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(54) 발명의 명칭 **유기발광화합물 및 이를 이용한 유기 광소자**

(57) 요 약

본 발명은 유기 광소자 및 이에 사용되는 유기발광화합물에 관한 것으로서, 보다 상세하게는 우수한 발광효율, 발광 휘도, 색순도 및 발광 수명을 구현할 수 있는 유기 발광 소자와 이에 사용되는 유기 발광 화합물 또는 태양광 발전용 광소자 및 이에 사용되는 광화합물에 관한 것으로, 특히 피리도이미다졸(pyridoimidazole)계 유도체 및 이를 이용한 유기 광소자를 개발하여 전자수송층(ETM), 발광층(EML), 정공수송층(HTM) 등, 제1전극과 상기 제2전극 사이의 각종 유기막과 같이 다각적으로 쓰일 수 있는 물질을 개발하고, 효율 증가와 구동 전압의 감소와 같은 성능의 개선 및 OLED 재료로서의 능력을 극대화시킬 수 있다.

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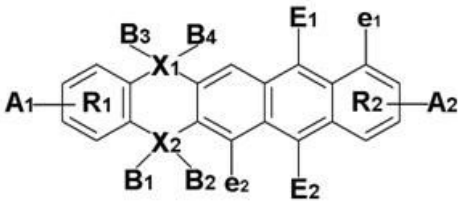
특허청구의 범위

청구항 1

제1전극; 제2전극; 및 상기 제1전극과 상기 제2전극 사이에 적어도 한 층의 유기막을 포함하는 유기 광소자로서, 상기 유기막이 하기 화학식 F의 유기발광화합물을 포함하는 것을 특징으로 하는 유기 광소자:

<화학식 F>



상기 화학식 F에서

상기 X1은 C, Si, N, O, S 또는 Se이고, X2는 Si, N, O, S 또는 Se이고,

X1 또는 X2가 O, S 또는 Se인 경우, 상기 B1, B2, B3 및 B4는 0(zero)이고,

X1 또는 X2가 N인 경우, 상기 B2 및 B4는 0(zero)이고, 상기 B1 및 B3는 각각 독립적으로 C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기, C5~C40의 디아릴아미노기, 실레인기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기로 이루어진 군에서 선택되거나; 또는 인접하는 기와 축합(fused) 지방족 고리, 축합 방향족 고리, 축합 헤테로지방족 고리 또는 축합 헤테로방향족 고리를 형성하는 기이고,

X1 또는 X2가 C 또는 Si인 경우, 상기 B1, B2, B3 및 B4는 각각 독립적으로 C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기, C5~C40의 디아릴아미노기, 실레인기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기로 이루어진 군에서 선택되거나; 또는 인접하는 기와 축합(fused) 지방족 고리, 축합 방향족 고리, 축합 헤테로지방족 고리 또는 축합 헤테로방향족 고리를 형성하는 기이고,

상기 A1, A2, E1, E2, e1 및 e2는 각각 독립적으로 H, D, F, C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기, C5~C40의 디아릴아미노기, 실레인기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기로 이루어진 군에서 선택되거나; 또는 인접하는 기와 축합(fused) 지방족 고리, 축합 방향족 고리, 축합 헤테로지방족 고리 또는 축합 헤테로방향족 고리를 형성하는 기이거나,

상기 A1 및 A2는 각각 독립적으로 인접하는 고리 R1 및 R2와 축합(fused) 지방족 고리, 축합 방향족 고리, 축합 헤테로지방족 고리 또는 축합 헤테로방향족 고리를 형성하는 기이다.

청구항 2

제 1 항에 있어서,

상기 A1, A2, E1, E2, e1, e2, B1, B2, B3 및 B4의 상기 C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기, C5~C40의 디아릴아미노기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기는

각각 독립적으로 D, F, 할로겐, 니트릴기, 니트로기, C1~C40의 알킬기, C5~C40의 아릴옥시기, C2~C40의 알케닐기, C1~C40의 알콕시기, C1~C40의 아미노기, C3~C40의 시클로알킬기, C3~C40의 헤테로시클로알킬기, C6~C40의 아릴기, C3~C40의 헤테로아릴기, 실레인기 및 트리플로로메틸기로 이루어진 군에서 선택되는 하나 이상으로 치환되거나 비치환된 것을 특징으로 하는 유기 광소자.

청구항 3

제 1 항에 있어서,

상기 A1, A2, E1, E2, e1, e2, B1, B2, B3 및 B4의 상기 C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기, C5~C40의 디아릴아미노기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기에 도입되는 치환기 중에서

C1~C40의 알킬기, C5~C40의 아릴옥시기, C2~C40의 알케닐기, C1~C40의 알콕시기, C1~C40의 아미노기, C3~C40의 시클로알킬기, C3~C40의 헤테로시클로알킬기, C6~C40의 아릴기, C3~C40의 헤테로아릴기, 실레인기는

각각 독립적으로 D, F, 할로겐, 니트릴기, 니트로기, C1~C40의 알킬기, C2~C40의 알케닐기, C1~C40의 알콕시기, C1~C40의 아미노기, C3~C40의 시클로알킬기, C3~C40의 헤테로시클로알킬기, C6~C40의 아릴기 및 C3~C40의 헤테로아릴기로 이루어진 군에서 선택되는 하나 이상의 제2치환기로 추가적으로 치환되거나; 또는 인접하는 기와 축합 지방족 고리, 축합 방향족 고리, 축합 헤테로지방족 고리 또는 축합 헤테로방향족 고리를 형성하거나 스피로 결합을 하는 것을 특징으로 하는 유기 광소자.

청구항 4

제 1 항에 있어서,

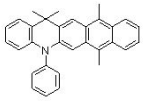
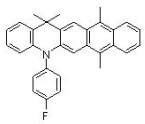
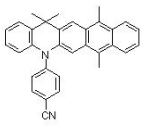
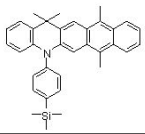
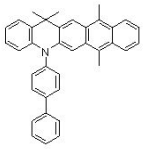
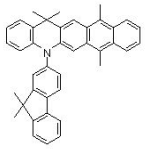
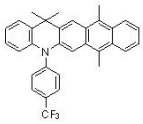
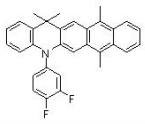
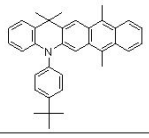
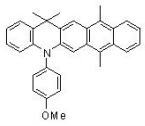
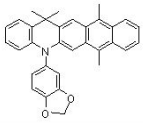
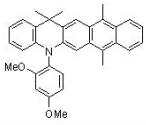
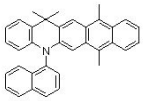
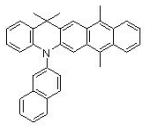
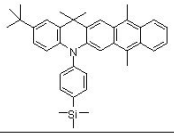
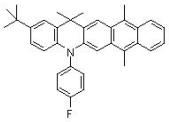
상기 A1, A2, E1, E2, e1, e2, B1, B2, B3 및 B4의 상기 C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기, C5~C40의 디아릴아미노기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기에 도입되는 치환기는

