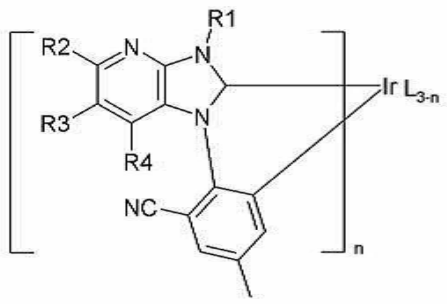
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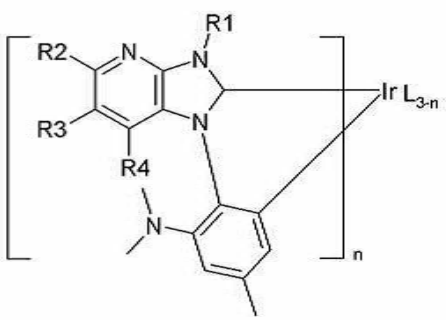
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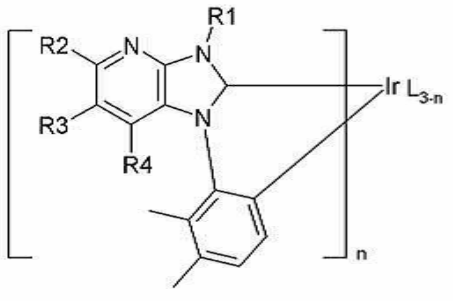
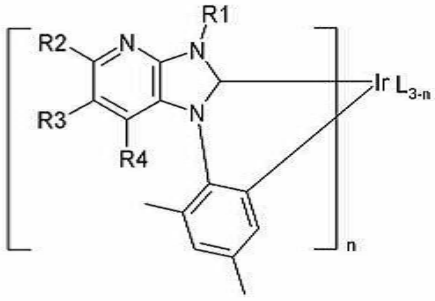
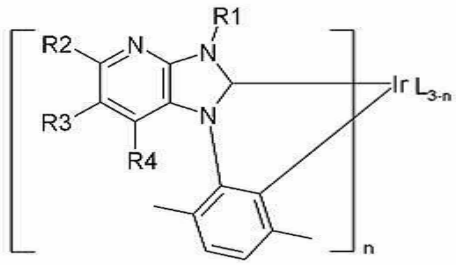
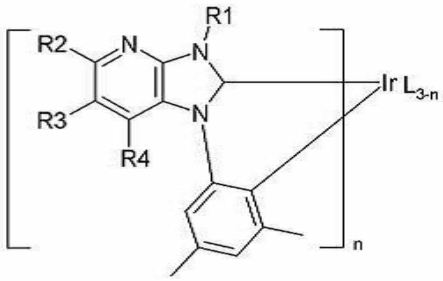
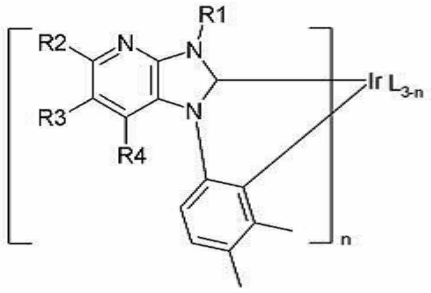
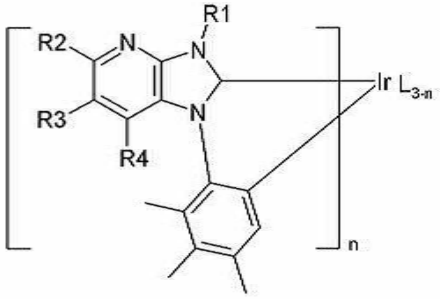
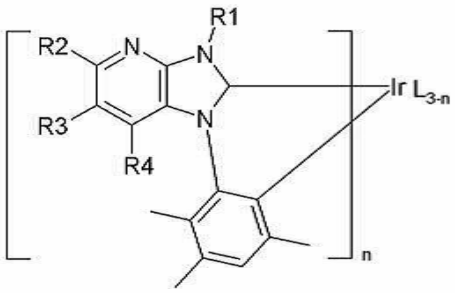
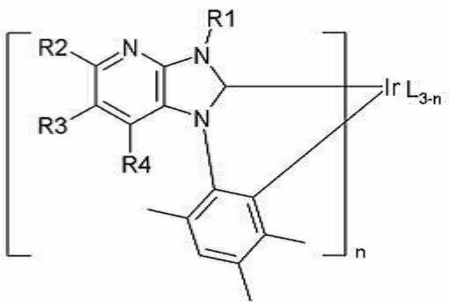
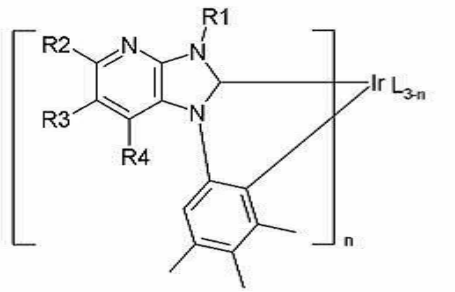
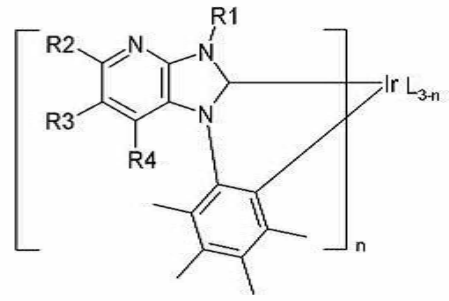

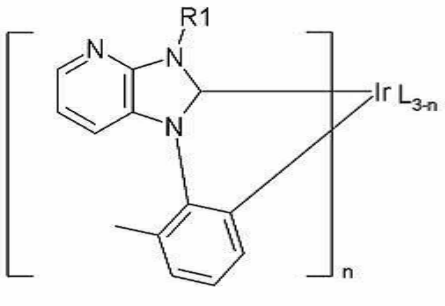
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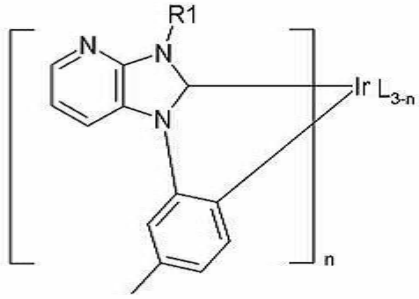
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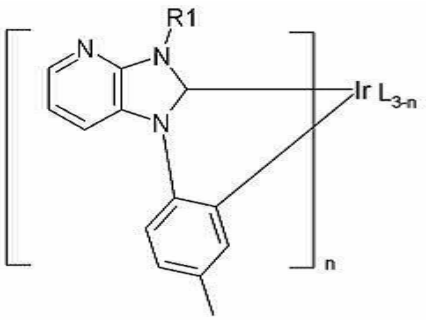
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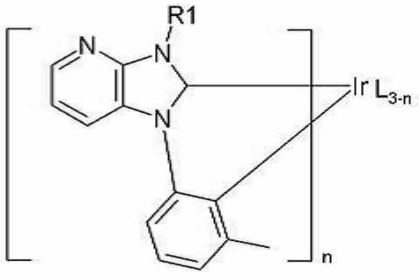
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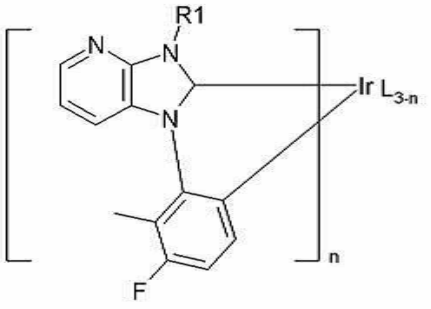
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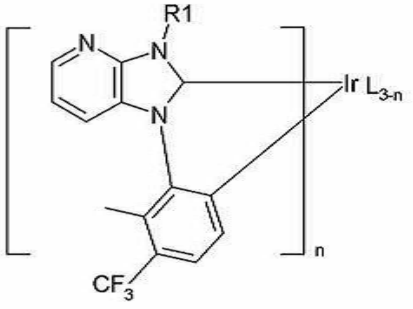
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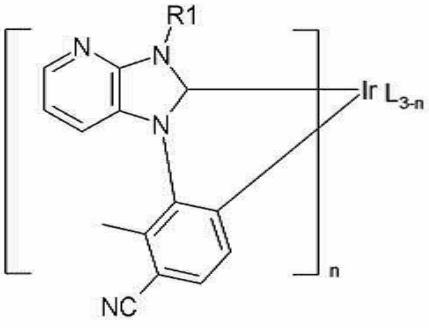
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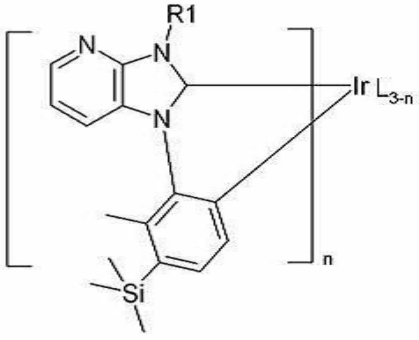
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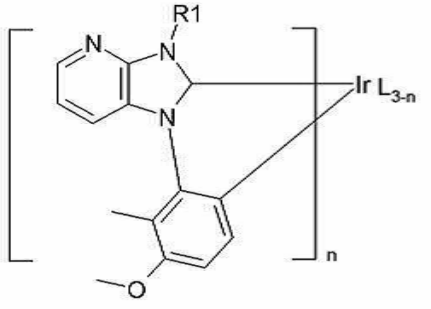
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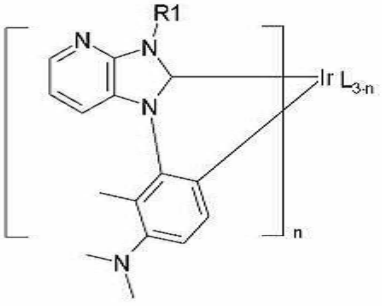
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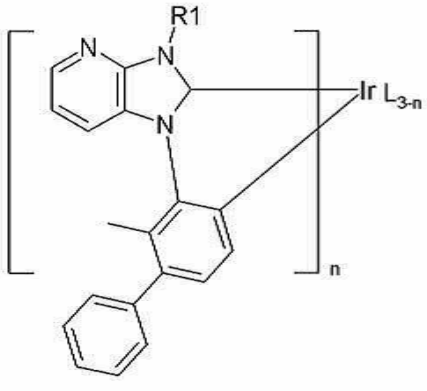
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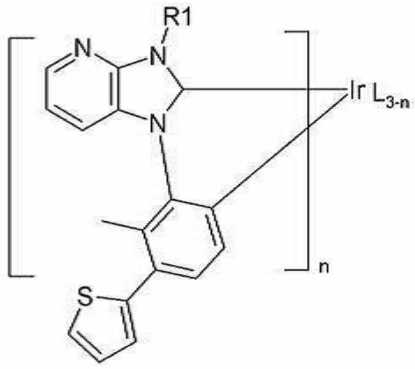
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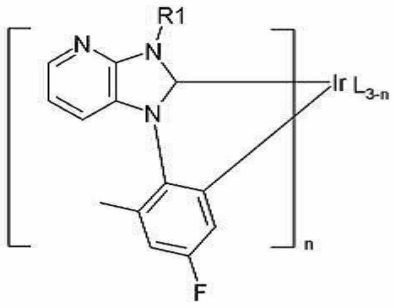
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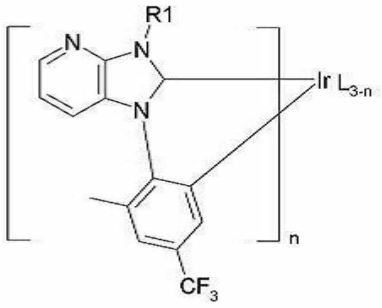
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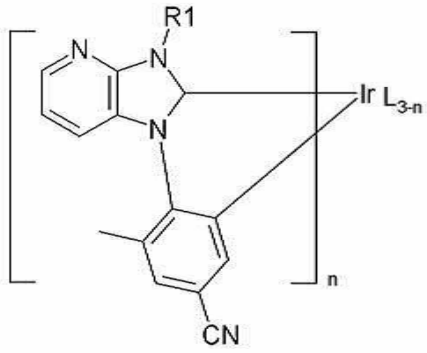
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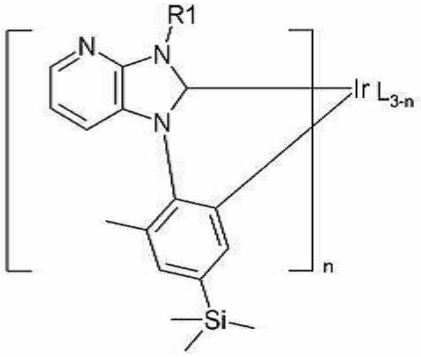
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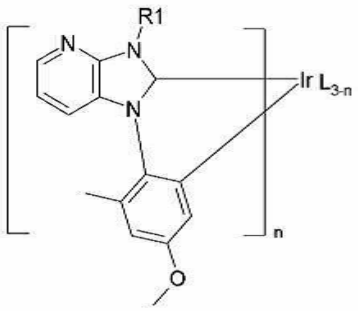
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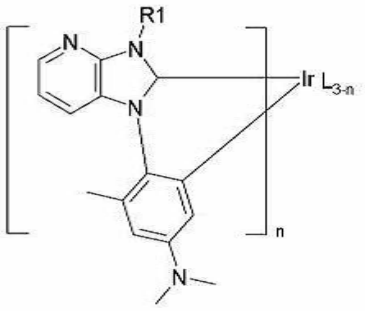
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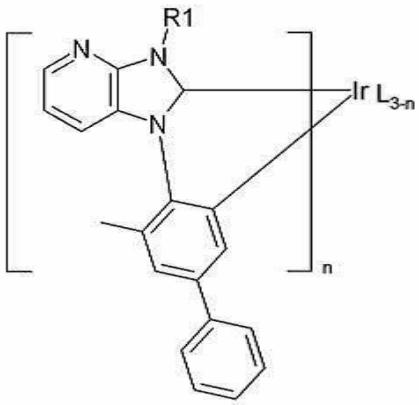
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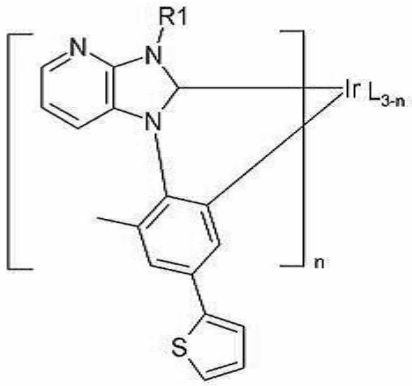
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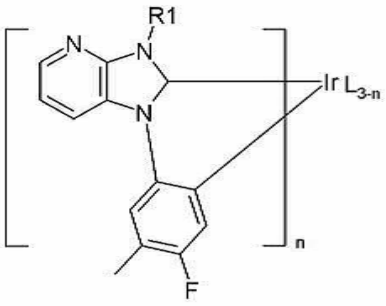
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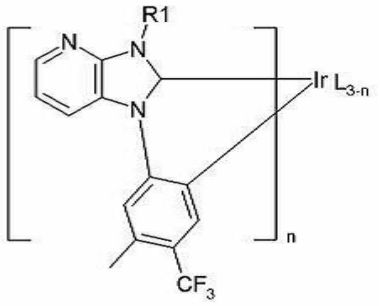
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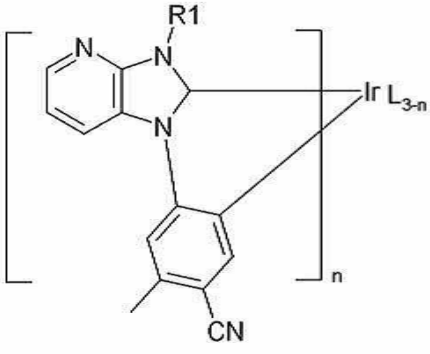
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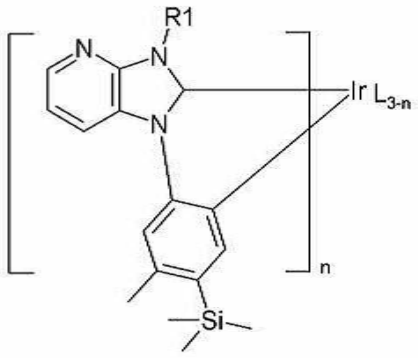
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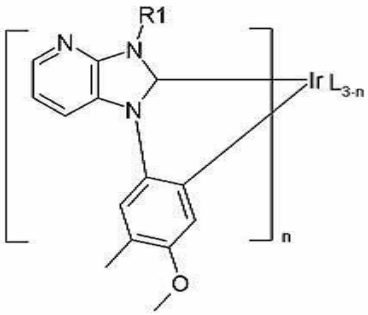
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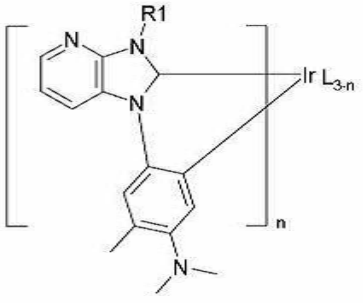
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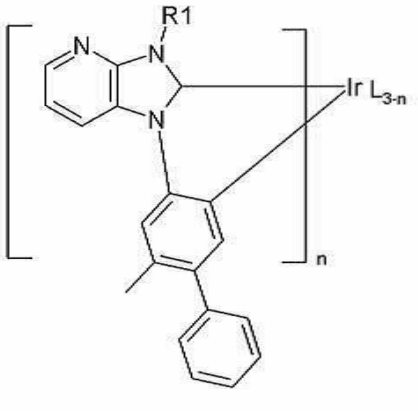
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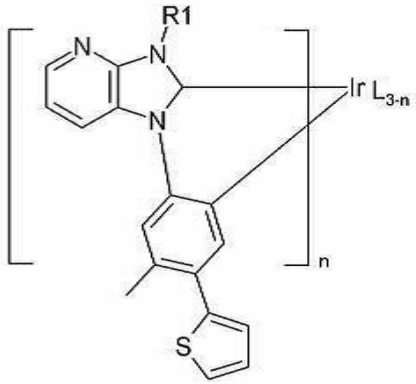
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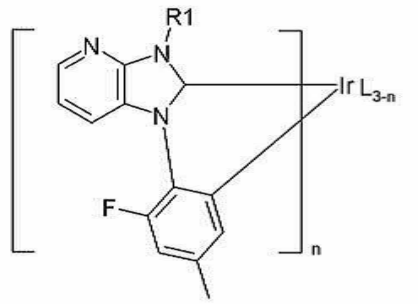
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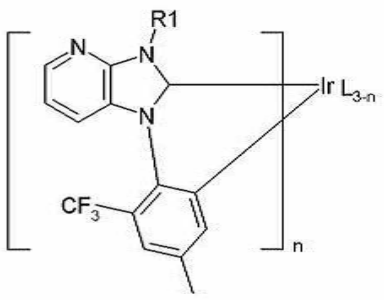
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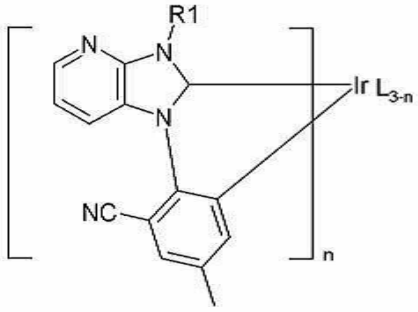
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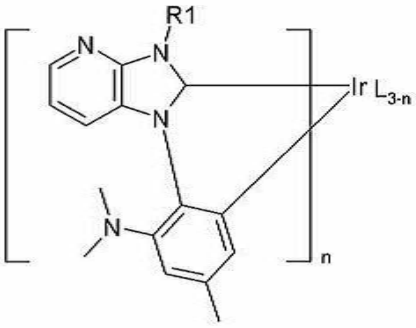
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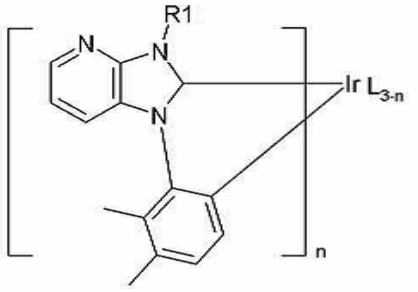
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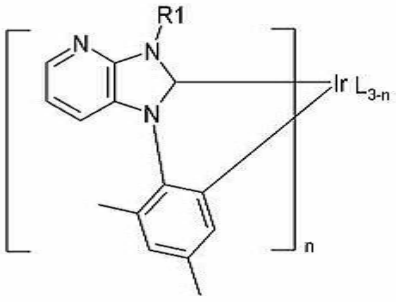
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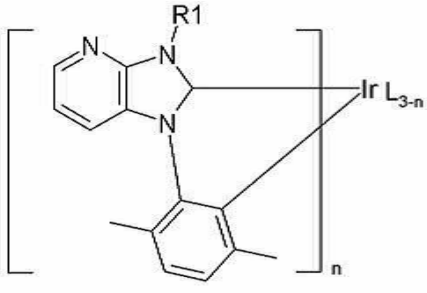
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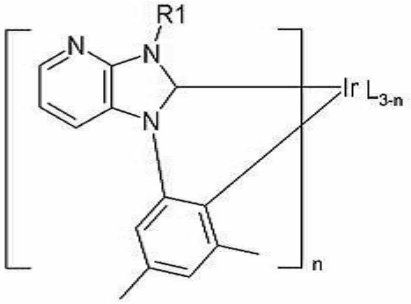
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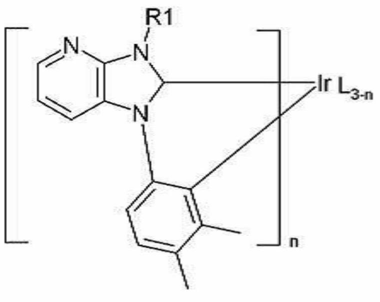