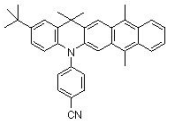
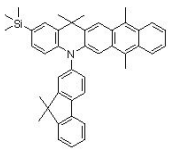
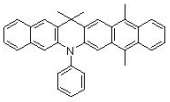
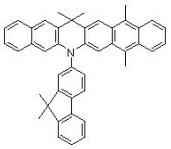
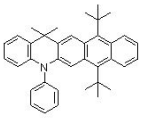
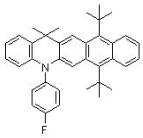
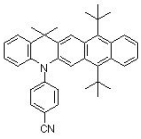
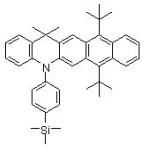
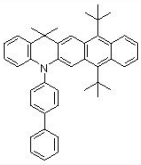
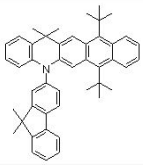
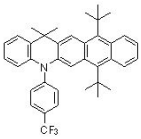
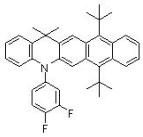
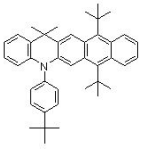
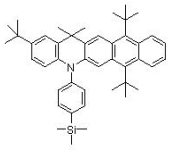
D, F, 페닐기, 톨일기, 비페닐기, 펜타레닐기, 인데닐기, 나프틸기, 비페닐레닐기, 안트라세닐기, 벤조안트라세닐기, 아즈레닐기, 헵타레닐기, 아세나프틸레닐기, 페나레닐기, 메틸안트릴기, 페난트레닐기, 트리페닐레닐기, 피레닐기, 크리세닐기, 피세닐기, 페릴레닐기, 클로로페릴레닐기, 펜타페닐기, 펜타세닐기, 테트라페닐레닐기, 헥사페닐기, 헥사세닐기, 루비세닐기, 코로네닐기, 트리나프틸레닐기, 헵타페닐기, 헵타세닐기, 플루오레닐기, 피란트레닐기, 오바레닐기, 카르바졸릴기, 디벤조퓨라닐기, 디벤조티오페닐기, 티오페닐기, 인돌일기, 푸리닐기, 벤즈이미다졸일기, 퀴놀리닐기, 벤조티오페닐기, 파라티아지닐기, 피롤일기, 피라졸릴기, 이미다졸릴기, 이미다졸리닐기, 옥사졸릴기, 티아졸릴기, 트리아졸릴기, 테트라졸일기, 옥사디아졸릴기, 피리디닐기, 피리다지닐기, 피리미디닐기, 피라지닐기, 티안트레닐기(thianthrenyl), 사이클로펜틸기, 사이클로헥실기, 옥시라닐기, 피롤리디닐기, 피라졸리디닐기, 이미다졸리디닐기, 피페리디닐기, 피페라지닐기, 모르폴리닐기, 디(C6-C50아릴)아미노기, 실레인기 및 이들의 유도체로 이루어진 군으로부터 선택된 것을 특징으로 하는 유기 광소자.

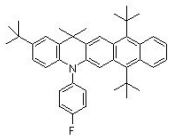
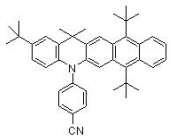
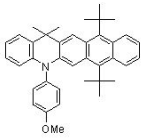
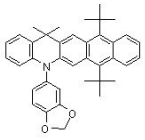
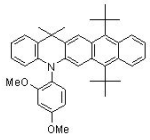
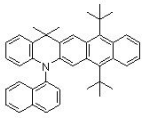
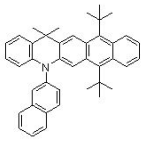
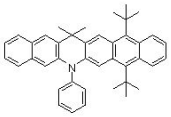
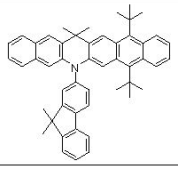
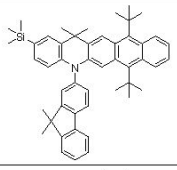
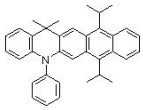
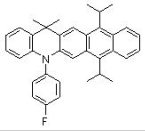
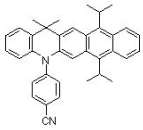
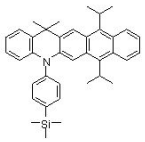
청구항 5

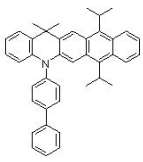
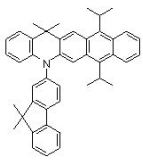
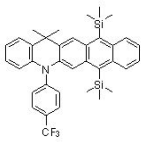
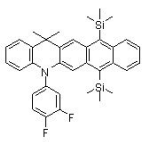
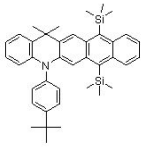
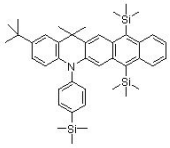
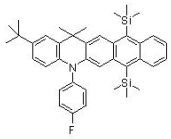
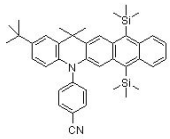
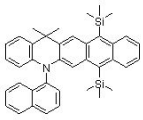
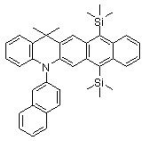
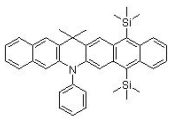
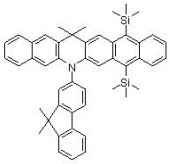
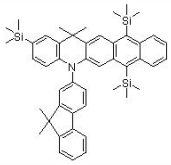
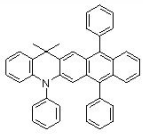
제 1 항에 있어서,