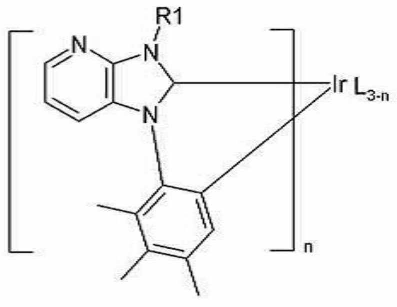

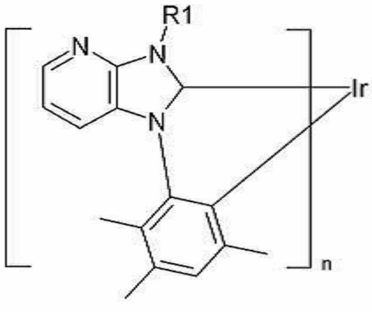

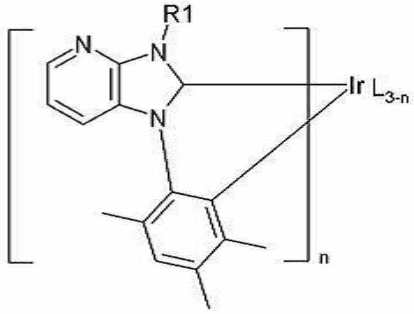

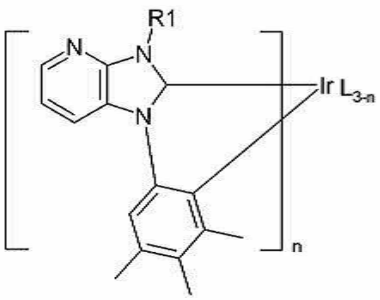

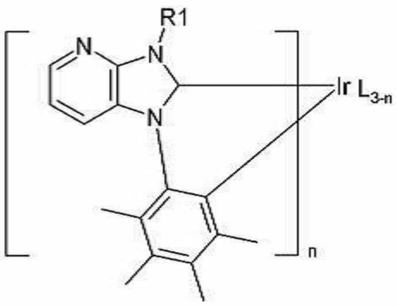

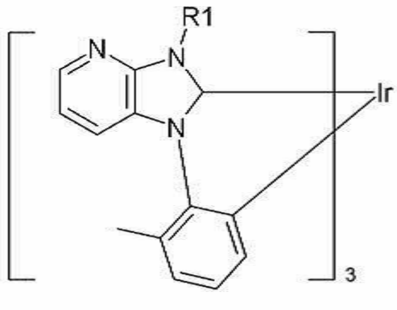

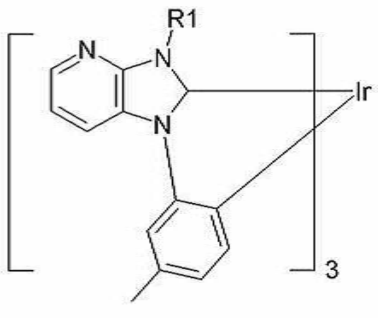

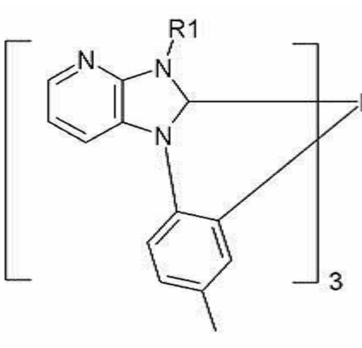

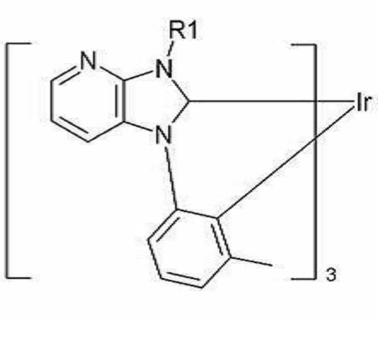

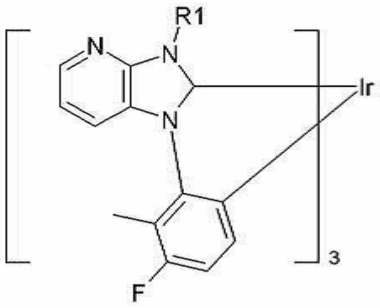
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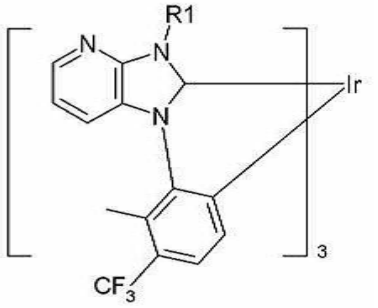
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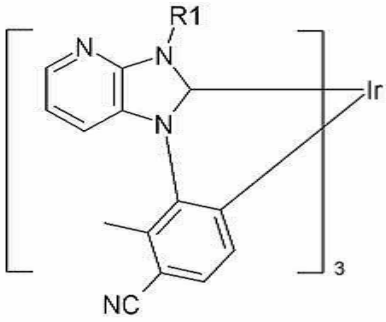
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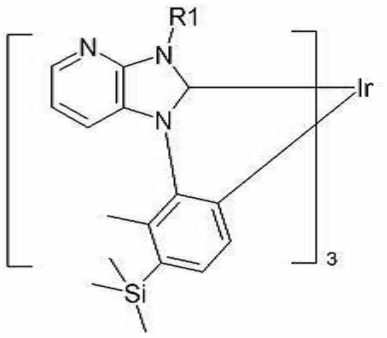
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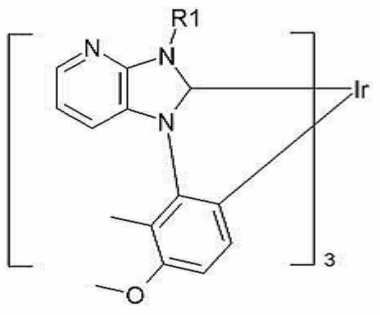
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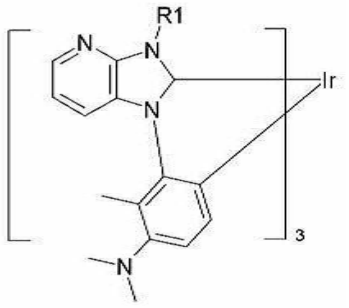
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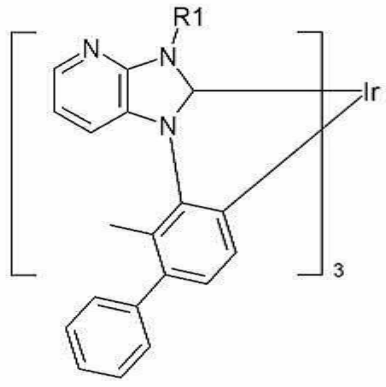
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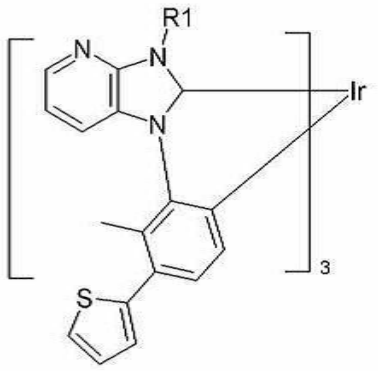
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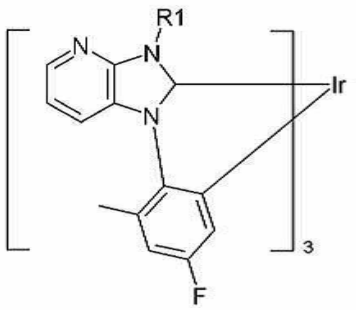
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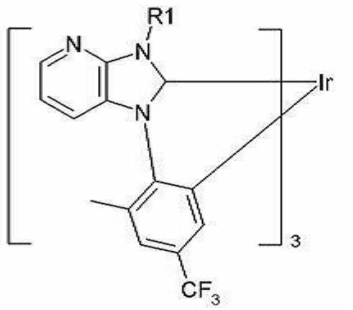
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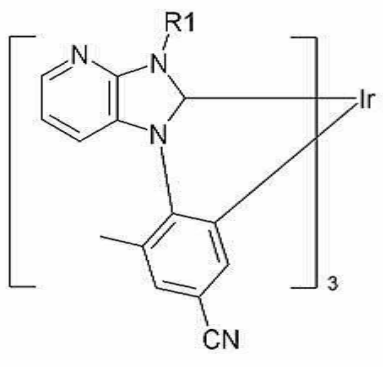
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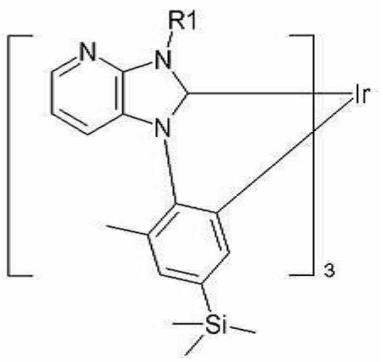
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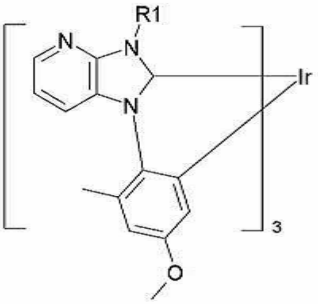
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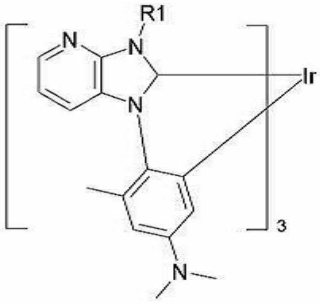
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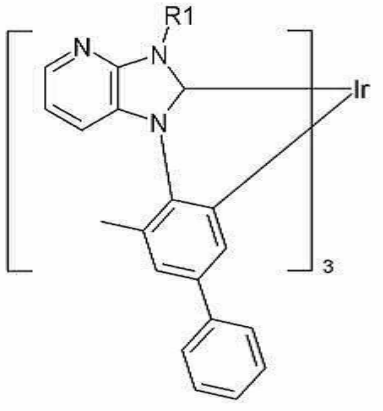
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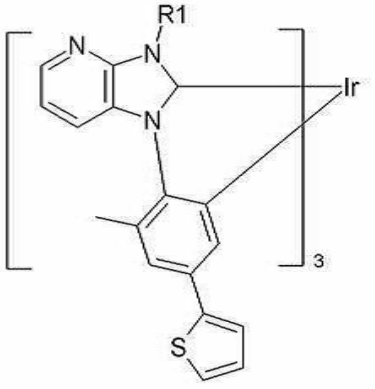
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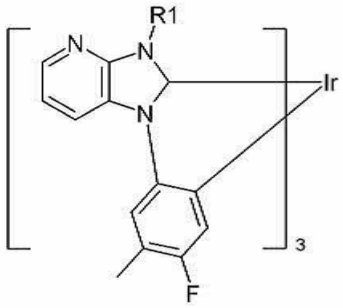
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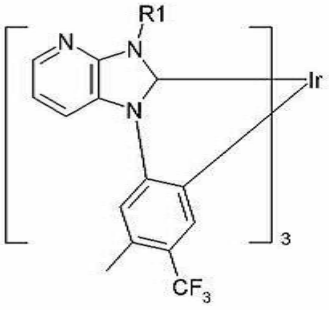
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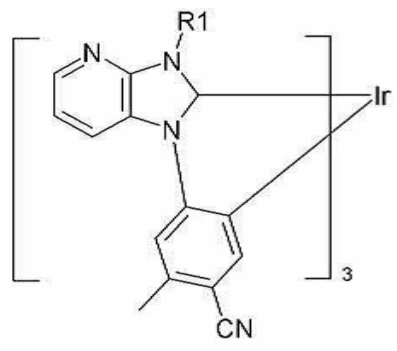
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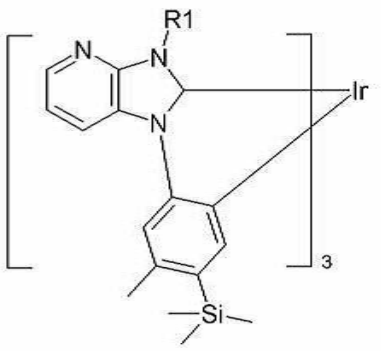
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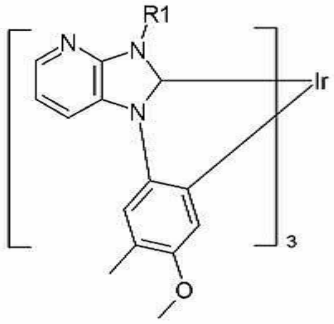
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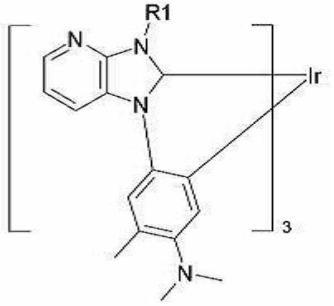
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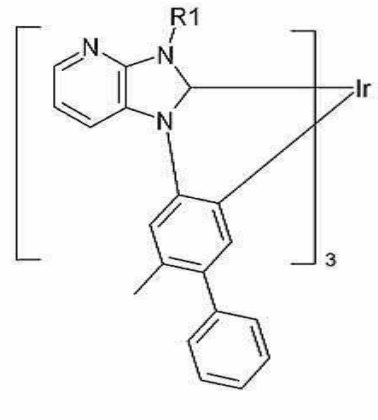
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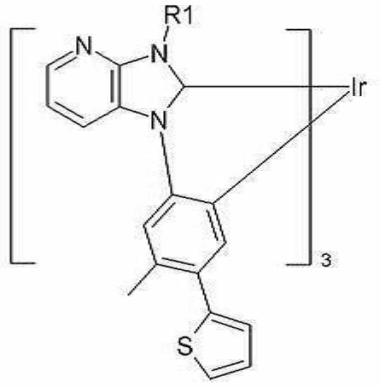
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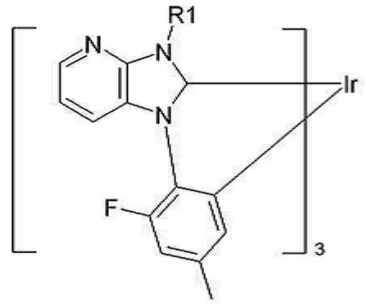
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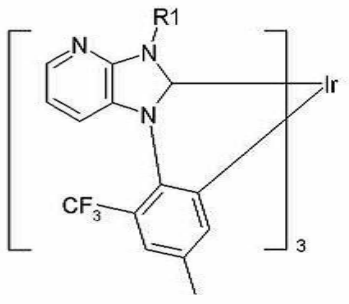
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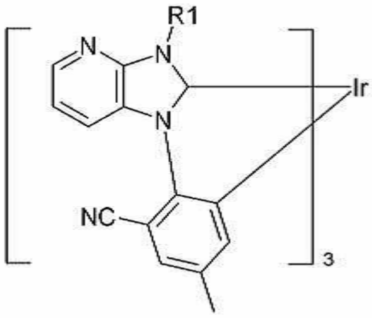
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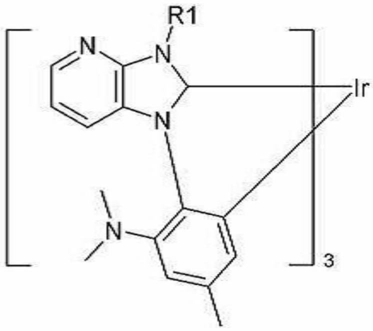
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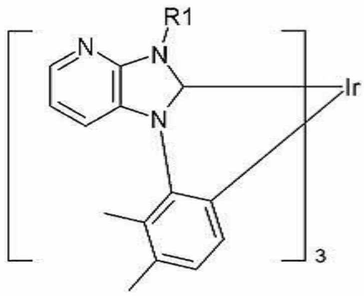
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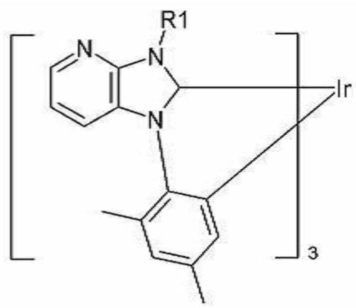
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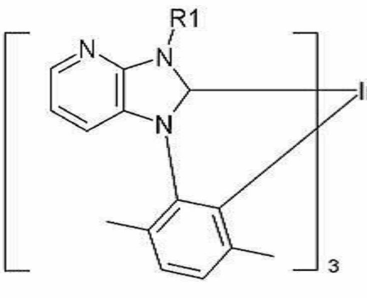
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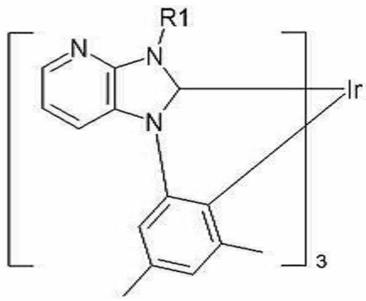
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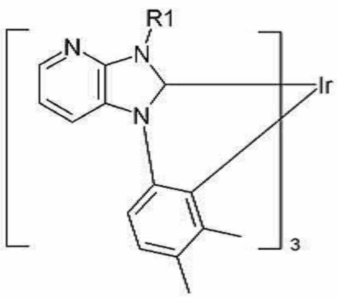
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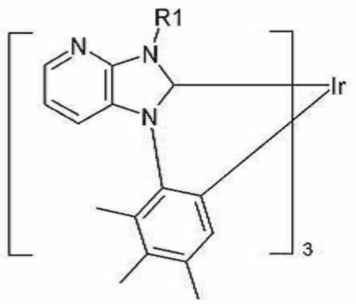
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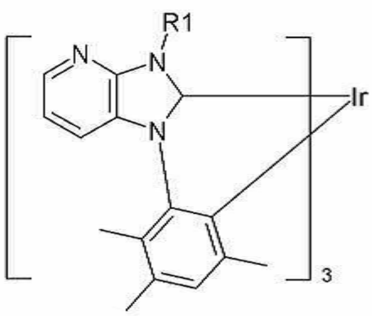
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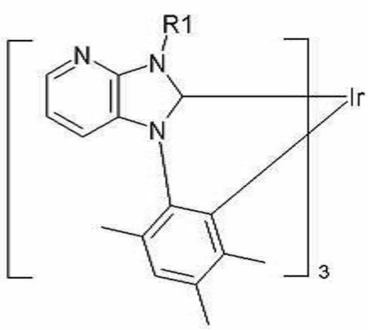
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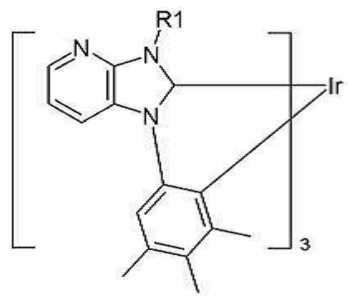
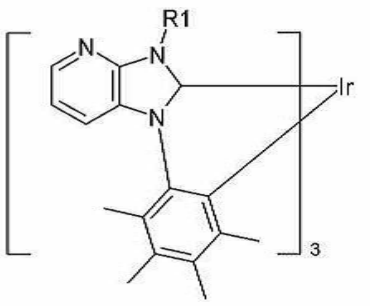
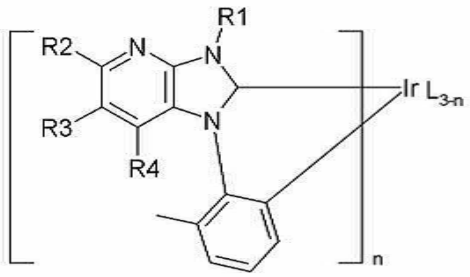
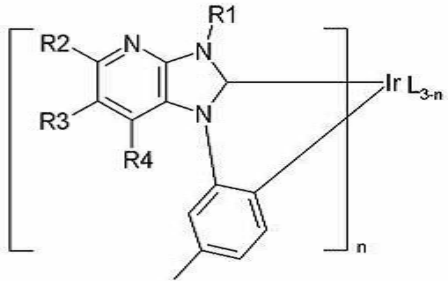
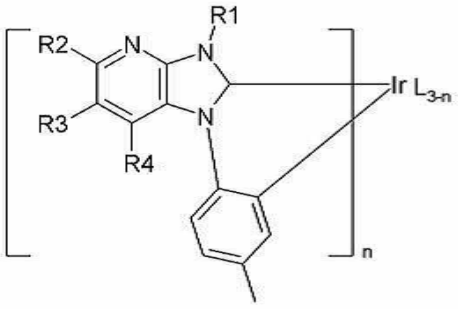
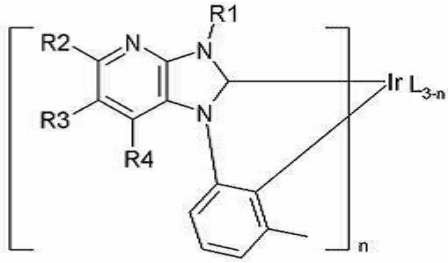
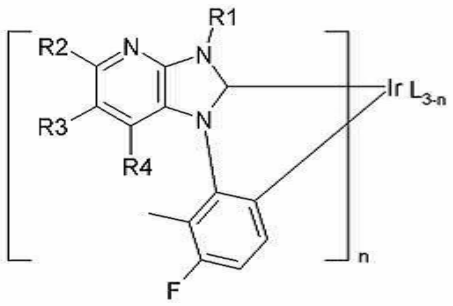
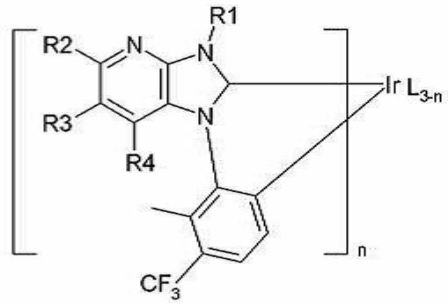
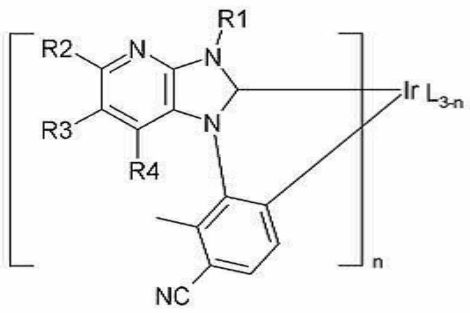
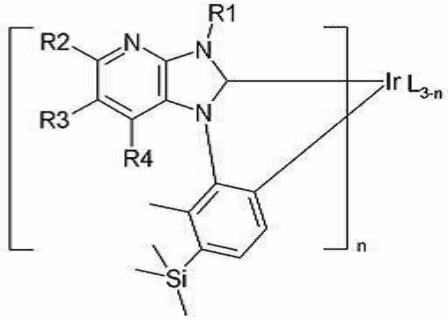
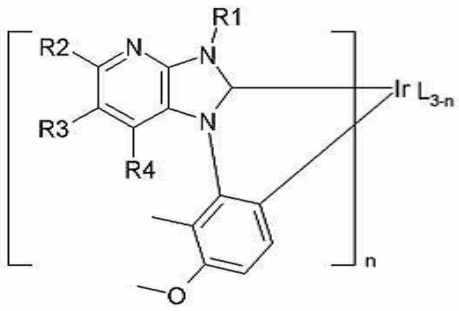



청구항 9

제 4 항에 있어서,

상기 청색 인광 화합물은 하기 물질들 중 어느 하나인 유기전계발광소자.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R4
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n
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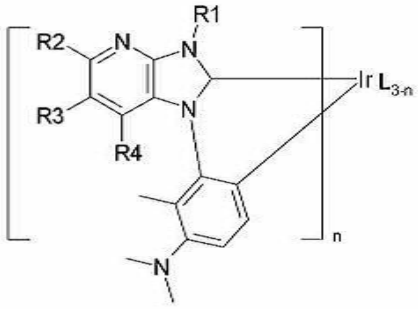
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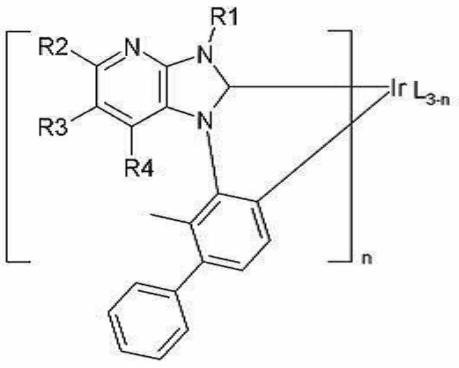
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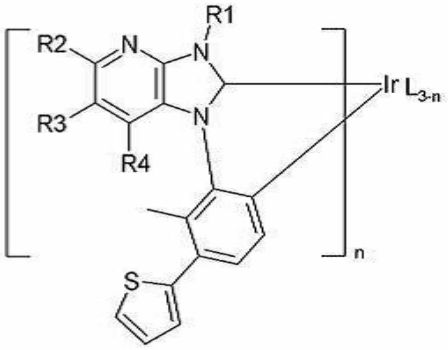
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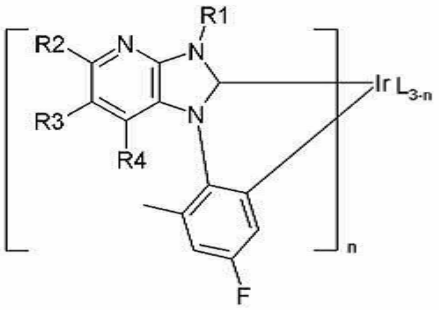
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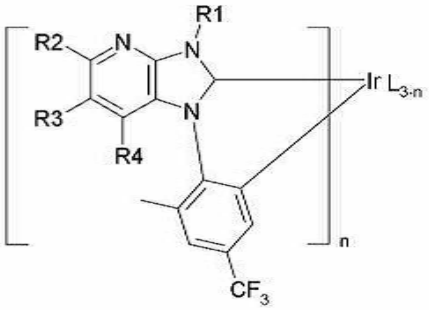
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R3
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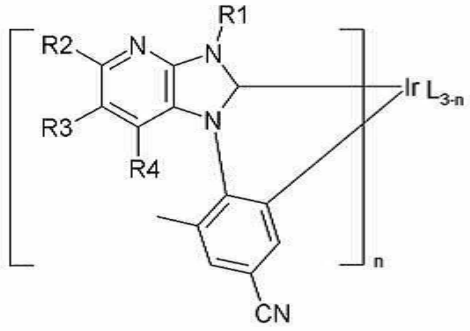
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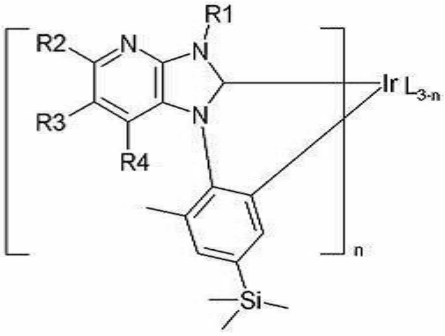
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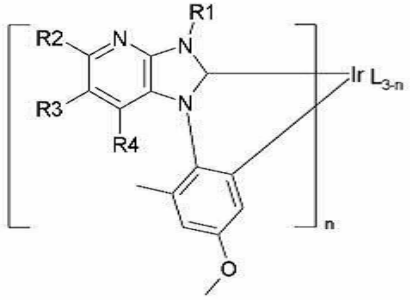
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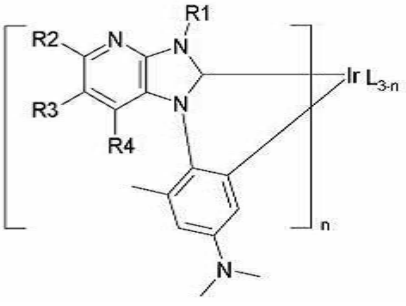
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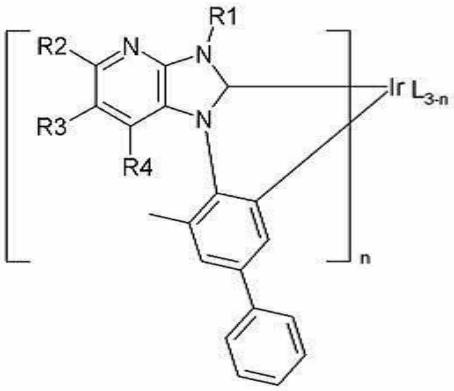
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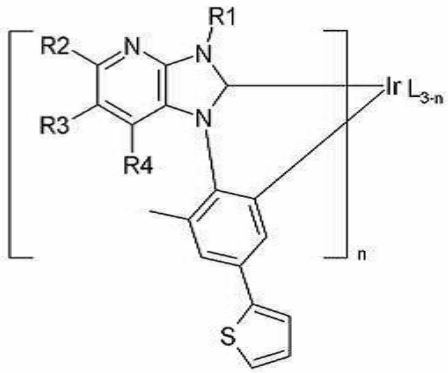
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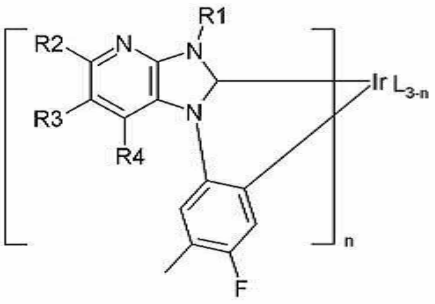
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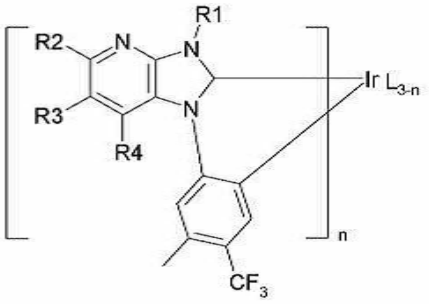
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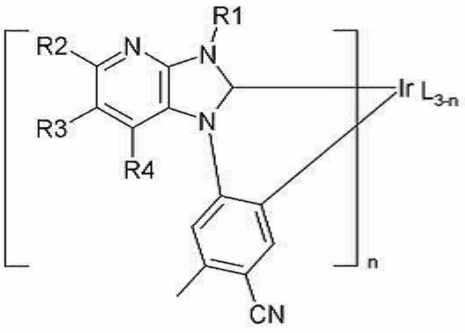
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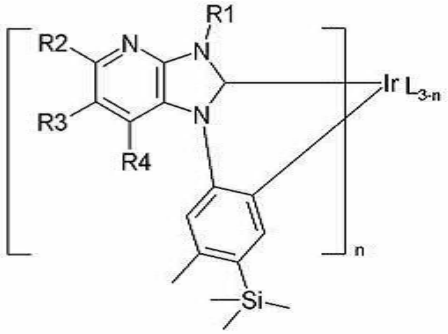
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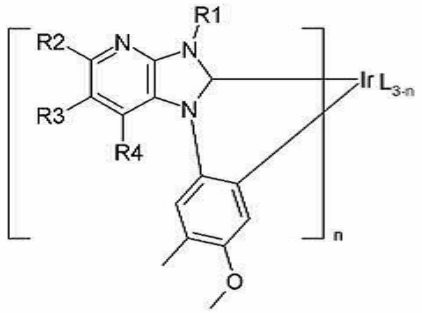
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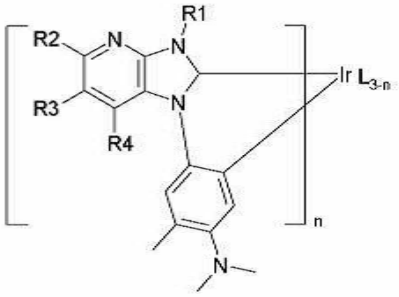
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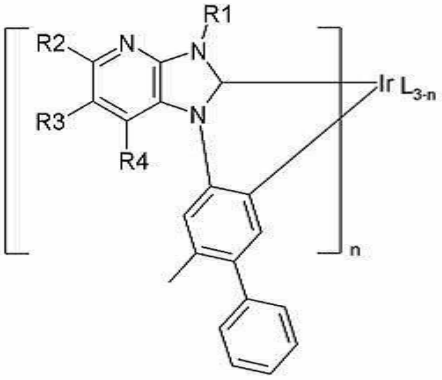
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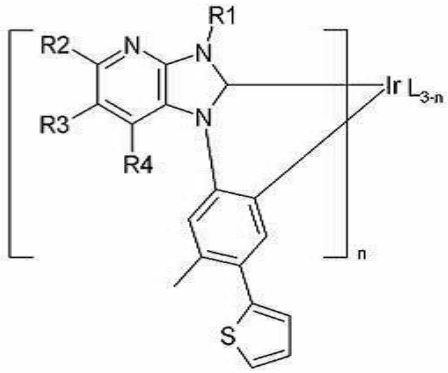
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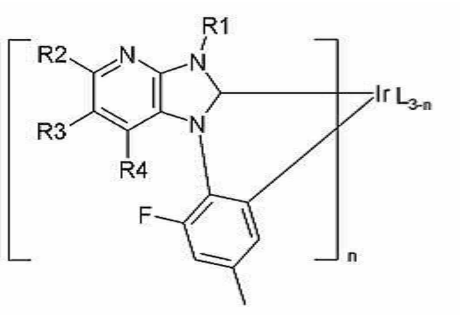
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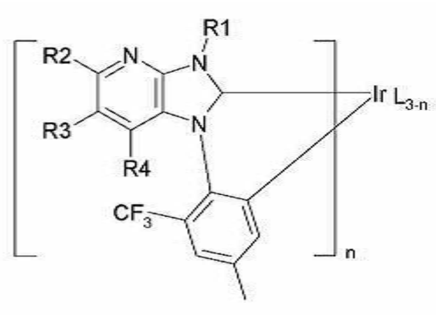
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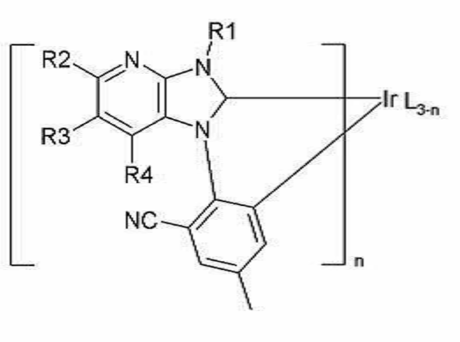
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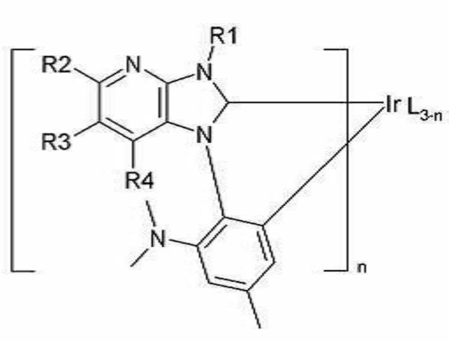
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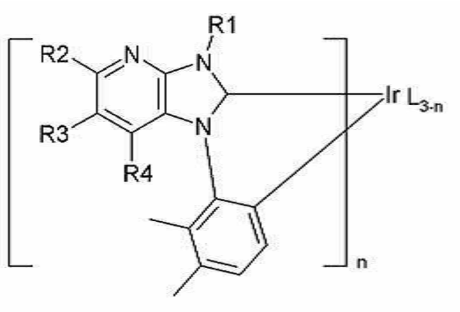
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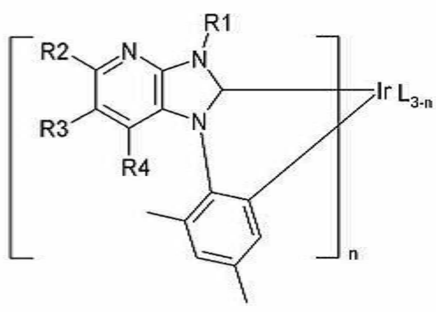
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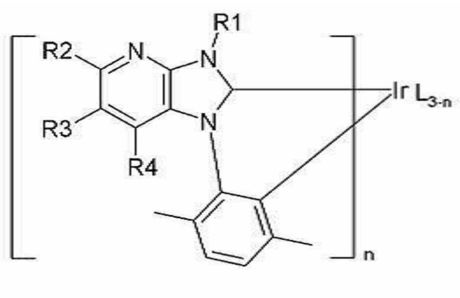
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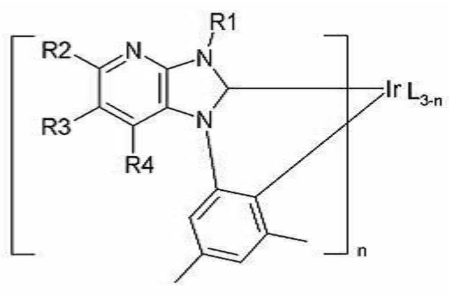
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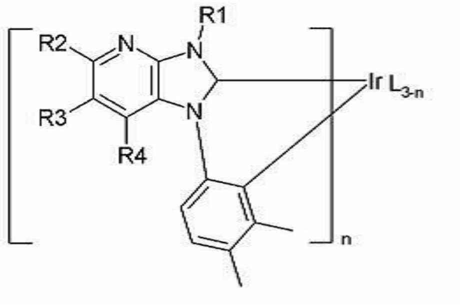
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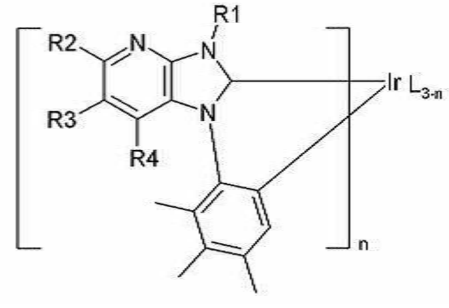
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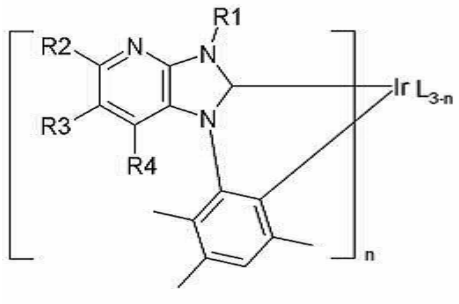
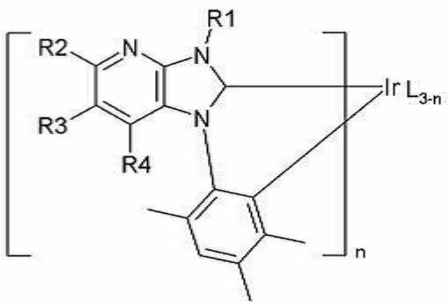
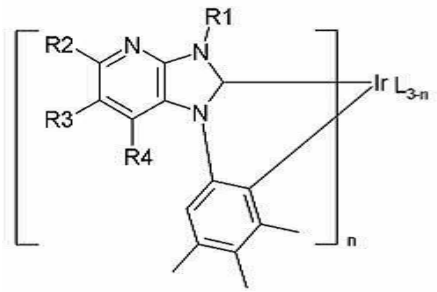
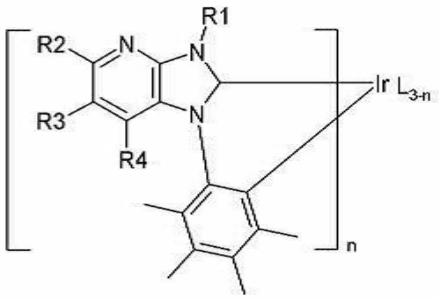
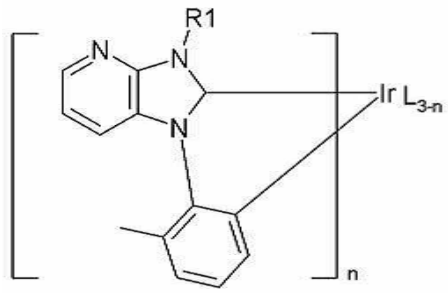
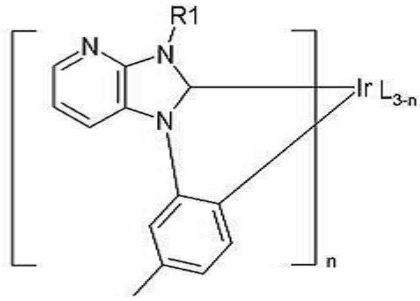
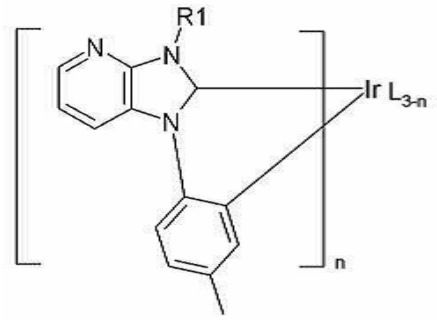
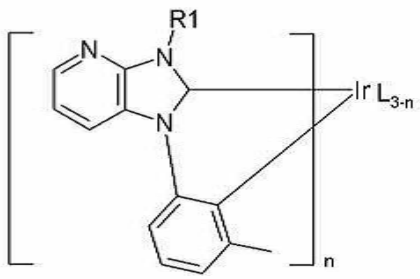
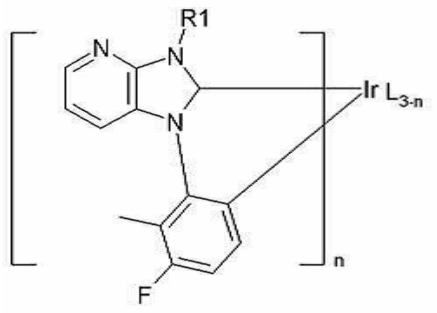
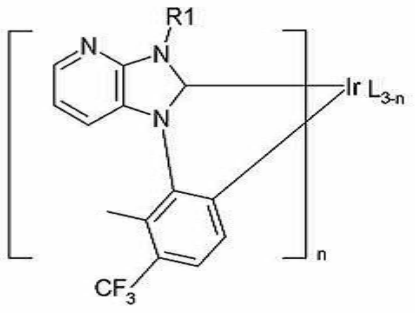