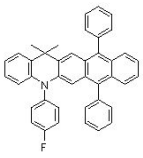
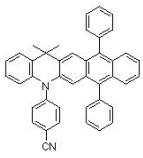
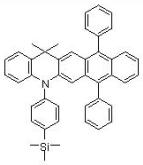
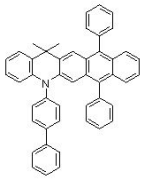
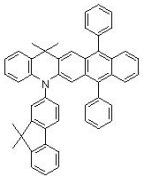
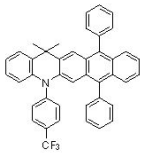
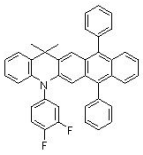
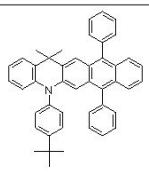
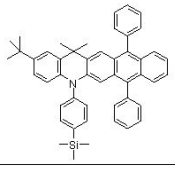
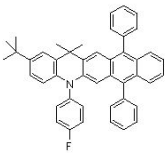
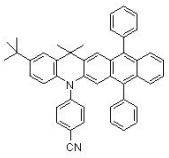
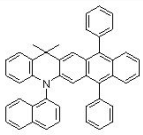
상기 화합물이 하기 화학식 1 내지 223으로 표시되는 것을 특징으로 하는 유기 광소자:

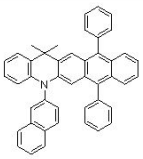
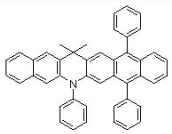
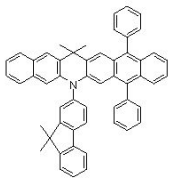
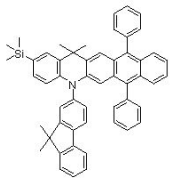
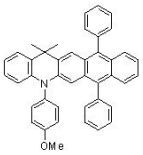
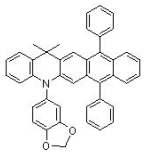
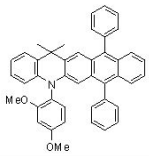
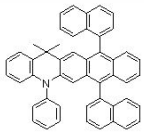
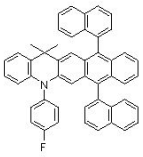
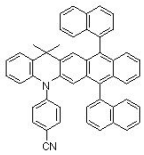
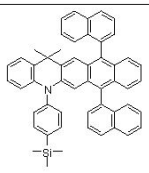
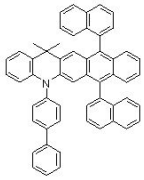
1		2	
3		4	
5		6	
7		8	
9		10	
11		12	
13		14	
15		16	

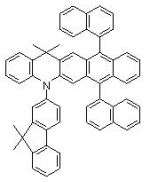
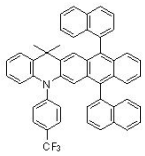
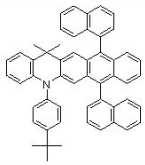
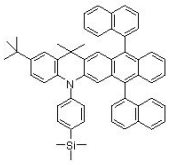
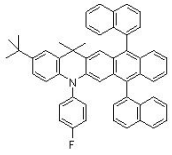
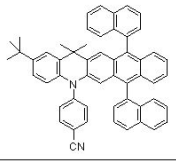
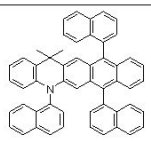
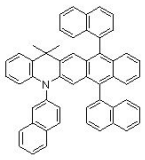
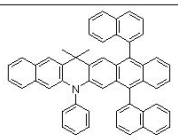
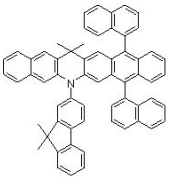
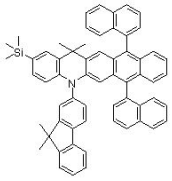
17		18	
19		20	
21		22	
23		24	
25		26	
27		28	
29		30	

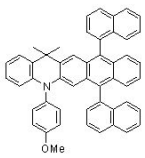
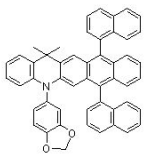
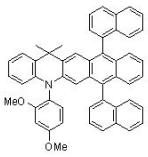
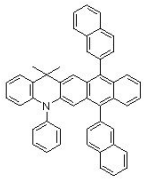
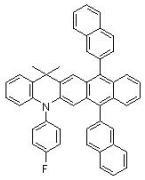
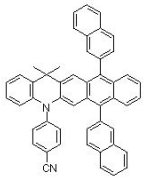
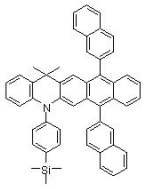
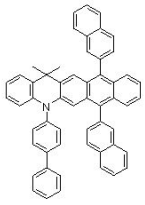
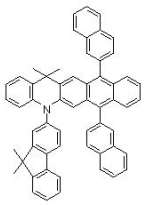
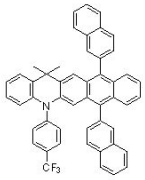
31		32	
33		34	
35		36	
37		38	
39		40	
41		42	
43		44	

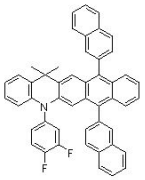
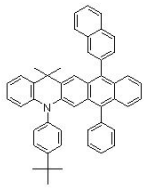
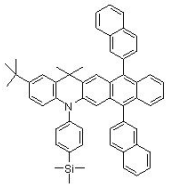
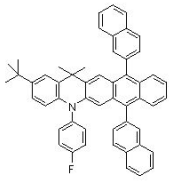
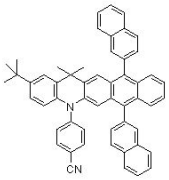
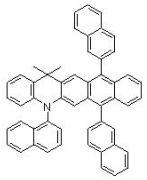
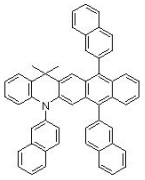
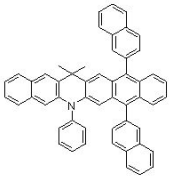
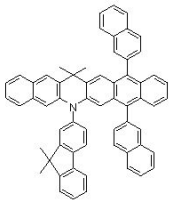
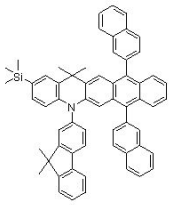
45		46	
47		48	
49		50	
51		52	
53		54	
55		56	
57		58	

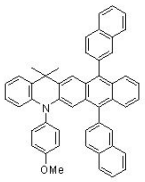
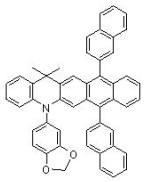
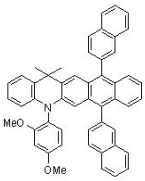
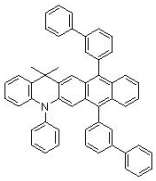
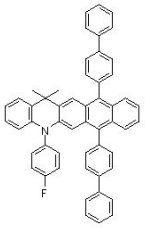
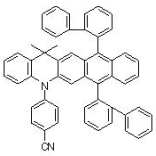
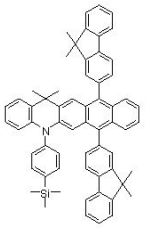
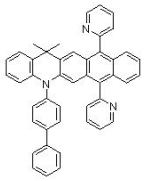
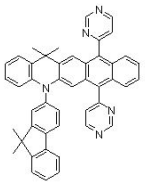
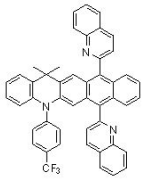
59		60	
61		62	
63		64	
65		66	
67		68	
69		70	