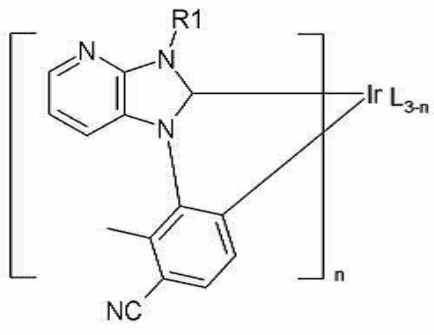
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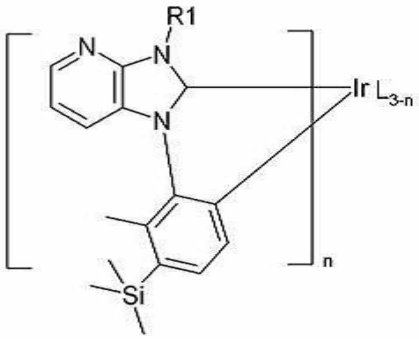
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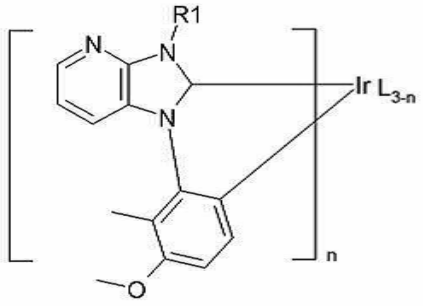
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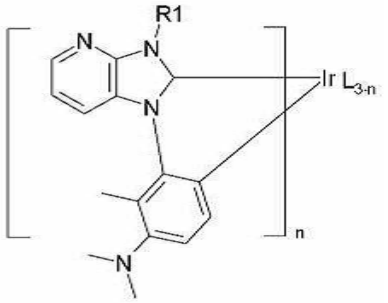
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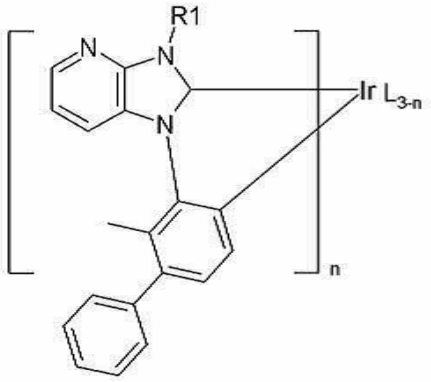
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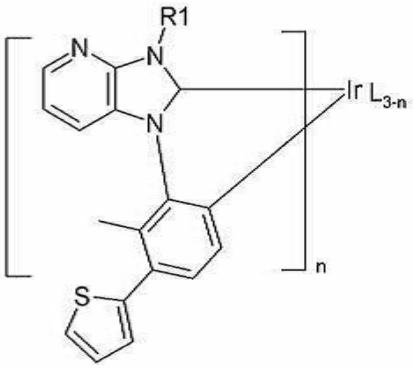
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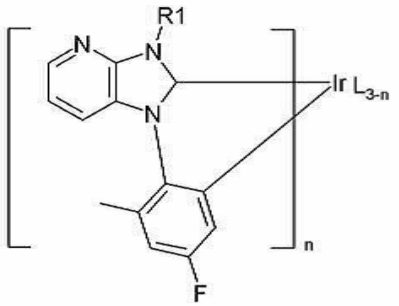
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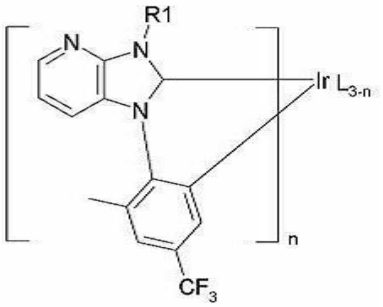
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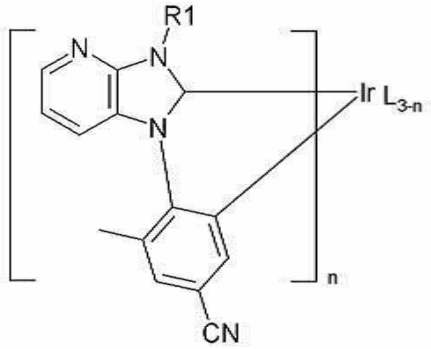
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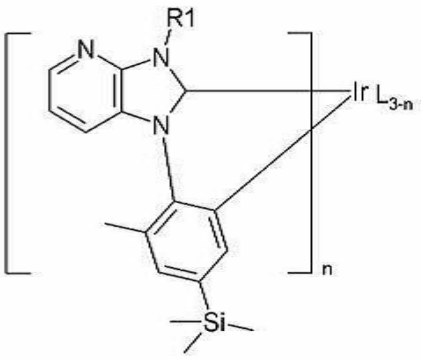
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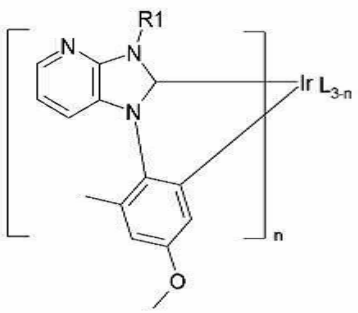
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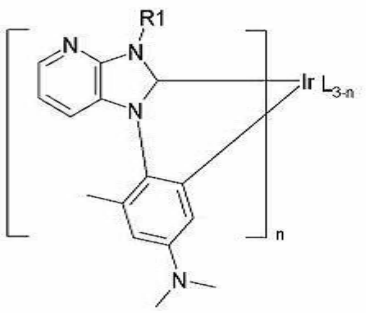
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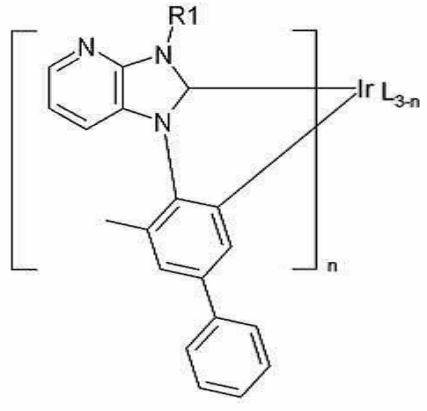
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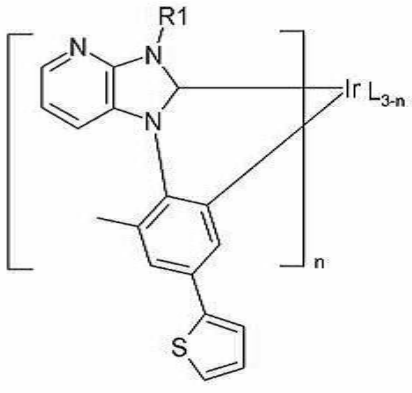
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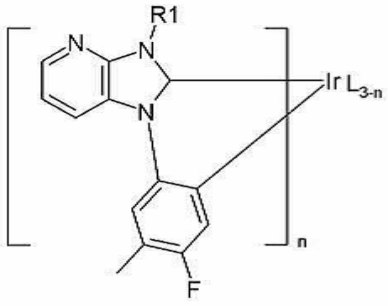
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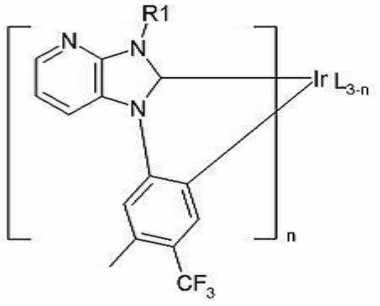
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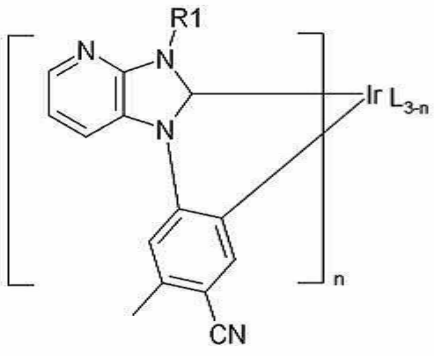
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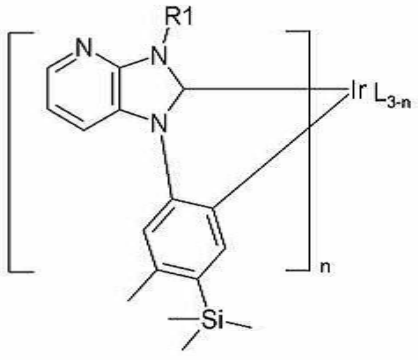
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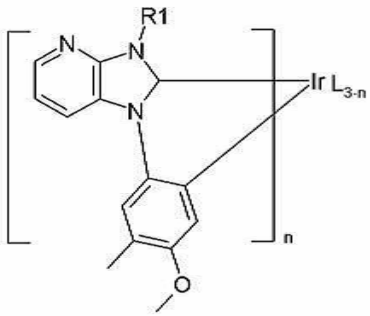
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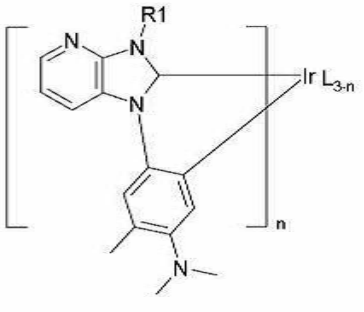
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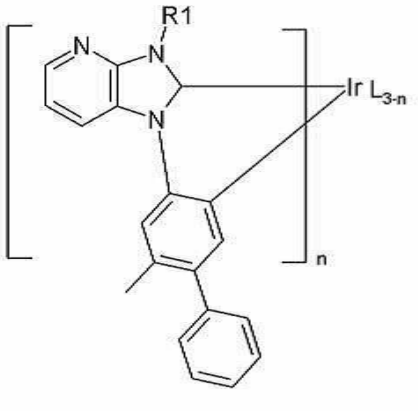
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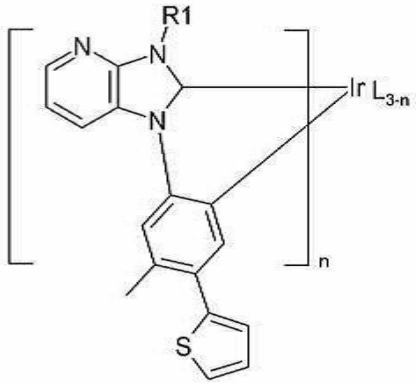
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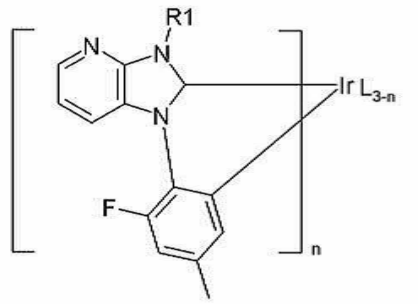
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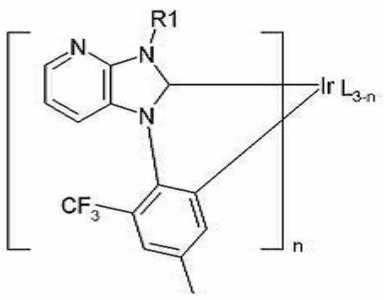
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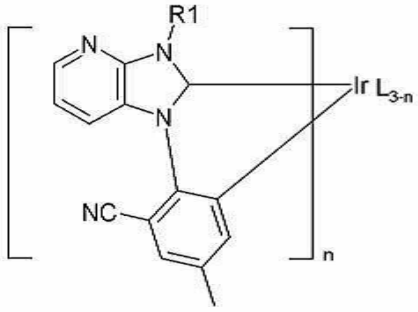
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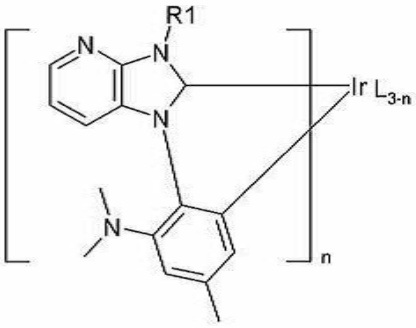
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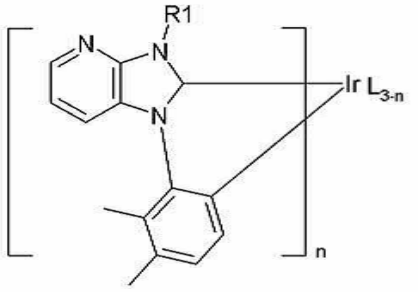
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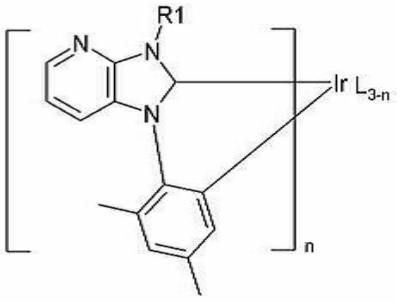
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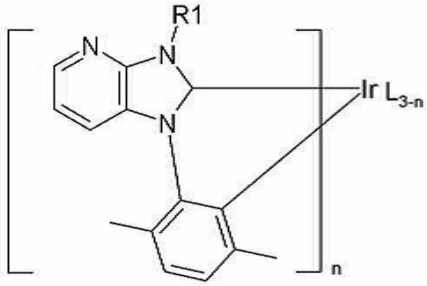
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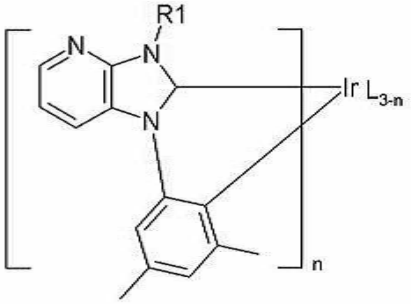
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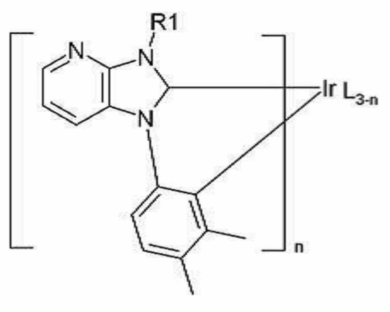
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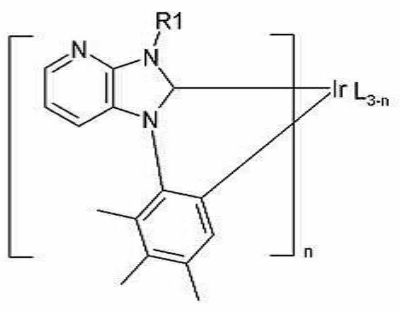
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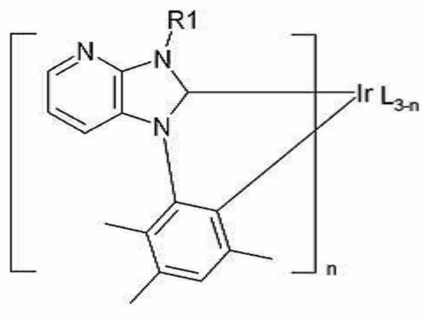
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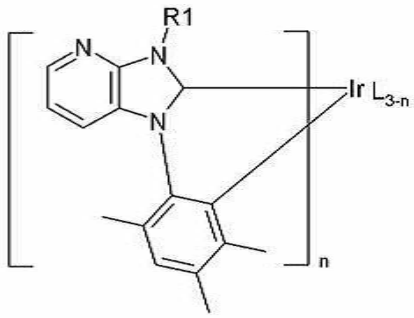
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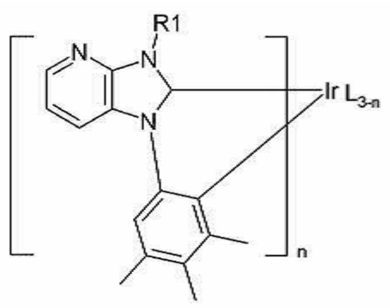
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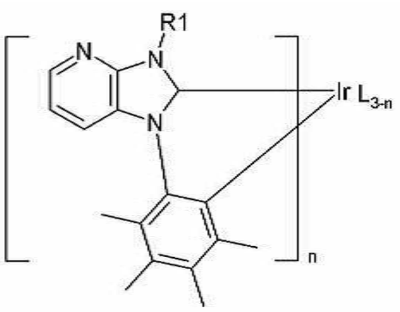
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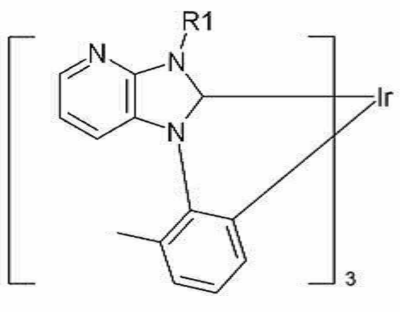
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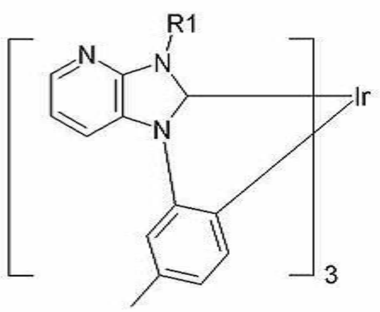
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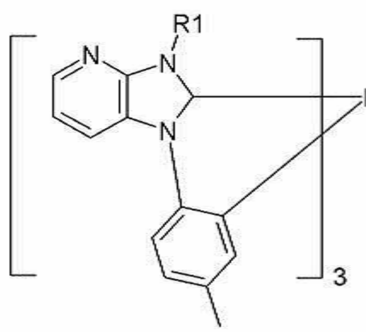
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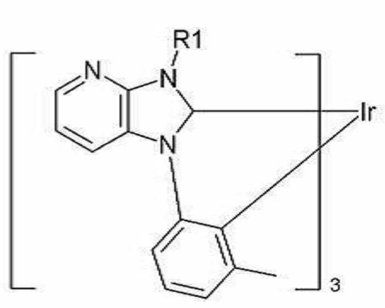
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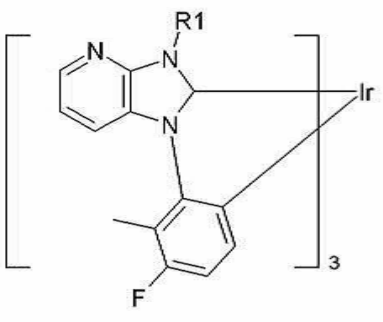
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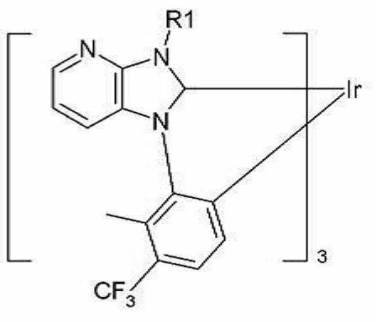
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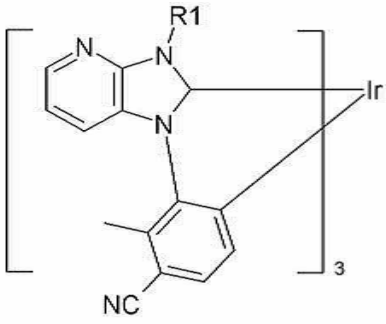
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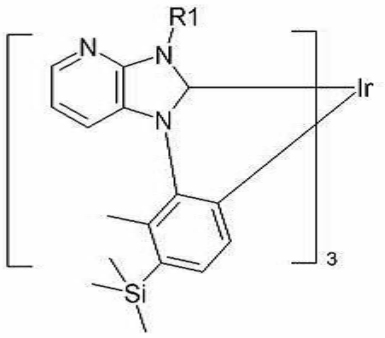
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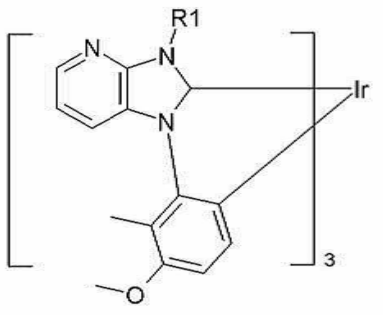
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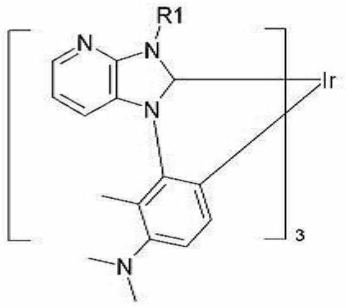
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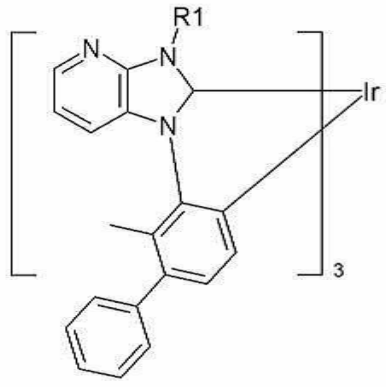
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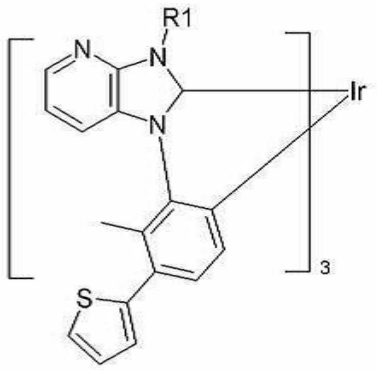
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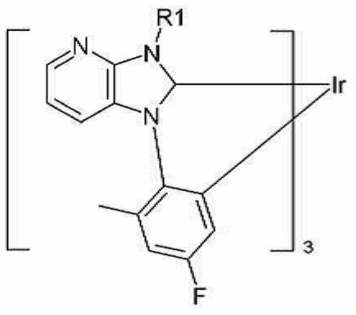
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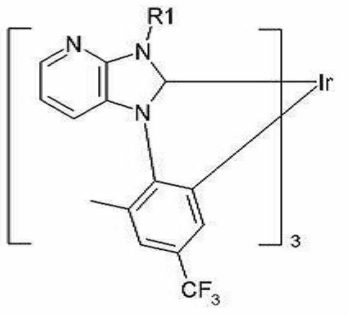
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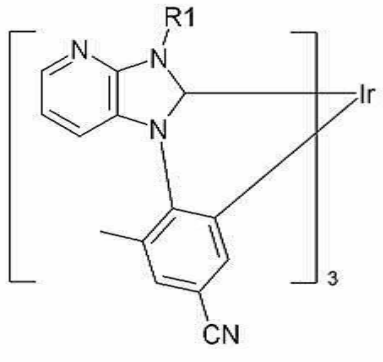
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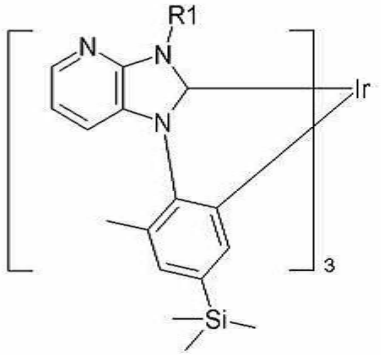
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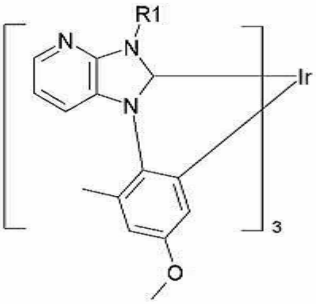
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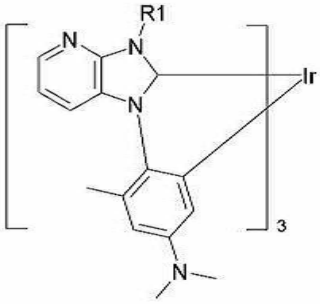
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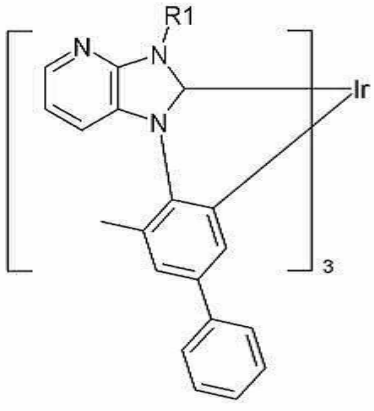
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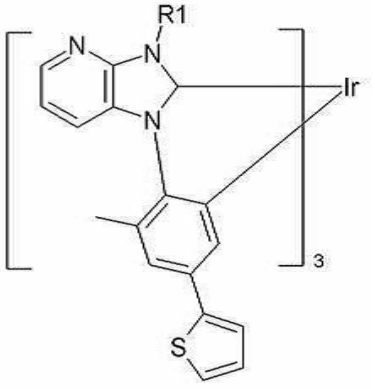
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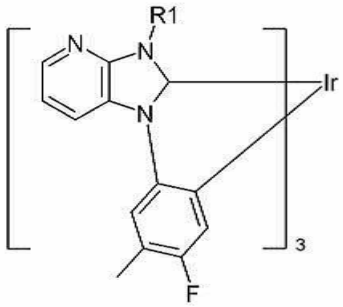
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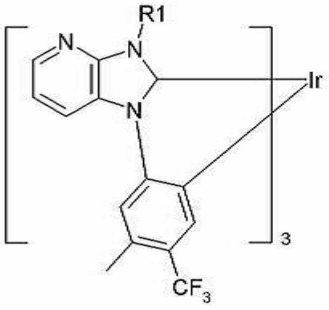
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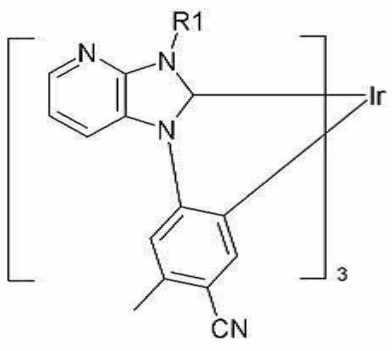
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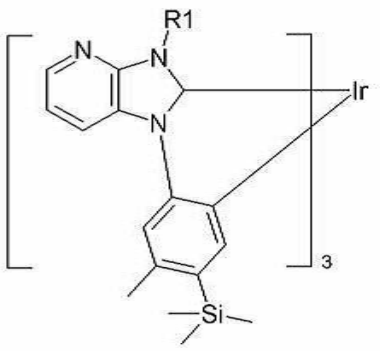
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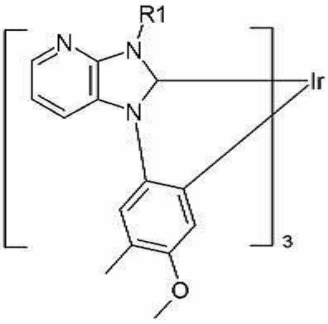
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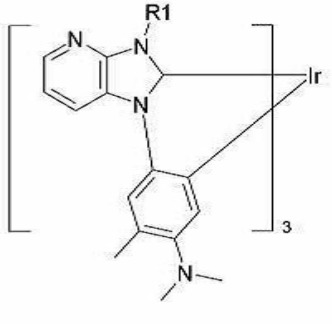
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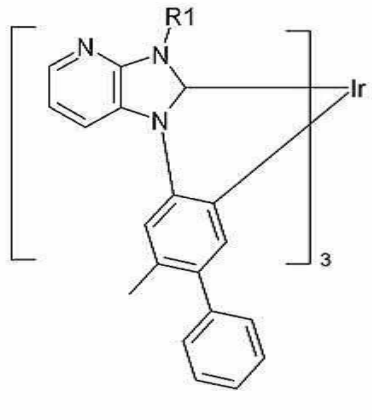
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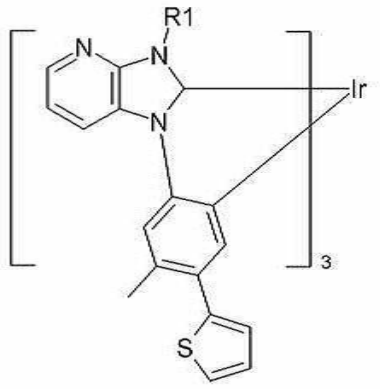
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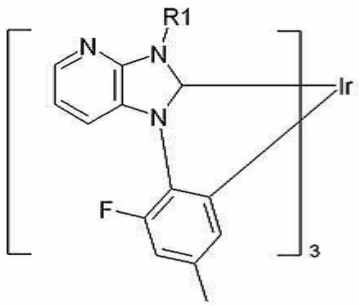
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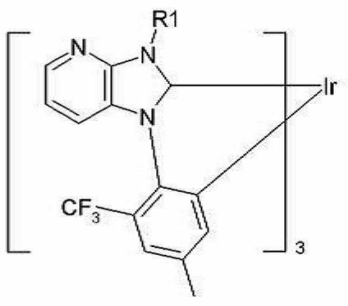
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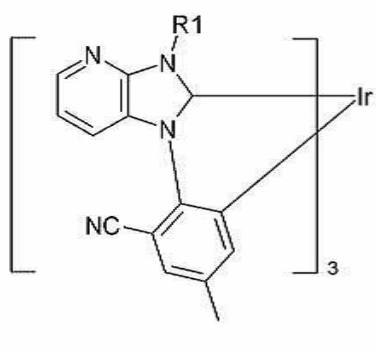
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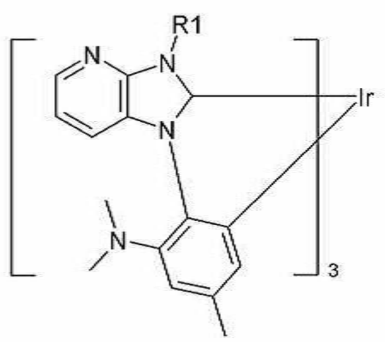
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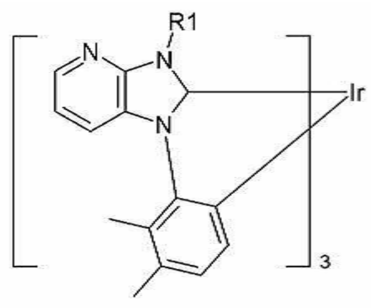
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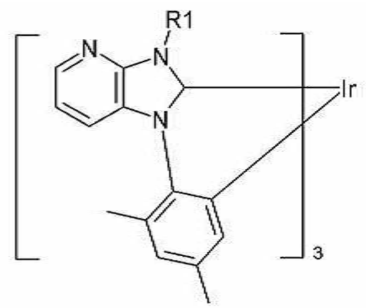
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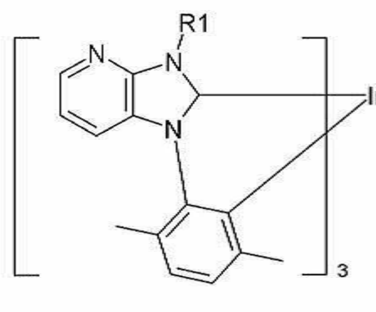
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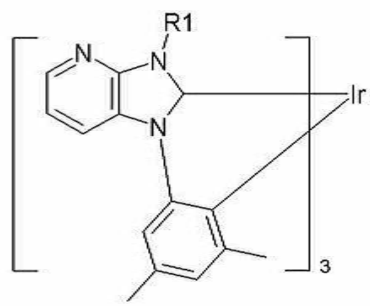
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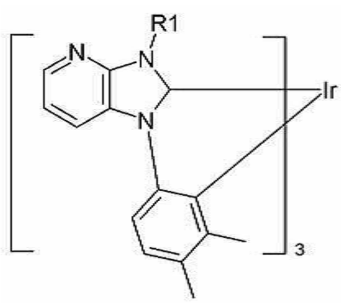
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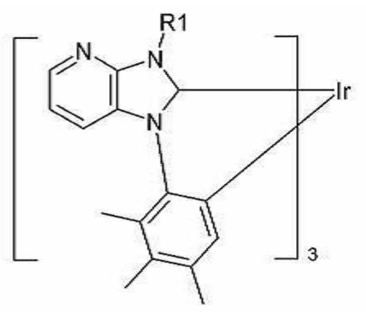
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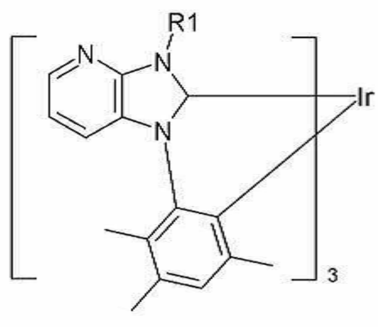
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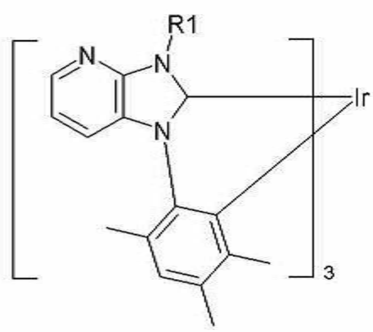
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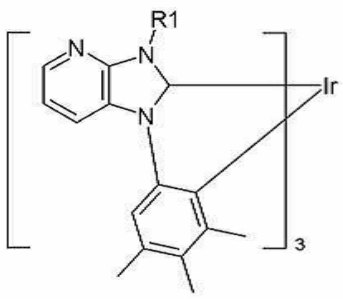
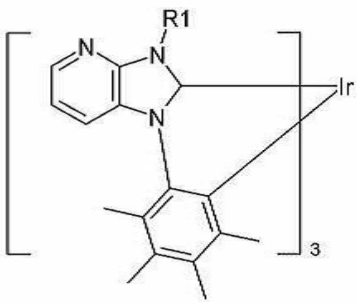