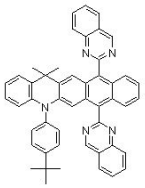
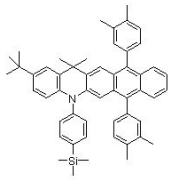
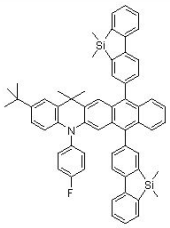
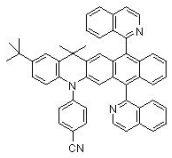
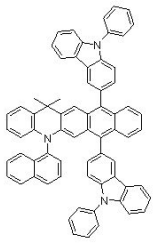
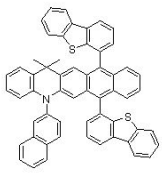
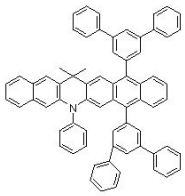
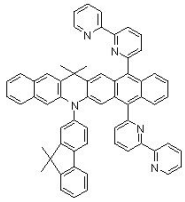
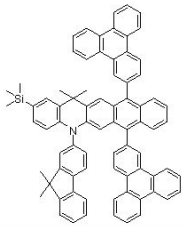
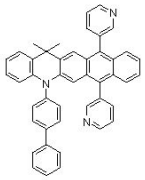
71		72	
73		74	
75		76	
77		78	
79		80	
81		82	

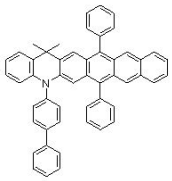
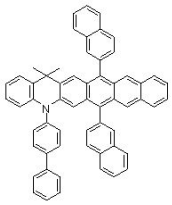
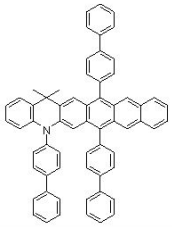
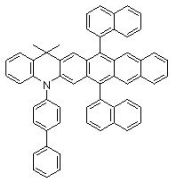
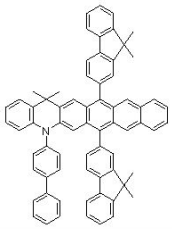
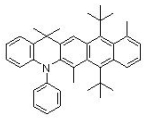
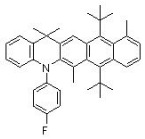
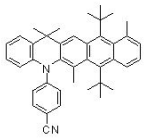
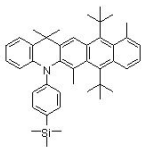
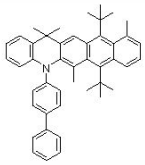
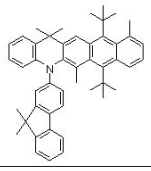
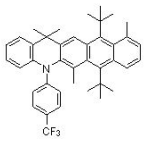
83		84	
85		86	
87		88	
89		90	
91		92	
93		94	

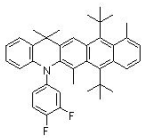
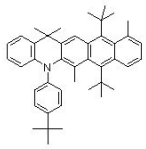
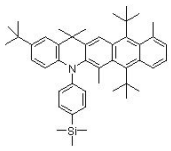
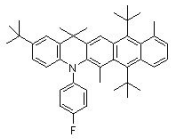
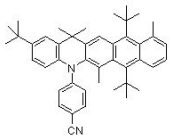
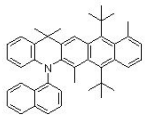
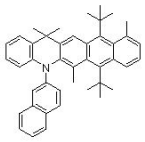
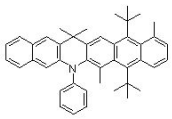
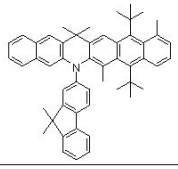
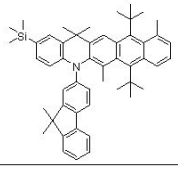
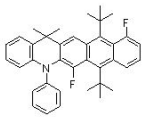
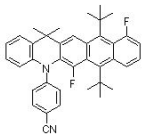
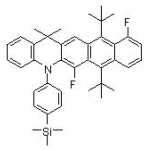
95		96	
97		98	
99		100	
101		102	
103		104	

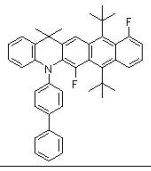
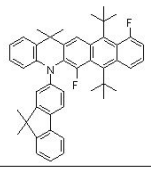
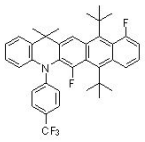
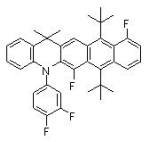
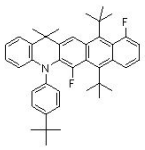
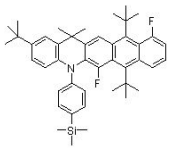
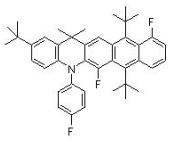
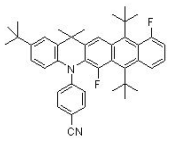
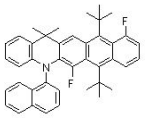
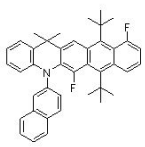
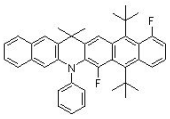
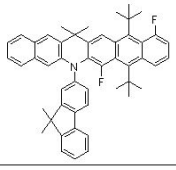
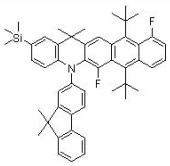
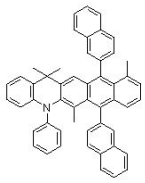
105		106	
107		108	
109		110	
111		112	
113		114	

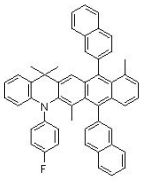
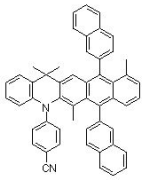
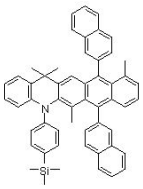
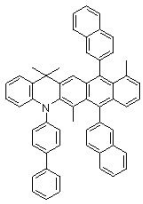
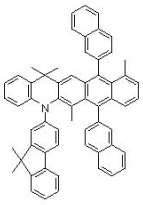
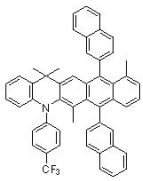
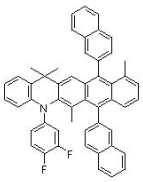
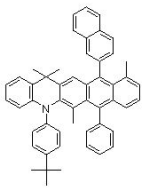
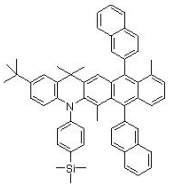
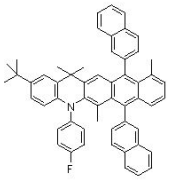
115		116	
117		118	
119		120	
121		122	
123		124	

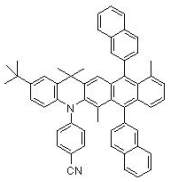
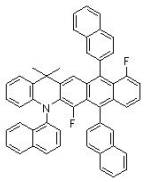
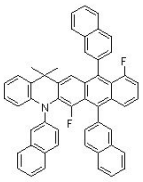
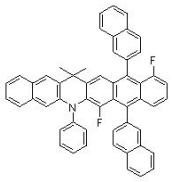
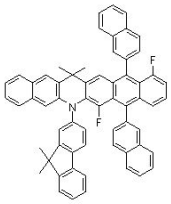
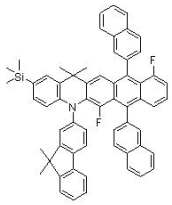
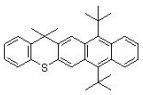
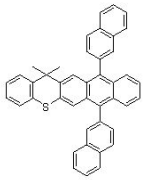
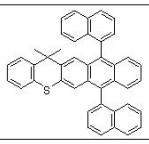
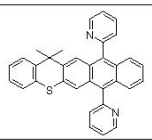
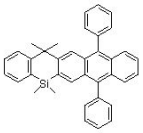
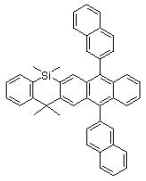
125		126	
127		128	
129		130	
131		132	
133		134	

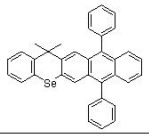
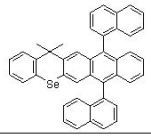
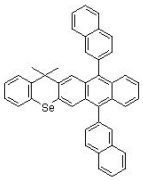
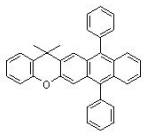
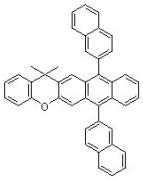
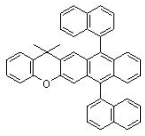
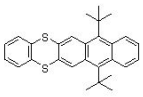
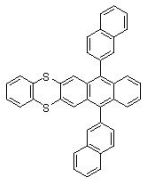
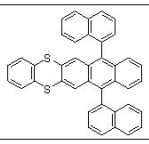
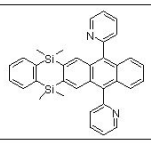
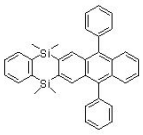
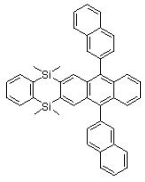
135		136	
137		138	
139		140	
141		142	
143		144	
145		146	

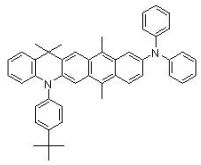
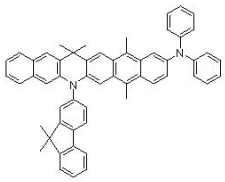
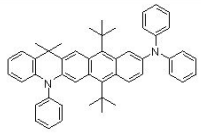
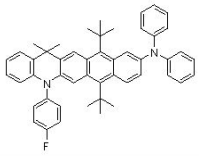
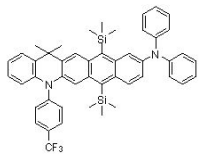
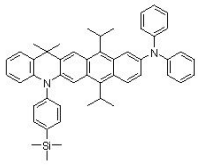
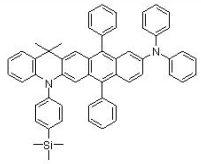
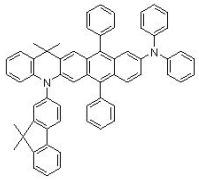
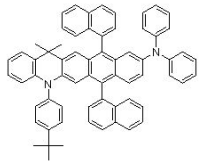
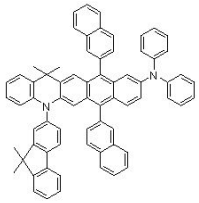
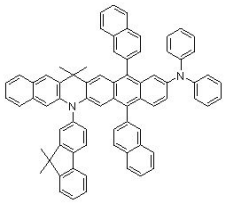
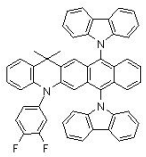
147		148	
149		150	
151		152	
153		154	
155		156	
157		158	
159		160	

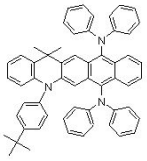
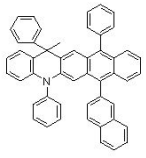
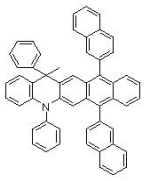
161		162	
163		164	
165		166	
167		168	
169		170	
171		172	
173		174	

175		176	
177		178	
179		180	
181		182	
183		184	

185		186	
187		188	
189		190	
191		192	
193		194	
195		196	

197		198	
199		200	
201		202	
203		204	
205		206	
207		208	

209		210	
211		212	
213		214	
215		216	
217		218	
219		220	

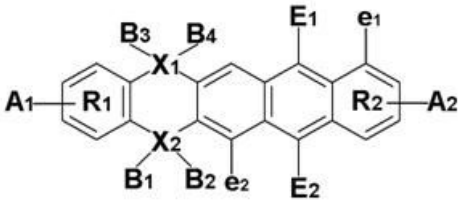
221		222	
223			

청구항 6

하기 화학식 F로 표시되는 유기발광화합물:

제1전극; 제2전극; 및 상기 제1전극과 상기 제2전극 사이에 적어도 한 층의 유기막을 포함하는 유기 광소자로서, 상기 유기막이 하기 화학식 F의 유기발광화합물을 포함하는 것을 특징으로 하는 유기 광소자:

<화학식 F>



상기 화학식 F에서

상기 X1은 C, Si, N, O, S 또는 Se이고, X2는 Si, N, O, S 또는 Se이고,

X1 또는 X2가 O, S 또는 Se인 경우, 상기 B1, B2, B3 및 B4는 0(zero)이고,

X1 또는 X2가 N인 경우, 상기 B2 및 B4는 0(zero)이고, 상기 B1 및 B3는 각각 독립적으로 C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기, C5~C40의 디아릴아미노기, 실레인기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기로 이루어진 군에서 선택되거나; 또는 인접하는 기와 축합(fused) 지방족 고리, 축합 방향족 고리, 축합 헤테로지방족 고리 또는 축합 헤테로방향족 고리를 형성하는 기이고,