발명의 설명

기 술 분 야

[0001] 본 발명은 청색 인광 화합물에 관한 것으로, 특히 높은 색순도를 갖는 청색 인광 화합물 및 이를 포함하여 고품질의 영상을 제공할 수 있는 유기전계발광소자에 관한 것이다.

배 경 기 술

[0002] 최근 표시장치의 대형화에 따라 공간 점유가 적은 평면표시소자의 요구가 증대되고 있는데, 이러한 평면표시소자 중 하나로서 유기발광다이오드(organic light emitting diode: OLED)라고도 불리는 유기전계발광소자의 기술이 빠른 속도로 발전하고 있으며, 이미 여러 시제품들이 발표된 바 있다.

[0003] 유기 전계 발광 소자는 전자 주입 전극(음극)과 정공 주입 전극(양극) 사이에 형성된 발광물질층에 전하를 주입하면 전자와 정공이 쌍을 이룬 후 소멸하면서 빛을 내는 소자이다. 플라스틱 같은 휠 수 있는(flexible) 투명 기판 위에도 소자를 형성할 수 있을 뿐 아니라, 플라즈마 디스플레이 패널(Plasma Display Panel)이나 무기 전계발광(EL) 디스플레이에 비해 낮은 전압에서 (10V이하) 구동이 가능하고, 또한 전력 소모가 비교적 적으며, 색순도가 뛰어나다는 장점이 있다. 또한 유기 전계 발광(EL) 소자는 녹색, 청색, 적색의 3가지 색을 나타낼 수가 있어 차세대 풍부한 색 디스플레이 소자로 많은 사람들의 많은 관심의 대상이 되고 있다. 여기서 유기전계발광소자를 제작하는 과정을 간단히 살펴보면,

[0004] (1) 먼저, 투명기판 위에 인듐-틴-옥사이드(indium tin oxide; ITO)와 같은 물질을 증착하여 양극(anode)을 형성한다.

[0005] (2) 상기 양극 상에 정공주입층(HIL:hole injecting layer)을 형성한다. 정공주입층은 주로 하기 화학식1-1로 표시되는 4,4'-bis[N-[4-{N,N-bis(3-methylphenyl)amino}phenyl]-N-phenylamino]biphenyl (DNTPD)를 10nm 내지 30nm 두께로 증착하여 형성된다.

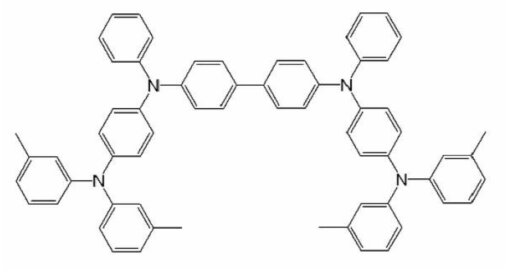
[0006] (3) 다음, 상기 정공주입층 상에 정공수송층(HTL: hole transport layer)을 형성한다. 이러한 정공수송층은 하기 화학식1-2로 표시되는 4,4'-bis[N-(1-naphtyl)-N-phenylamino]-biphenyl (NPB)을 30nm 내지 60nm 정도 증착하여 형성된다.

[0007] (4) 다음, 상기 정공수송층 상에 발광물질층 (EML: emitting material layer)을 형성한다. 이때 필요에 따라 도펀트(dopant)를 첨가한다. 예를 들어, 하기 화학식1-3으로 표시되는 Bis(N-carbazolyl)biphenyl (CBP)에 하기 화학식1-4로 표시되는 인광 적색 Dopant Bis(2-phenylquinoline)(acetylacetonate) iridium(III) (Ir(phq)2acac)를 도핑하여 적색 발광물질층을 형성하고, 하기 화학식1-5로 표시되는 1,3-bis(9H-carbazol-9-yl)benzene (mCP)에 하기 화학식1-6으로 표시되는 FIrpic을 도핑하여 청색 발광물질층을 형성한다.

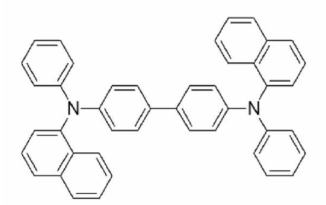
[0008] (5) 다음, 상기 발광물질층 상에 전자수송층(ETL:electron transport layer) 및 전자주입층(EIL: electron injecting layer)을 연속적으로 형성한다.

[0009] (6) 다음, 상기 전자주입층 상에 음극(cathode)을 형성하고, 마지막으로 상기 음극 상에 보호막을 형성한다.

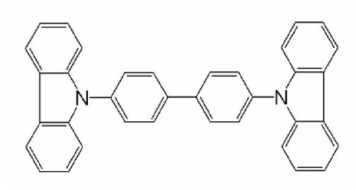
[0010] 화학식1-1

[0011] 

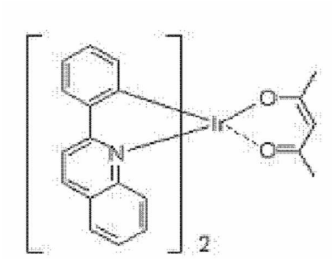
[0012] 화학식1-2

[0013] 

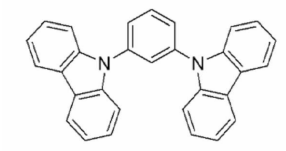
[0014] 화학식1-3

[0015] 

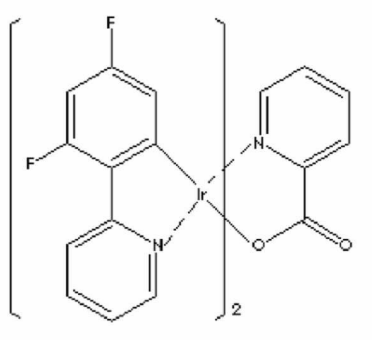
[0016] 화학식1-4

[0017] 

[0018] 화학식1-5

[0019] 

[0020] 화학식1-6

[0021] 

[0022] 최근에는 발광물질층에 형광 물질보다 인광 물질이 많이 사용되는 추세이다. 형광 물질의 경우 발광물질층에서 형성되는 엑시톤 중에 약 25%의 단일항만이 빛을 만드는 데 사용되고 75%의 삼중항은 대부분 열로 소실되는 반면, 인광 물질은 단일항과 삼중항 모두를 빛으로 전환시키는 발광 메커니즘을 가지고 있기 때문이다. 인광 화합물은 일반적으로 유기물의 중심부에 이리듐(Ir)과 같은 무거운 원소(heavy atom)를 포함하며 삼중항에서 단일항으로의 전자 전이 확률이 높다.

[0023] 그러나, 전술한 FIrpic과 같은 청색 인광 화합물의 경우 색순도가 디스플레이 장치에 적합한 수준에 이르지 못한다. 따라서, 높은 색순도를 갖는 새로운 청색 인광 화합물의 개발이 필요하다.

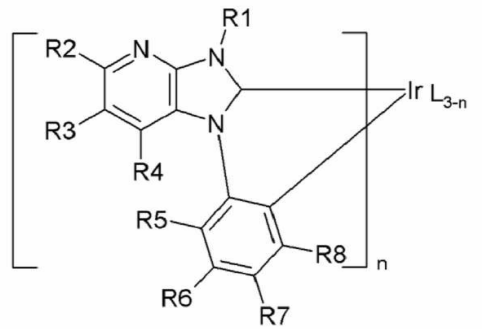
발명의 내용

해결하려는 과제

[0024] 본 발명은 고색순도의 청색 인광 화합물을 제공하여 고품질의 영상을 구현할 수 있는 유기전계발광소자를 제공하고자 한다.

과제의 해결 수단

[0025] 위와 같은 과제의 해결을 위해, 본 발명은 하기 화학식으로 표시되는 청색 인광 화합물을 제공한다.

[0026] 

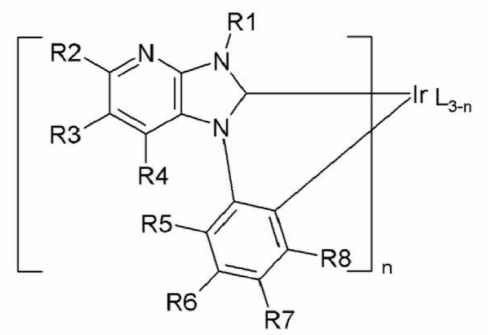
[0027] (R1은 C1 내지 C6의 알킬기, C6 이상의 치환 또는 비치환된 방향족 그룹, C5 이상의 치환 또는 비치환된 이형고리 그룹으로부터 선택되고, R2 내지 R8 각각은 수소, 할로겐, 시아노기, 트리플루오로메틸기, C1 내지 C6의 알킬기, C1 내지 C6의 알콕시기, 실릴기, C6 이상의 치환 또는 비치환된 방향족 그룹, C5 이상의 치환 또는 비치환된 이형고리 그룹, C1 내지 C6의 아민기, C6 이상의 방향족 그룹이 치환된 아민기, C5 이상의 이형고리 그룹이 치환된 아민기로부터 선택되고, L은 두자리 결합 리간드이며, n은 1 내지 3이다.)

[0028] 상기 R5 내지 R8 중 적어도 하나는 메틸기인 것을 특징으로 한다.

[0029] 상기 실릴기는 C1 내지 C6의 알킬기 또는 C6 이상의 치환 또는 비치환된 방향족 그룹으로 치환되는 것을 특징으

로 한다.

[0030] 다른 관점에서, 본 발명은 제 1 전극과; 상기 제 1 전극과 마주보는 제 2 전극과; 상기 제 1 및 제 2 전극 사이에 위치하는 발광물질층을 포함하고, 상기 발광물질층은 하기 화학식으로 표시되는 청색 인광 화합물을 포함하여 이루어지는 것이 특징인 유기전계발광소자를 제공한다.



[0031]

[0032] (R1은 C1 내지 C6의 알킬기, C6 이상의 치환 또는 비치환된 방향족 그룹, C5 이상의 치환 또는 비치환된 이형고리 그룹으로부터 선택되고, R2 내지 R8 각각은 수소, 할로겐, 시아노기, 트리플루오로메틸기, C1 내지 C6의 알킬기, C1 내지 C6의 알콕시기, 실릴기, C6 이상의 치환 또는 비치환된 방향족 그룹, C5 이상의 치환 또는 비치환된 이형고리 그룹, C1 내지 C6의 아민기, C6 이상의 방향족 그룹이 치환된 아민기, C5 이상의 이형고리 그룹이 치환된 아민기로부터 선택되고, L은 두자리 결합 리간드이며, n은 1 내지 3이다.)

[0033] 상기 제 1 전극과 상기 발광물질층 사이에 위치하는 정공주입층과; 상기 정공주입층과 상기 발광물질층 사이에 위치하는 정공수송층과; 상기 발광물질층과 상기 제 2 전극 사이에 위치하는 전자주입층과; 상기 전자주입층과 상기 발광물질층 사이에 위치하는 전자수송층을 포함하는 것을 특징으로 한다.

[0034] 상기 R5 내지 R8 중 적어도 하나는 메틸기인 것을 특징으로 한다.

[0035] 상기 실릴기는 C1 내지 C6의 알킬기 또는 C6 이상의 치환 또는 비치환된 방향족 그룹으로 치환되는 것을 특징으로 한다.

발명의 효과

[0036] 본 발명의 청색 인광 화합물은 카르벤 화합물을 리간드로 이용하는 이리듐 착물을 제공하여 색순도를 높이고자 한다.

[0037] 또한, 리간드의 벤젠링에는 적어도 하나의 메틸기가 치환되어 스펙트럼을 쉬프트시킴으로써, 발광효율을 향상시킬 수 있다.

[0038] 위와 같은 청색 인광 화합물을 이용한 유기전계발광소자는 색순도 향상에 의해 고품질의 영상 구현이 가능하고, 발광효율 향상에 의해 소비 전력이 감소되는 효과를 갖는다.

도면의 간단한 설명

[0039] 도 1은 본 발명의 실시예에 따른 청색 인광 도펀트의 자외선-가시광선(UV/vis.) 스펙트럼 및 PL 스펙트럼이다.

도 2는 본 발명의 실시예에 따른 유기전계발광소자의 개략적인 단면도이다.

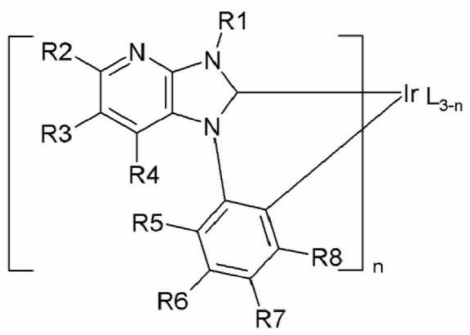
발명을 실시하기 위한 구체적인 내용

[0040] 이하, 본 발명에 따른 청색 인광 화합물의 구조 및 그 합성예와, 이를 이용한 유기전계발광소자에 대해 설명한다.

[0041] 본 발명의 청색 인광 화합물은 N-헤테로고리가 치환된 카르벤(carbene) 화합물을 리간드로 이용하는 이리듐

(iridium, Ir) 화합물이며, 하기 화학식2로 표시된다.

[0042] 화학식2



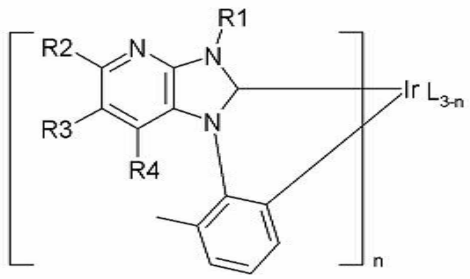
[0043]

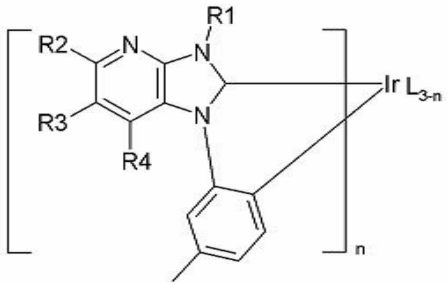
[0044] 상기 화학식2에서 R1은 C1 내지 C6의 알킬기, C6 이상의 치환 또는 비치환된 방향족 그룹, C5 이상의 치환 또는 비치환된 이형고리 그룹으로부터 선택되고, R2 내지 R8 각각은 수소, F, Cl, Br와 같은 할로겐, 시아노기, 트리플루오로메틸기, C1 내지 C6의 알킬기, C1 내지 C6의 알콕시기, R9R10R11Si의 실릴기, C6 이상의 치환 또는 비치환된 방향족 그룹, C5 이상의 치환 또는 비치환된 이형고리 그룹, C1 내지 C6의 아민기, C6 이상의 방향족 그룹이 치환된 아민기, C5 이상의 이형고리 그룹이 치환된 아민기로부터 선택될 수 있다. 여기서 R9, R10 및 R11은 C1 내지 C6의 알킬기 혹은 C6 이상의 치환 또는 비치환된 방향족 그룹에서 선택된다.