X1 또는 X2가 C 또는 Si인 경우, 상기 B1, B2, B3 및 B4는 각각 독립적으로 C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기, C5~C40의 디아릴아미노기, 실레인기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기로 이루어진 군에서 선택되거나; 또는 인접하는 기와 축합(fused) 지방족 고리, 축합 방향족 고리, 축합 헤테로지방족 고리 또는 축합 헤테로방향족 고리를 형성하는 기이고,

상기 A1, A2, E1, E2, e1 및 e2는 각각 독립적으로 H, D, F, C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기, C5~C40의 디아릴아미노기, 실레인기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기로 이루어진 군에서 선택되거나; 또는 인접하는 기와 축합(fused) 지방족 고리, 축합 방향족 고리, 축합 헤테로지방족 고리 또는 축합 헤테로방향족 고리를 형성하는 기이거나,

상기 A1 및 A2는 각각 독립적으로 인접하는 고리 R1 및 R2와 축합(fused) 지방족 고리, 축합 방향족 고리, 축합 헤테로지방족 고리 또는 축합 헤테로방향족 고리를 형성하는 기이다.

청구항 7

제 6 항에 있어서,

상기 A1, A2, E1, E2, e1, e2, B1, B2, B3 및 B4의 상기 C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기, C5~C40의 디아릴아미노기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기는

각각 독립적으로 D, F, 할로겐, 니트릴기, 니트로기, C1~C40의 알킬기, C5~C40의 아릴옥시기, C2~C40의 알케닐기, C1~C40의 알콕시기, C1~C40의 아미노기, C3~C40의 시클로알킬기, C3~C40의 헤테로시클로알킬기, C6~C40의 아릴기, C3~C40의 헤테로아릴기, 실레인기 및 트리플로로메틸기로 이루어진 군에서 선택되는 하나 이상으로 치환되거나 비치환된 것을 특징으로 하는 유기발광화합물.

청구항 8

제 6 항에 있어서,

상기 A1, A2, E1, E2, e1, e2, B1, B2, B3 및 B4의 상기 C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기, C5~C40의 디아릴아미노기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기에 도입되는 치환기 중에서

C1~C40의 알킬기, C5~C40의 아릴옥시기, C2~C40의 알케닐기, C1~C40의 알콕시기, C1~C40의 아미노기, C3~C40의 시클로알킬기, C3~C40의 헤테로시클로알킬기, C6~C40의 아릴기, C3~C40의 헤테로아릴기, 실레인기는

각각 독립적으로 D, F, 할로겐, 니트릴기, 니트로기, C1~C40의 알킬기, C2~C40의 알케닐기, C1~C40의 알콕시기, C1~C40의 아미노기, C3~C40의 시클로알킬기, C3~C40의 헤테로시클로알킬기, C6~C40의 아릴기 및 C3~C40의 헤테로아릴기로 이루어진 군에서 선택되는 하나 이상의 제2치환기로 추가적으로 치환되거나; 또는 인접하는 기와 축합 지방족 고리, 축합 방향족 고리, 축합 헤테로지방족 고리 또는 축합 헤테로방향족 고리를 형성하거나 스피로 결합을 하는 것을 특징으로 하는 유기발광화합물.

청구항 9

제 6 항에 있어서,

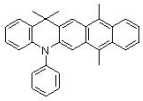
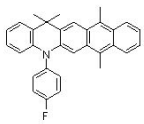
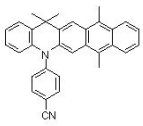
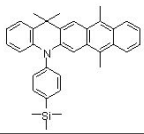
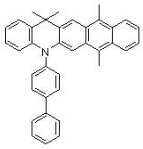
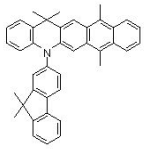
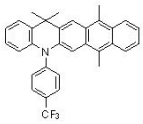
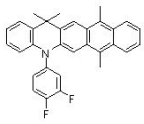
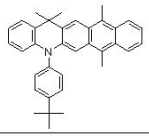
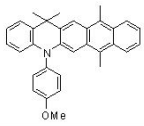
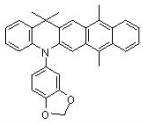
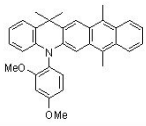
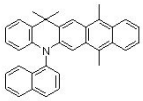
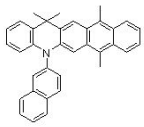
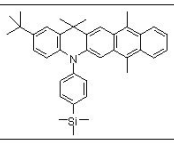
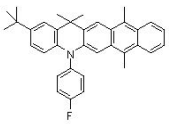
상기 A1, A2, E1, E2, e1, e2, B1, B2, B3 및 B4의 상기 C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기, C5~C40의 디아릴아미노기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기에 도입되는 치환기는

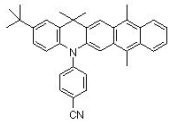
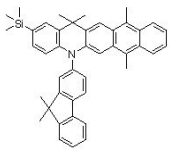
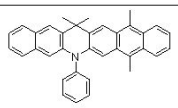
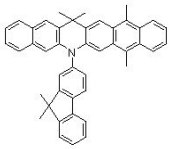
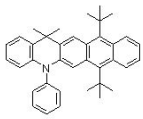
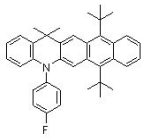
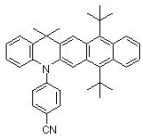
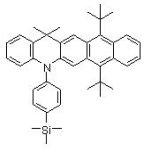
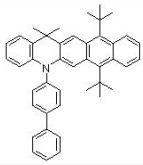
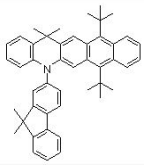
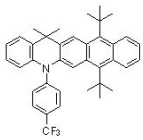
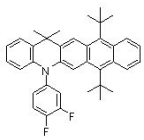
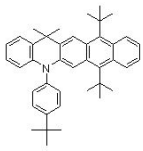
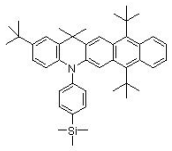
D, F, 페닐기, 톨일기, 비페닐기, 펜타레닐기, 인데닐기, 나프틸기, 비페닐레닐기, 안트라세닐기, 벤조안트라세닐기, 아즈레닐기, 헵타레닐기, 아세나프틸레닐기, 페나레닐기, 메틸안트릴기, 페난트레닐기, 트리페닐레닐기, 피레닐기, 크리세닐기, 피세닐기, 페릴레닐기, 클로로페릴레닐기, 펜타페닐기, 펜타세닐기, 테트라페닐레닐기, 헥사페닐기, 헥사세닐기, 루비세닐기, 코로네닐기, 트리나프틸레닐기, 헵타페닐기, 헵타세닐기, 플루오레닐기, 피란트레닐기, 오바레닐기, 카르바졸릴기, 디벤조퓨라닐기, 디벤조티오페닐기, 티오페닐기, 인돌일기, 푸리닐기, 벤즈이미다졸일기, 퀴놀리닐기, 벤조티오페닐기, 파라티아지닐기, 피롤일기, 피라졸릴기, 이미다졸릴기, 이미다졸리닐기, 옥사졸릴기, 티아졸릴기, 트리아졸릴기, 테트라졸일기, 옥사디아졸릴기, 피리디닐기, 피리다지닐기, 피리미디닐기, 피라지닐기, 티안트레닐기(thianthrenyl), 사이클로펜틸기, 사이클로헥실기, 옥시라닐기, 피롤리디닐기, 피라졸리디닐기, 이미다졸리디닐기, 피페리디닐기, 피페라지닐기, 모르폴리닐기, 디(C6-C50아릴)아미노기, 실레인기 및 이들의 유도체로 이루어진 군으로부터 선택된 것을 특징으로 하는 유기발광화합물.