[0045] 또한, 상기 화학식2에서 R5 내지 R8 중 적어도 하나는 메틸기이며, L은 두자리 결합 리간드이고, n은 1 내지 3이다.

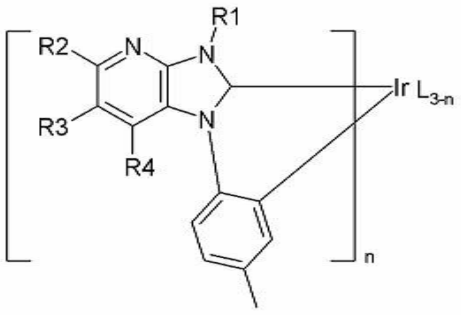
[0046] 예를 들어, 상기 화학식2의 물질은 하기 화학식3에 표시된 다수의 물질 중 어느 하나일 수 있다.

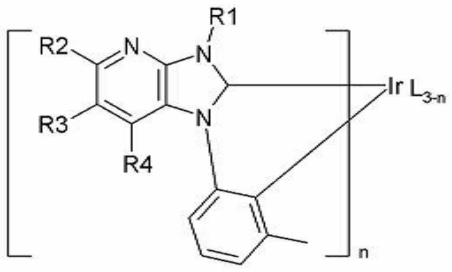
[0047] 화학식3





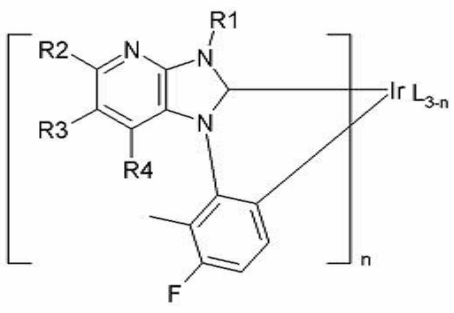
[0048]

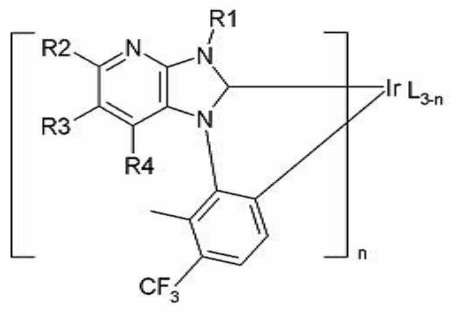




[0049]

[0050]





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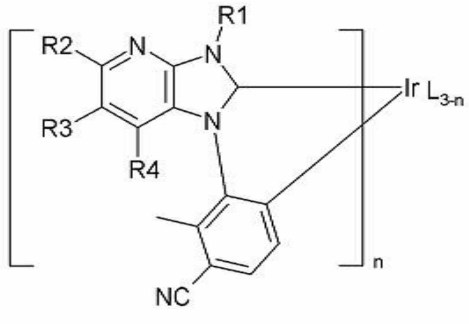

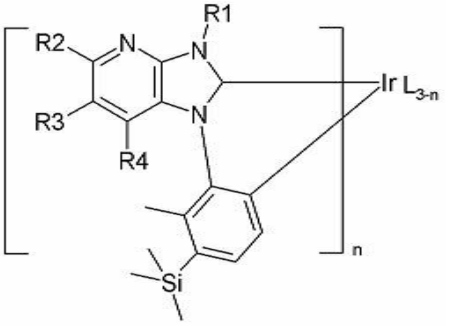

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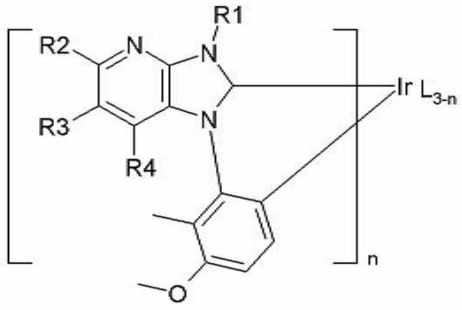

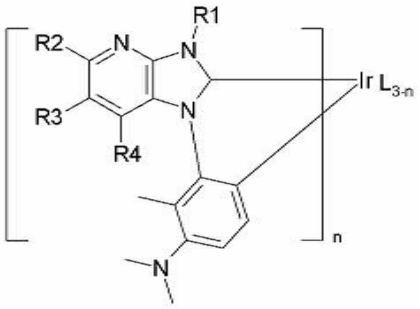

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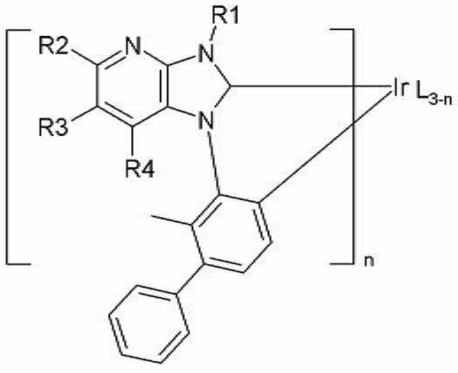

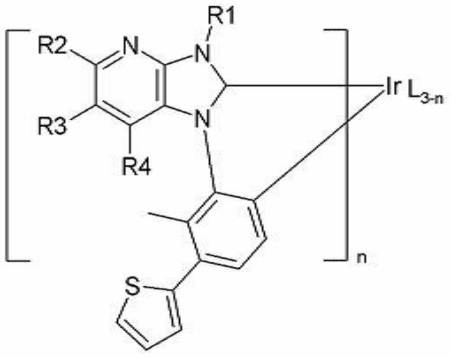

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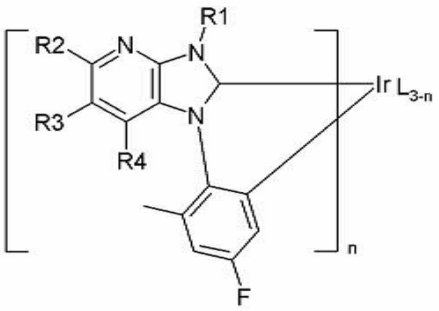

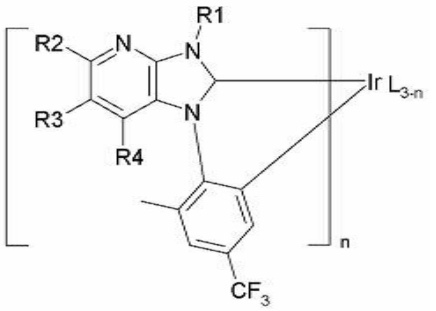

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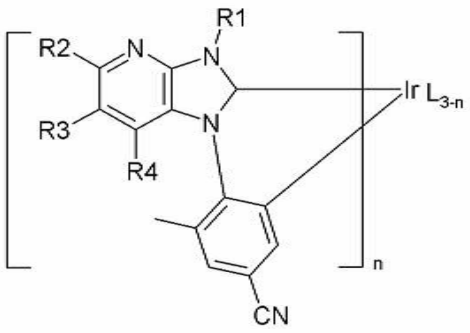

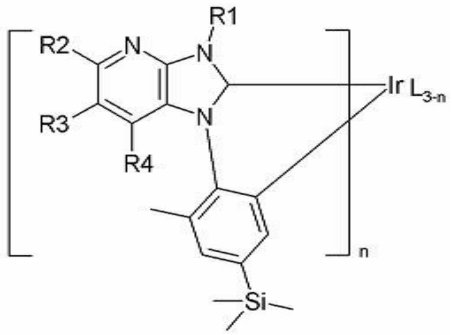

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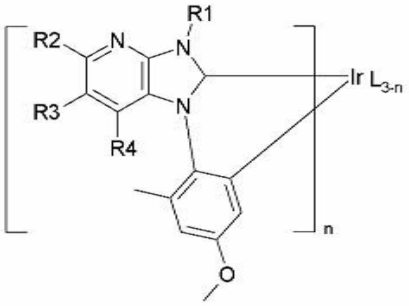

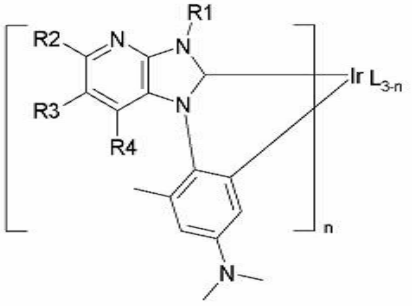

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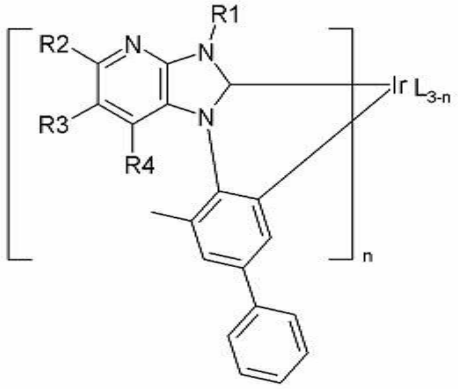

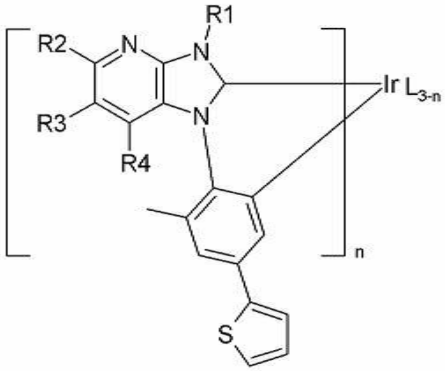

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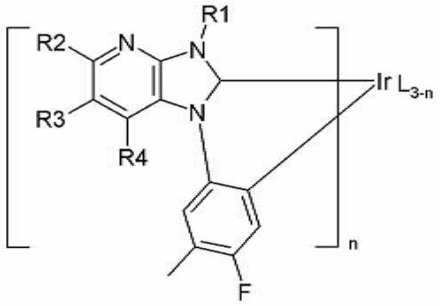

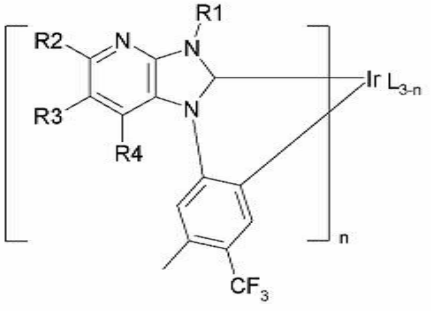

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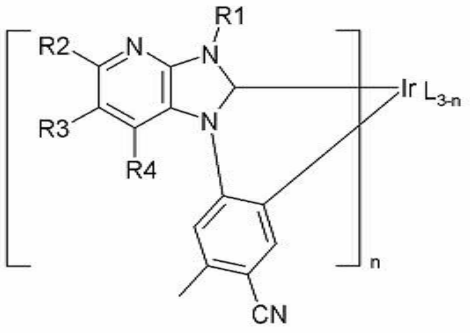

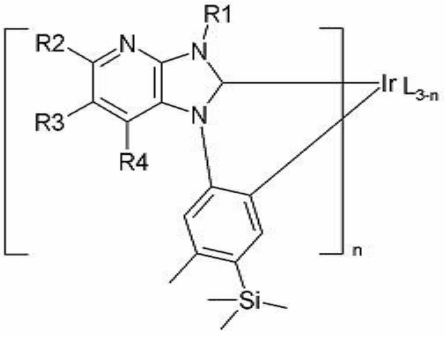

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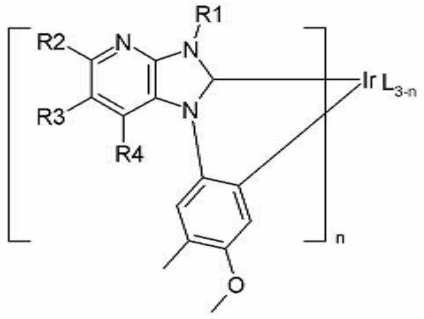

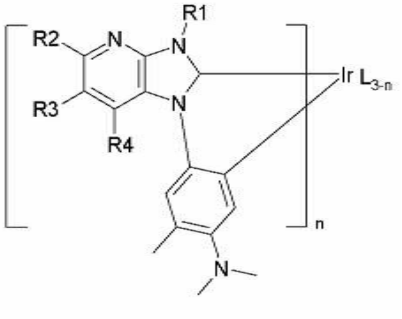

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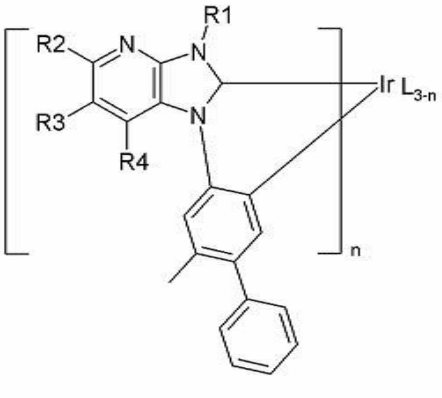

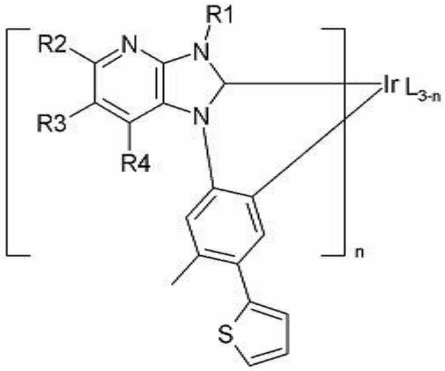

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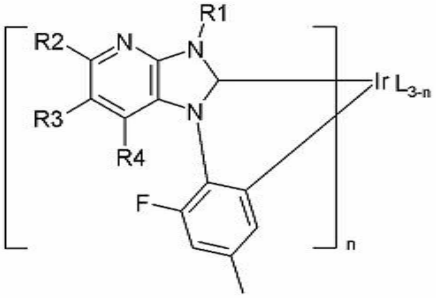

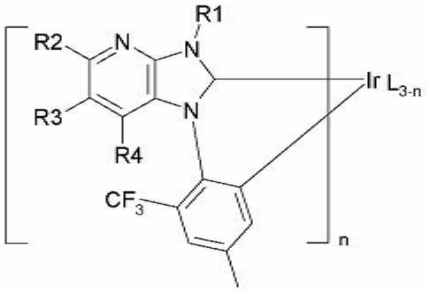

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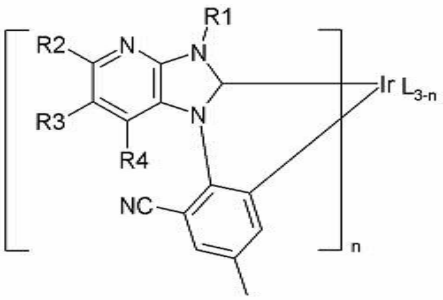

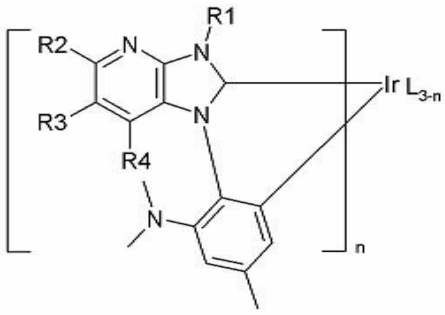

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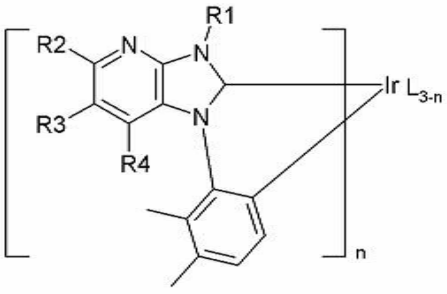

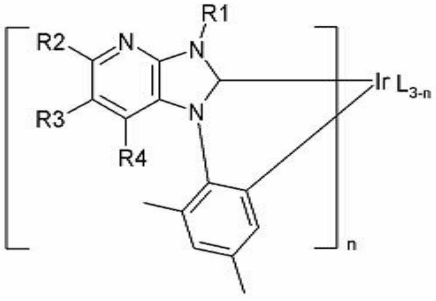

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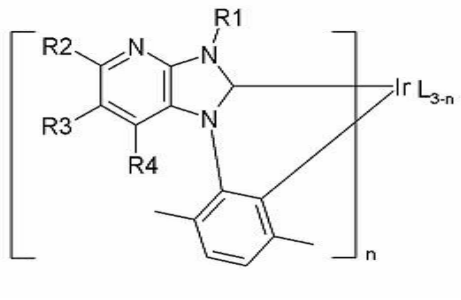
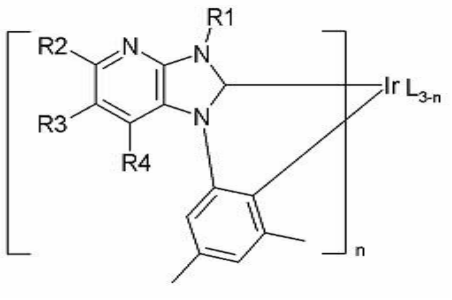

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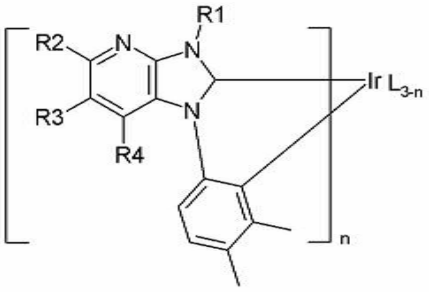
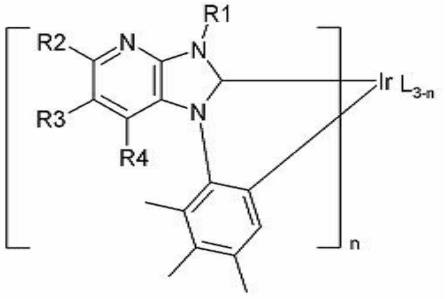

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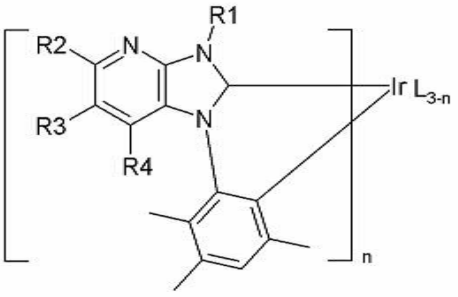
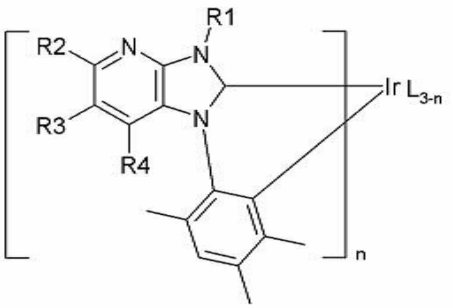

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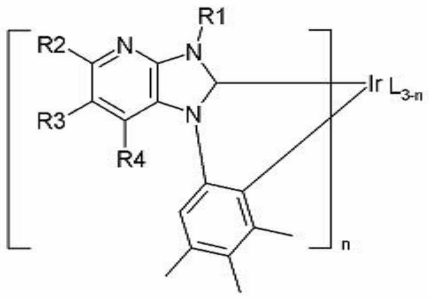
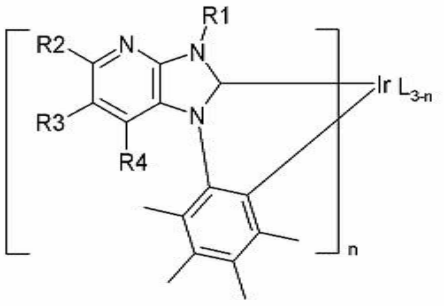

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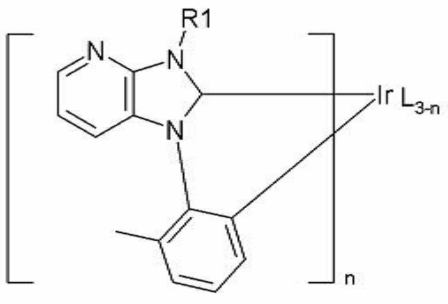
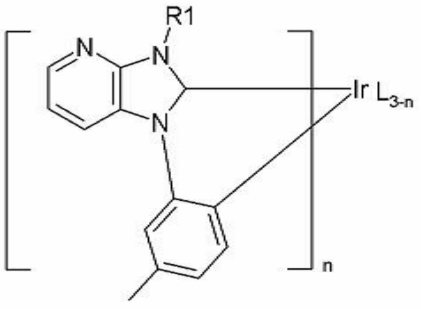

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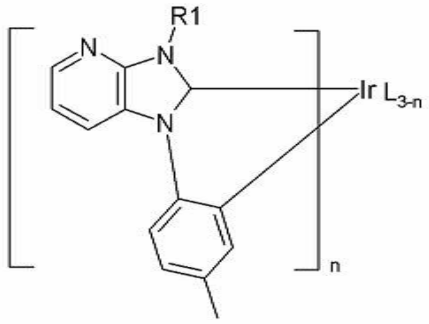

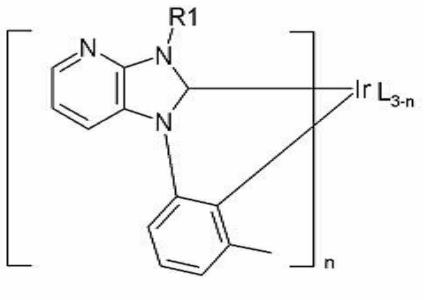

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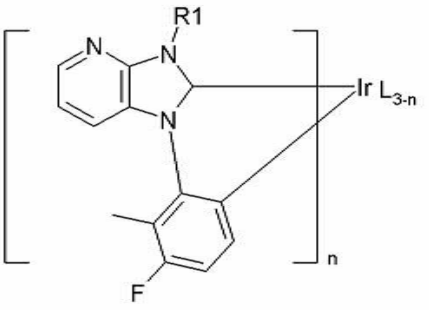

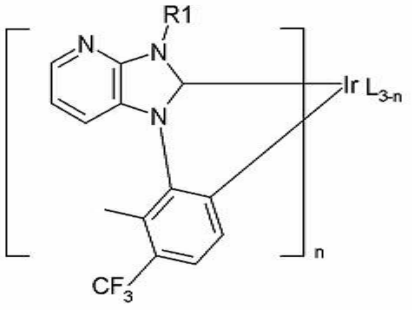

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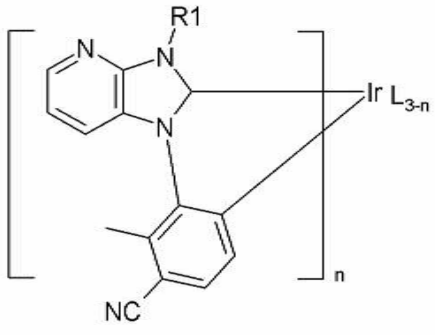