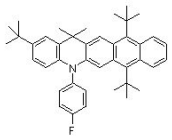
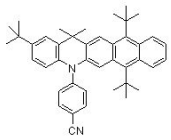
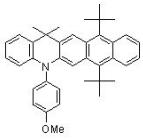
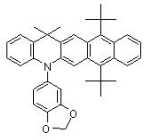
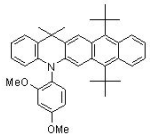
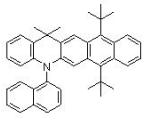
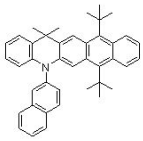
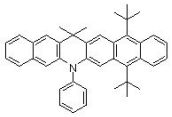
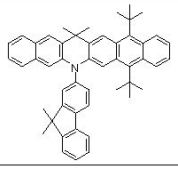
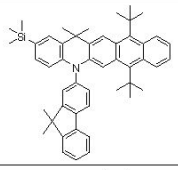
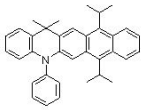
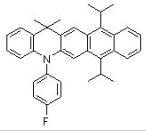
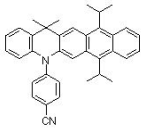
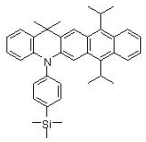
청구항 10

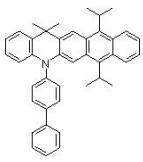
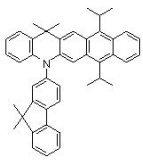
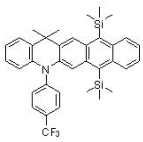
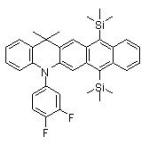
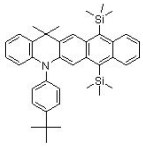
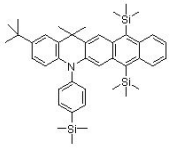
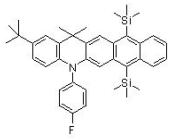
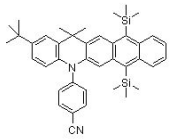
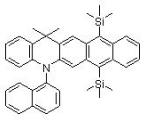
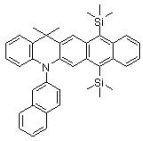
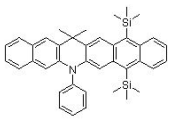
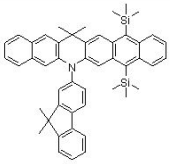
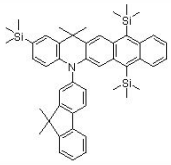
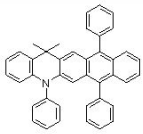
제 6 항에 있어서,

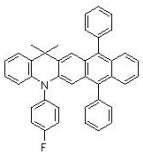
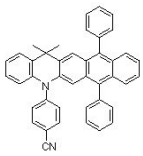
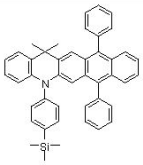
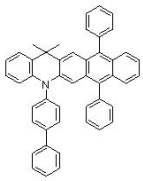
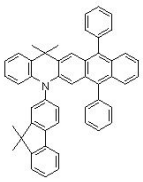
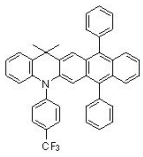
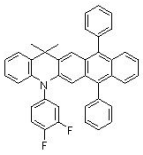
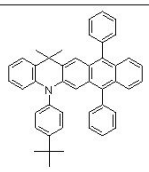
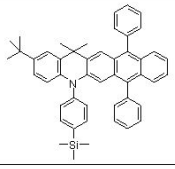
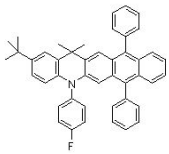
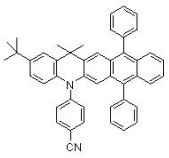
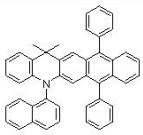
상기 화합물이 하기 화학식 1 내지 223으로 표시되는 것을 특징으로 하는 유기발광화합물:

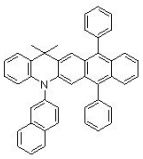
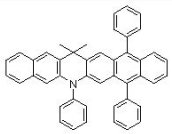
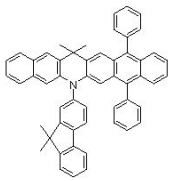
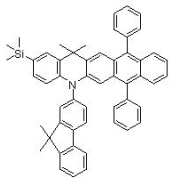
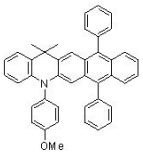
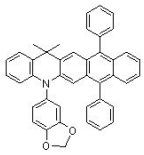
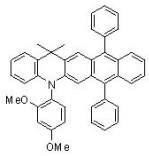
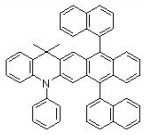
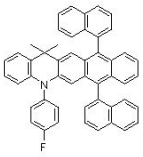
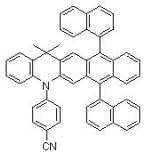
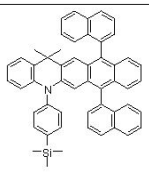
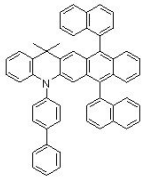
1		2	
3		4	
5		6	
7		8	
9		10	
11		12	
13		14	
15		16	