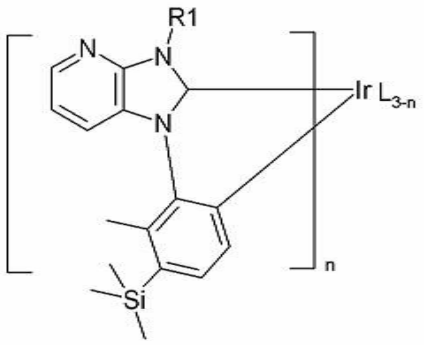

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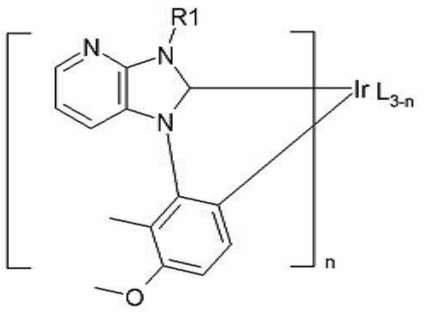

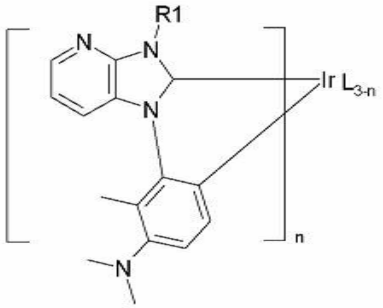

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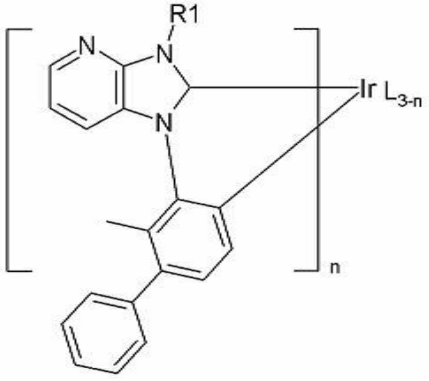

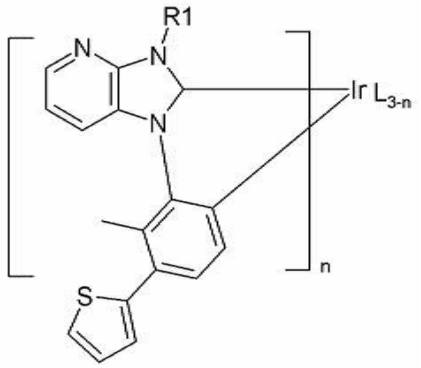

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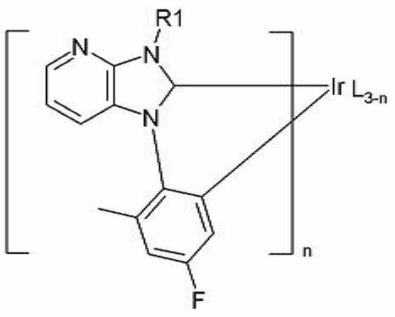

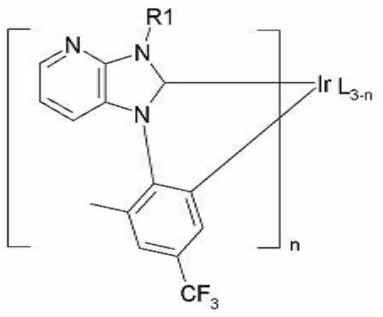

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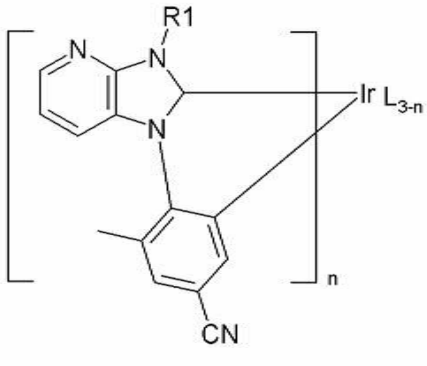

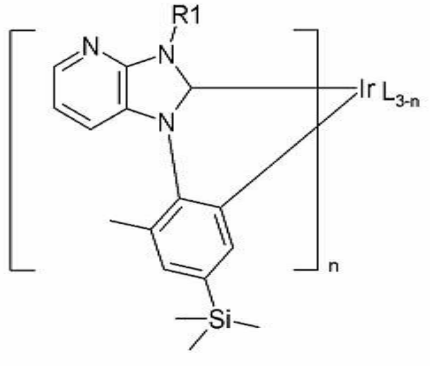

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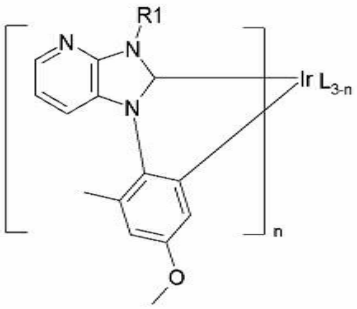

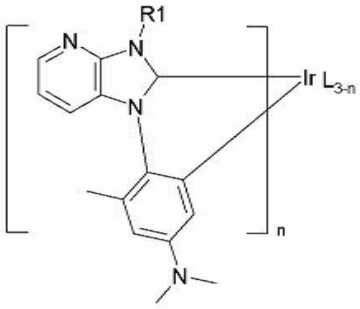

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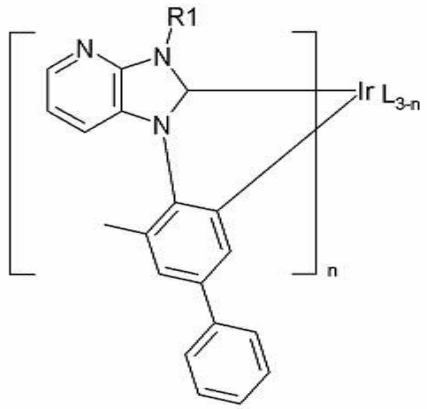

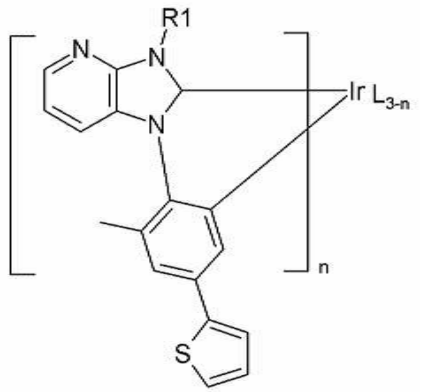

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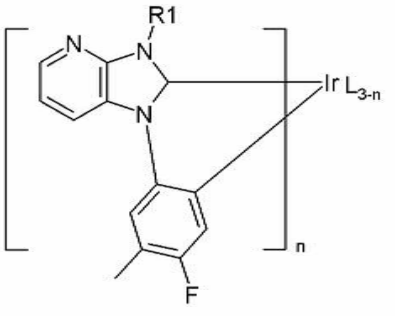

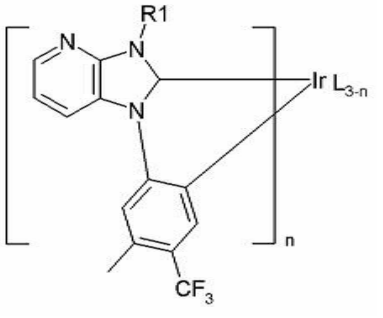

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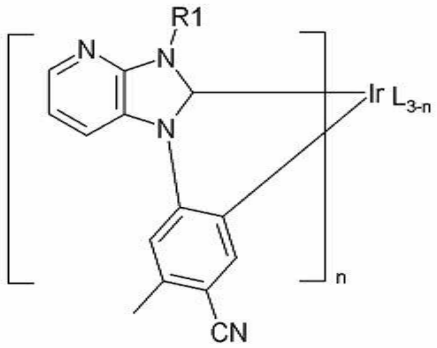

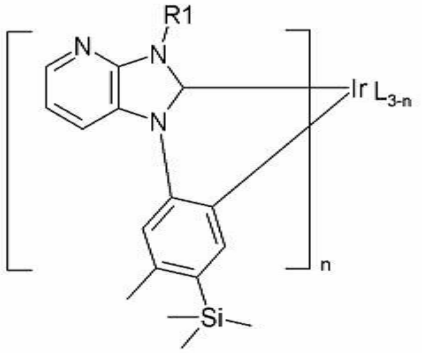

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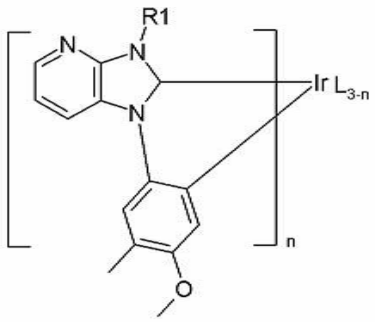

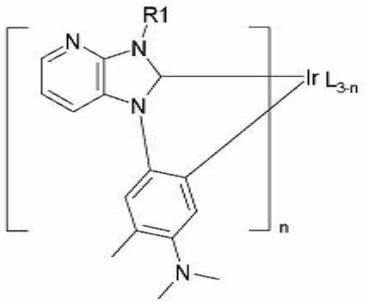

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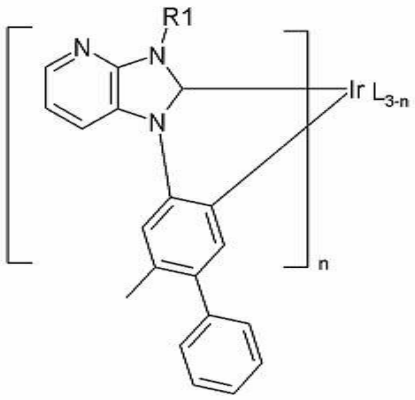

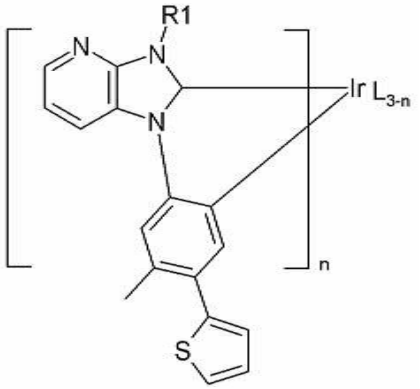

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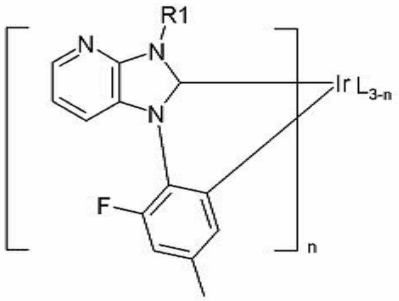

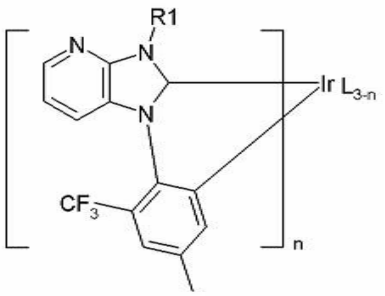

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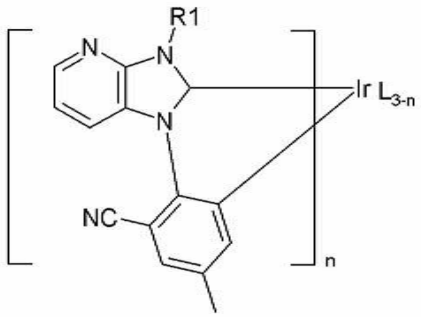

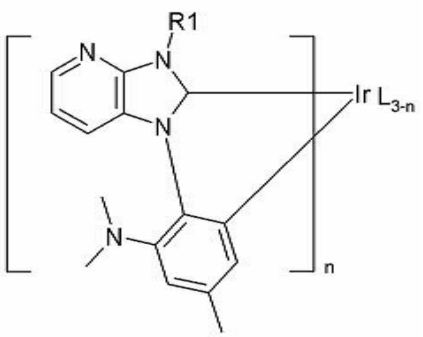

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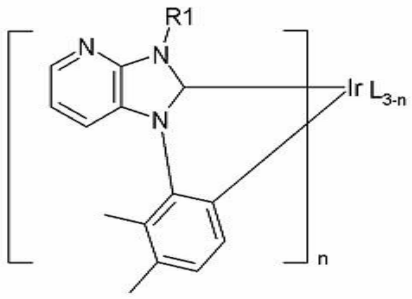
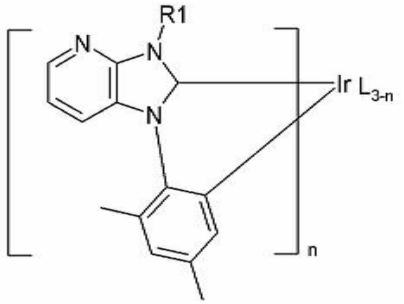

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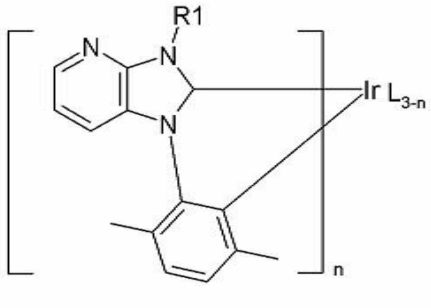
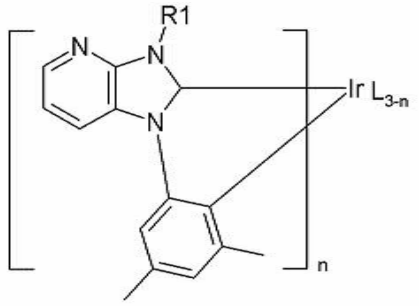

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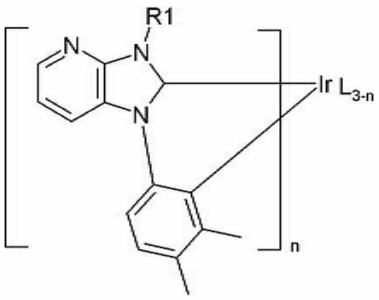
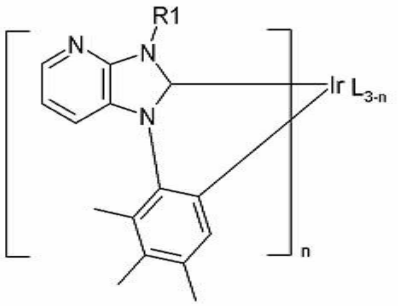

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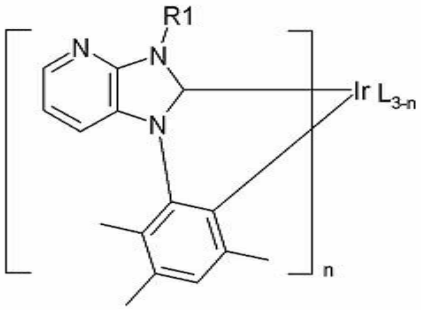
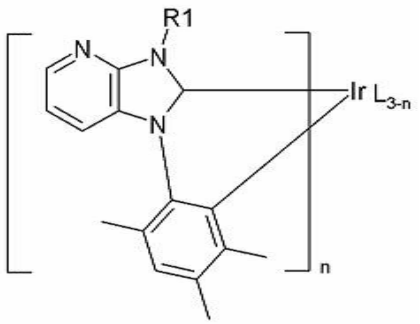

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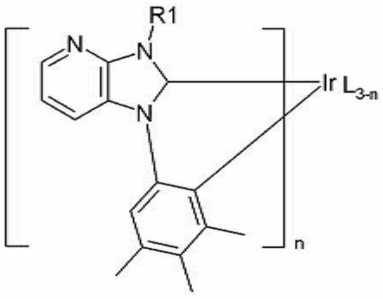
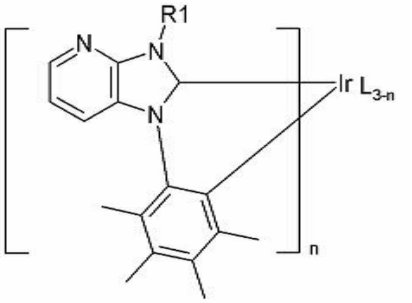

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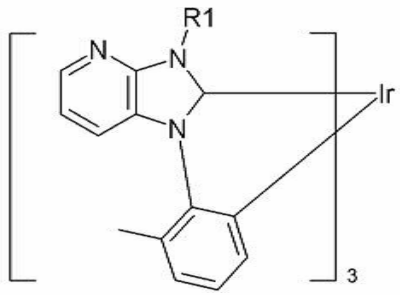

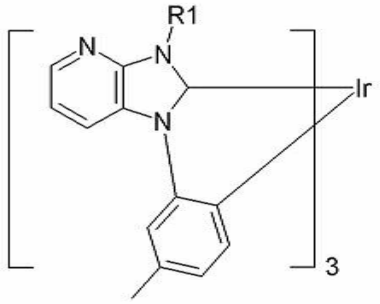

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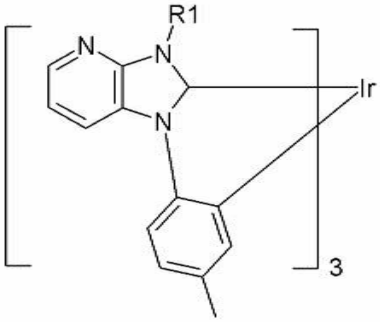

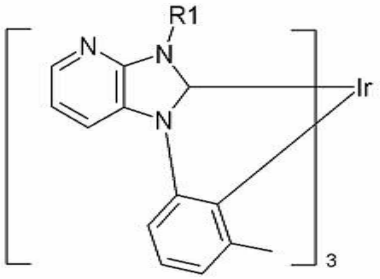

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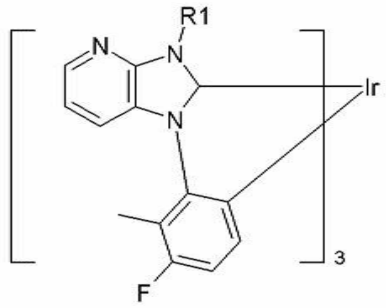

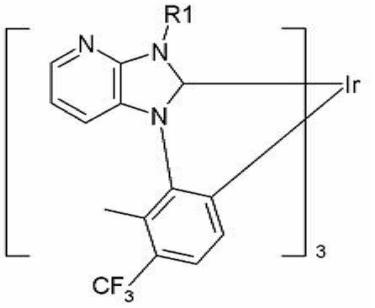

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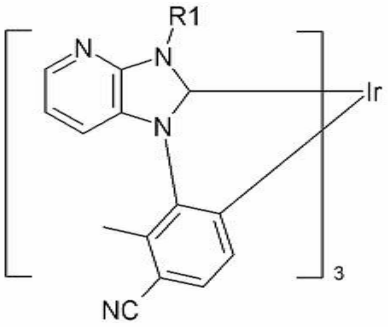

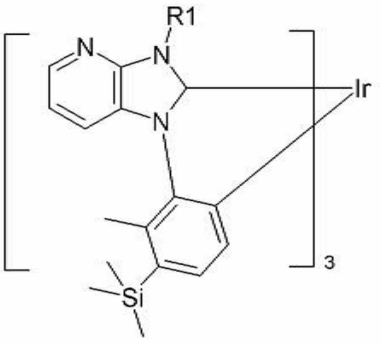

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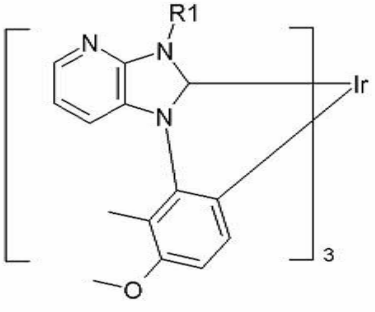

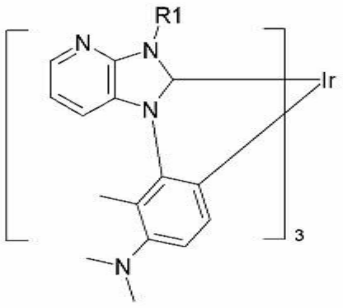

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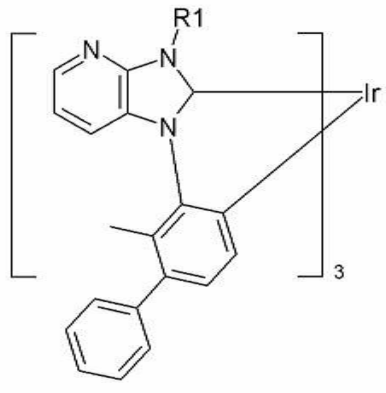

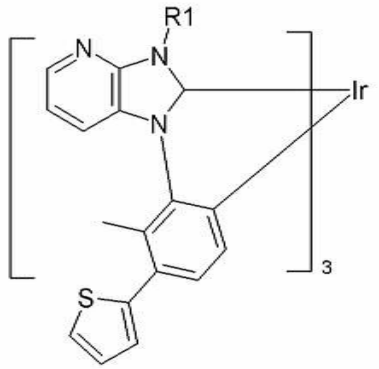

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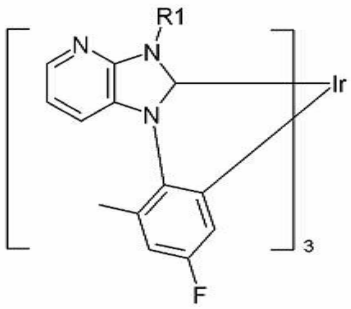

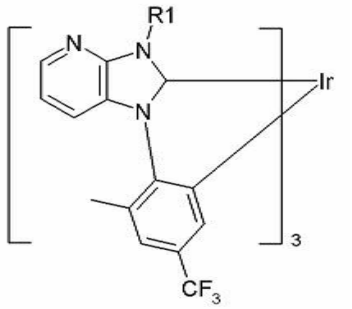

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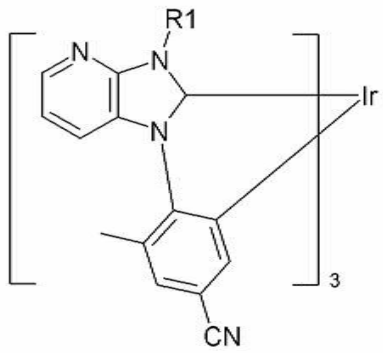

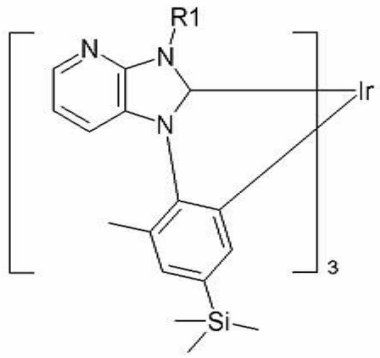

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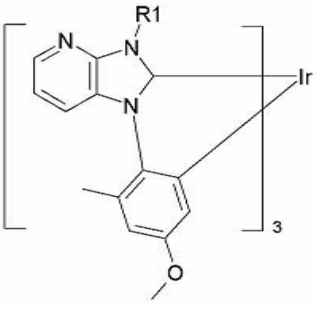

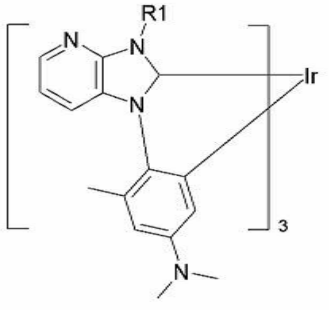

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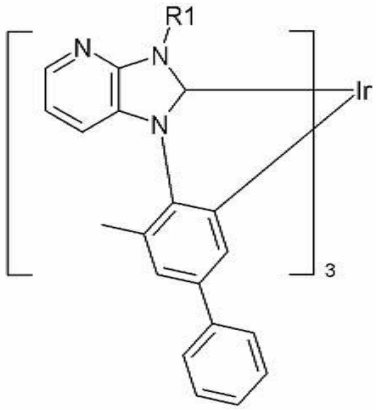

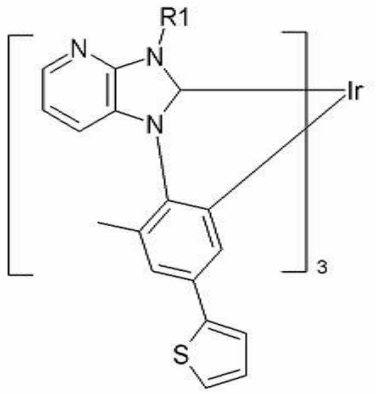

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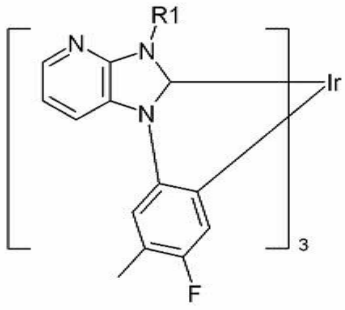

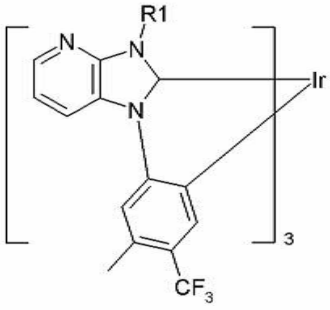

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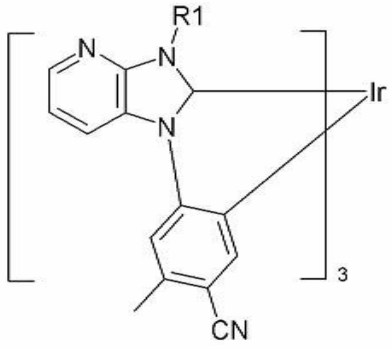

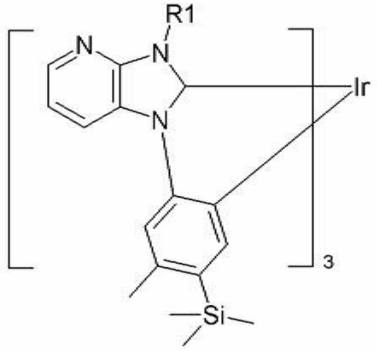

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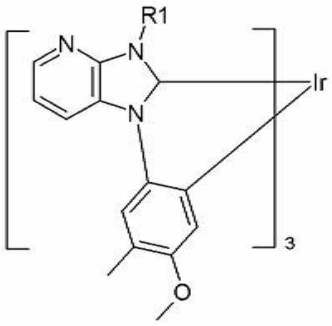

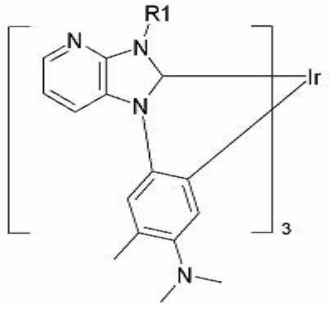

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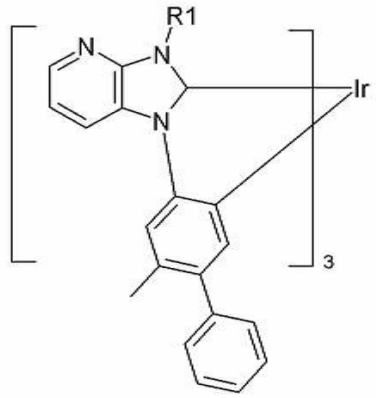

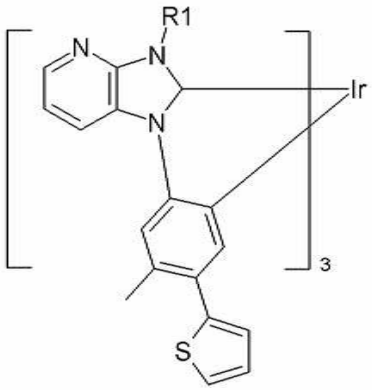

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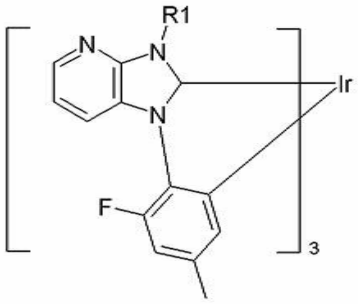

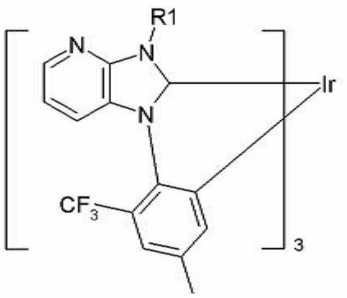

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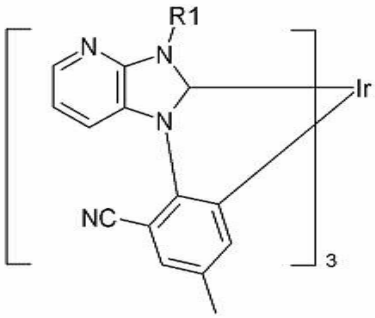

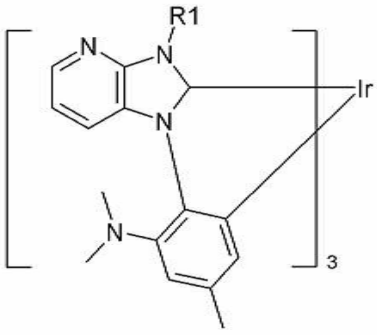

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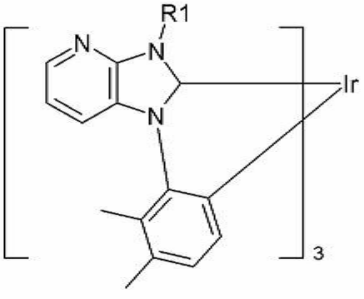

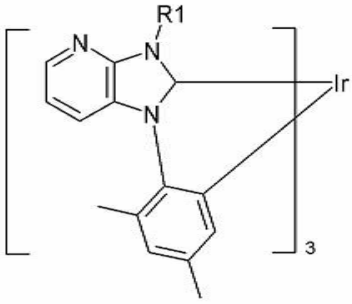

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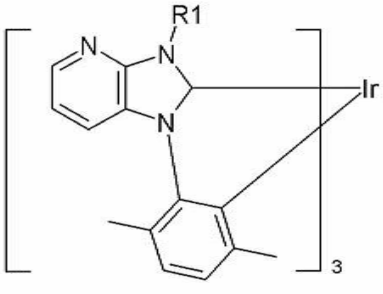
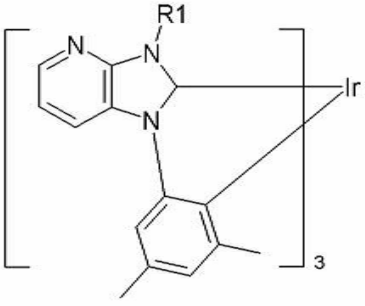
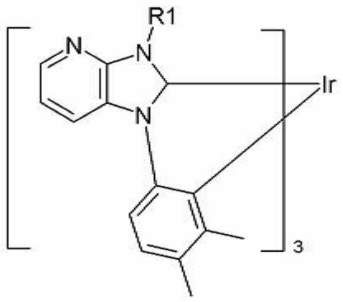
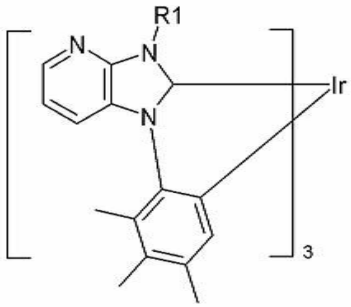
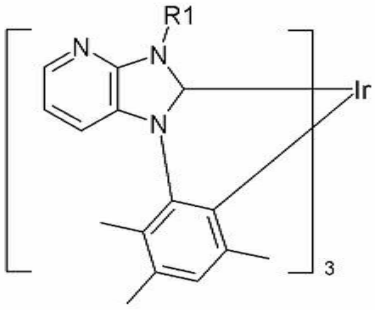
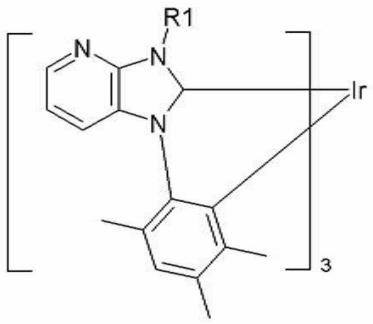
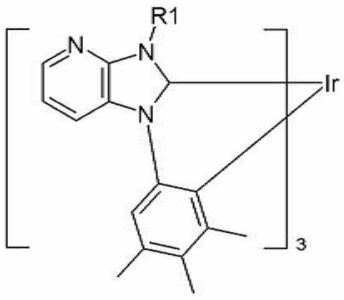
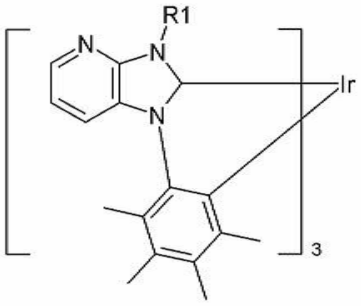




[0108]  

[0109]  

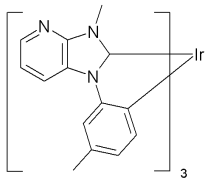
[0110]  

[0111]

[0112] 상기 화학식2로 표시된 청색 인광 화합물은 단파장의 발광 스펙트럼을 가져 높은 색순도를 얻을 수 있다. 또한, 벤젠링에 적어도 하나의 메틸기가 치환되어 스펙트럼을 가시광선 영역으로 쉬프트시킴으로써, 발광소자에 적용할 경우 소자의 발광 효율을 높일 수 있다.

[0113] 이하에서는, 본 발명에 따른 청색 인광 화합물 중 하기 화학식4에 표시된 청색 인광 화합물(A)의 합성예를 설명한다.

[0114] 화학식4

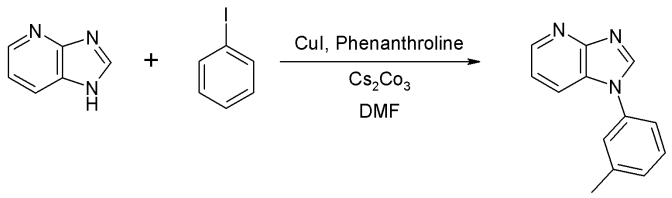


[0115] A

[0116] (1) 리간드 전구체(ligand precursor)의 합성

[0117] 하기 반응식1 및 반응식2을 통해 리간드 전구체를 합성하였다.

[0118] 반응식1

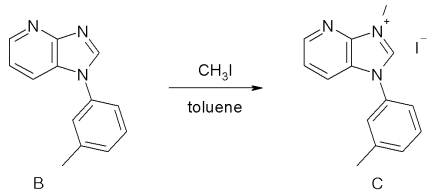


B

[0119]

[0120] 4-아자벤즈이미다졸 5.0 g(42 mmol), 요오드벤젠 6.5 ml(51 mmol)을 요오드화구리 0.80 g(4.2 mmol), 페난트롤린 1.5 g(8.4 mmol)의 DMF 용액 (100 ml)에 넣고 세슘카보네이트 28 g(84 mmol)을 넣어준 후 18시간 환류시킨다. 용액을 실온으로 식히고 실리카겔 패드를 이용하여 거른 후 여액을 감압하여 휘발물을 제거한다. 남은 잔류물을 컬럼크로마토그래피를 통하여 화합물 B 6.9 g(78%)을 얻었다.

[0121] 반응식2



B C

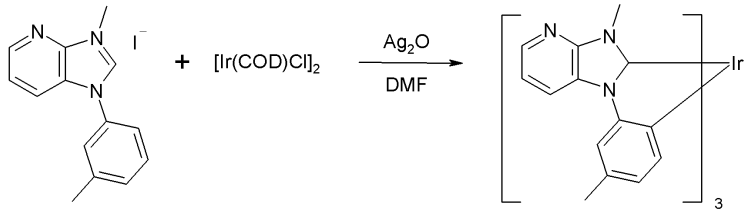
[0122]

[0123] B 6.0 g(29 mmol)의 톨루엔 (25 ml) 용액에 요오드화메탄 2.0 ml(32 mmol)를 넣고 실온에서 다섯시간 동안 교반 후 용액을 걸러 5.8 g의 침전물 C를 얻었다. 여액은 감압조건에서 휘발물을 제거하여 2.5 g의 B를 얻고 여기에 다시 톨루엔 15ml과 요오드화메탄 0.82ml (13 mmol)을 넣어 같은 반응을 반복, 3.1 g의 C를 추가로 얻었다(88%). 얻어진 C는 에틸아세테이트로 반복하여 씻고 추가 정제과정 없이 다음 반응에 사용하였다.

[0124] (2) 청색 인광 화합물(A)의 합성

[0125] 하기 반응식3을 통해 청색 인광 화합물(A)를 합성하였다.

[0126] 반응식3



C A

[0127]

[0128] 질소 분위기 하에서 화합물 C 2.8 g(8.0 mmol), [Ir(COD)Cl]2 0.84 g(1.3 mmol), Ag2O 1.82 g(7.9 mmol)을 DMF 100 ml에 넣고 18시간 동안 환류하여 교반하였다. 반응이 종료된 후, 침전물을 걸러내고 여과액을 감압조건 하에서 농축하였다. 잔류물은 컬럼크로마토그래피를 거쳐 화합물 A 2.9g을 얻었다(42%, 이성질체 비율 mer- 22%, fac- 78%).

[0129] 청색 인광 화합물(A)의 UV/vis. 스펙트럼과 PL(photoluminescence) 스펙트럼을 도 1에 도시하였으며, 도시된 바와 같이 약 450nm의 단파장 영역에서 λmax를 보였다. 즉, 본 발명의 청색 인광 화합물은 단파장의 PL 스펙트럼에 의해 색순도가 향상된다.

[0130] 또한, 리간드의 벤젠링에 치환된 메틸기에 의해 PL 스펙트럼이 쉬프트되는데, PL 스펙트럼의 전영역이 가시광선 영역에 위치하기 때문에, 발광소자에 적용할 경우 소자의 발광 효율이 향상되는 장점을 갖는다.

[0131] 상기한 청색 인광 화합물을 포함하여 이루어지는 유기전계발광소자에 대한 일 실시예를 도 2에 도시하였다.

[0132] 도시한 바와 같이, 유기전계발광소자는 서로 마주보는 제 1 및 제 2 기판(미도시)과, 상기 제 1 및 제 2 기판(미도시) 사이에 형성되어 있는 유기발광다이오드(130)를 포함한다.

[0133] 상기 유기발광다이오드(130)는 양극 역할을 하는 제 1 전극(132), 음극 역할을 하는 제 2 전극(138) 및 상기 제 1 및 제 2 전극(132, 138) 사이에 형성되는 유기발광층으로 이루어진다.

[0134] 상기 제 1 전극(132)은 일함수 값이 비교적 높은 물질, 예를 들어, 인듐-틴-옥사이드(ITO)로 이루어지며, 상기 제 2 전극(138)은 일함수 값이 비교적 낮은 물질, 예를 들어, 알루미늄(Al) 또는 알루미늄 합금으로 이루어진다.

[0135] 상기 유기발광층은 발광효율을 극대화하기 위해, 다중층 구조 즉, 제 1 전극(132)으로부터 순차적으로 정공주입층(hole injection layer; HTL) (133), 정공수송층(hole transporting layer; HIL) (134), 발광물질층(emitting material layer; EML) (135), 전자수송층(electron transporting layer, ETL)(136) 및 전자주입층(electron injection layer, EIL)(137)으로 이루어질 수 있다.

[0136] 여기서, 상기 유기발광층은 상기 화학식2로 표시된 청색 인광 화합물을 포함하여 형성된다. 이러한 청색 인광 화합물은 N-헤테로고리가 치환된 카르벤(carbene) 화합물을 리간드로 이용하는 이리듐(iridium, Ir) 화합물로, 단파장의 발광 스펙트럼을 가져 높은 색순도를 얻을 수 있다. 또한, 리간드의 벤젠링에 적어도 하나의 메틸기가 치환되어 스펙트럼을 가시광선 영역으로 쉬프트시킴으로써, 발광소자에 적용할 경우 소자의 발광 효율을 높일 수 있다. 따라서, 이러한 청색 인광 화합물을 이용하는 유기전계발광소자는 고품질의 영상을 표시하며 저소비전력의 장점을 갖는다.

[0137] 상기에서는 본 발명의 바람직한 실시예를 참조하여 설명하였지만, 해당 기술분야의 숙련된 당업자는 하기의 특허청구범위에 기재된 본 발명의 기술적 사상 및 영역으로부터 벗어나지 않는 범위 내에서 본 발명을 다양하게 수정 및 변경시킬 수 있음을 이해할 수 있을 것이다.

부호의 설명

[0138] 132: 제 1 전극 133: 정공주입층

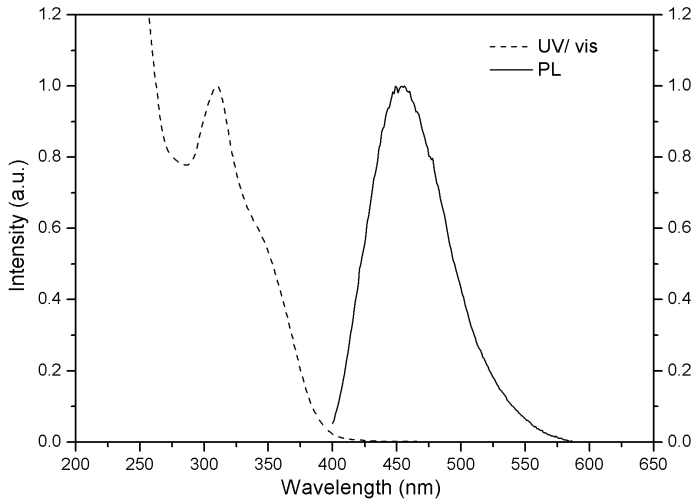
134: 정공수송층 135: 발광물질층

136: 전자수송층 136: 전자주입층

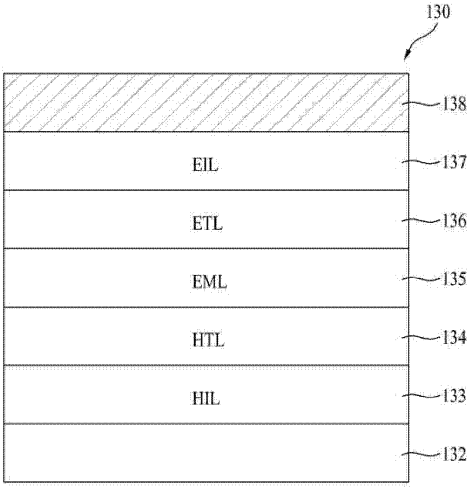
138: 제 2 전극

도면

도면1



도면2



专利名称(译)	蓝色磷光化合物和使用其的有机电致发光器件		
公开(公告)号	KR101916867B1	公开(公告)日	2018-11-09
申请号	KR1020110107388	申请日	2011-10-20
[标]申请(专利权)人(译)	乐金显示有限公司		
申请(专利权)人(译)	LG显示器有限公司		
当前申请(专利权)人(译)	LG显示器有限公司		
[标]发明人	KIM DO HAN 김도한 LEE SEUNG JAE 이승재 YOON DAE WI 윤대위 SHIN IN AE 신인애		
发明人	김도한 이승재 윤대위 신인애		
IPC分类号	C09K11/06 C07D471/04 H01L51/50		
CPC分类号	H01L51/5012 H01L51/0085 C07F15/0033 C09K2211/185		
其他公开文献	KR1020130043342A		
外部链接	Espacenet		

摘要(译)

用途：提供蓝色磷光掺杂剂，具有高色纯度和高发光效率，从而获得有机电致发光器件的高质量图像。组成：蓝色磷光掺杂剂由化学式1表示。在化学式1中，R1为C1 -6个烷基，C6或更多个取代或未取代的芳族基团，或C5或更多个取代或未取代的杂环基团; R2-R8各自为卤素，氰基，C6或更多个取代或未取代的芳族基团，C5或更多个取代或未取代的杂环基团，C1-6胺基团，C6或更多个芳族基团取代的胺基团，C5或更多个杂环基团 - 取代的胺基，C1-6烷基，或C6或更多个芳基取代的芳基，或C6-或更多个芳基取代的甲硅烷基，C1-6烷基，C1-6烷氧基，甲硅烷基，C6或更多个取代或未取代的芳族基团，C5或更多个取代或未取代的杂环基，C1-6胺基，C6或更多个芳族基团取代的胺基，或C5或更多个杂环基取代的胺基; L是双齿配体; n是1-3。