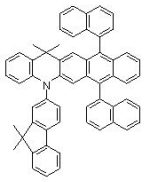
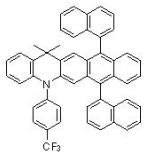
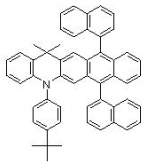
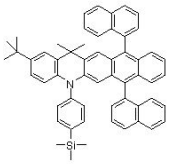
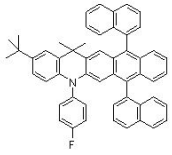
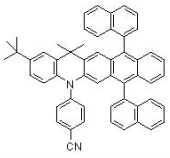
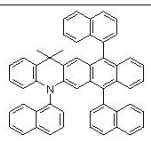
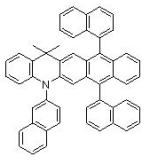
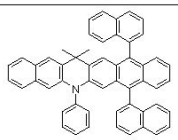
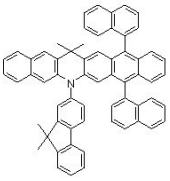
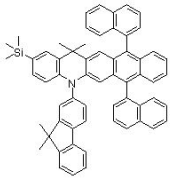
17		18	
19		20	
21		22	
23		24	
25		26	
27		28	
29		30	

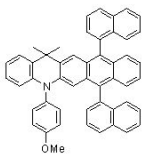
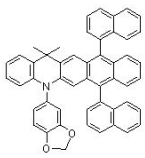
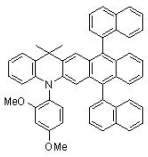
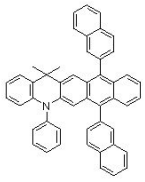
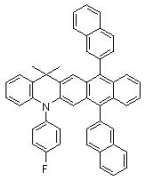
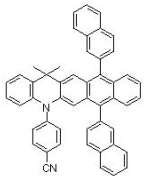
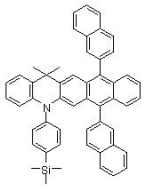
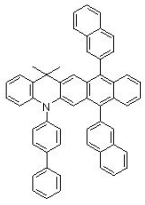
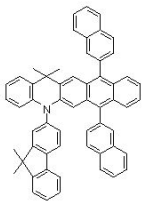
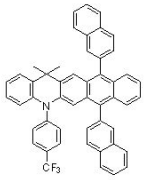
31		32	
33		34	
35		36	
37		38	
39		40	
41		42	
43		44	

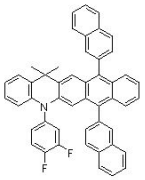
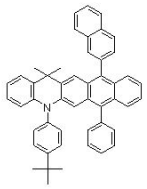
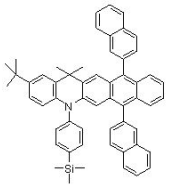
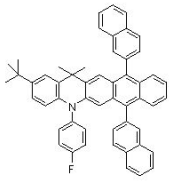
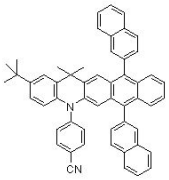
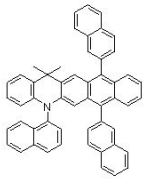
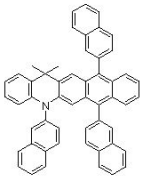
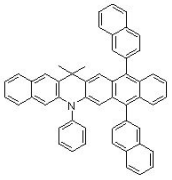
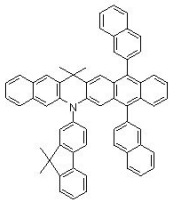
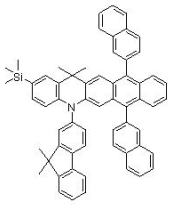
45		46	
47		48	
49		50	
51		52	
53		54	
55		56	
57		58	

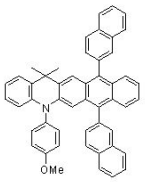
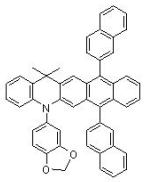
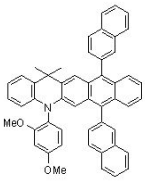
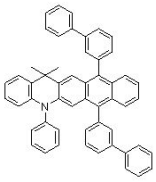
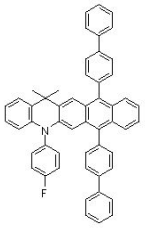
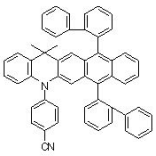
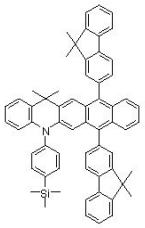
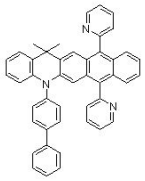
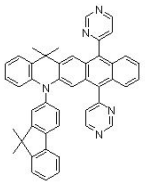
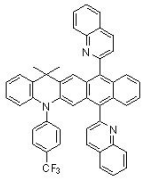
59		60	
61		62	
63		64	
65		66	
67		68	
69		70	

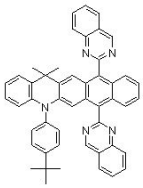
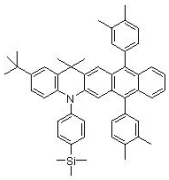
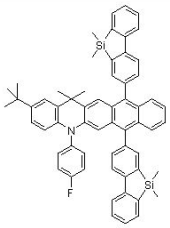
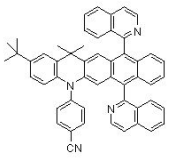
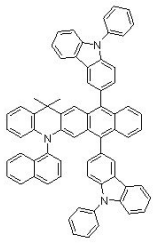
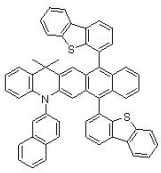
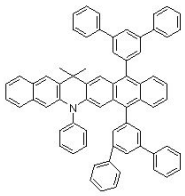
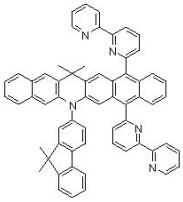
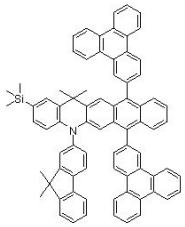
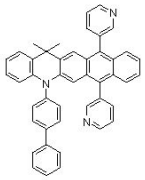
71		72	
73		74	
75		76	
77		78	
79		80	
81		82	

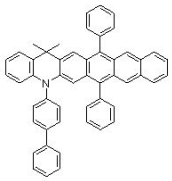
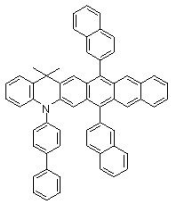
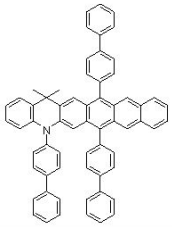
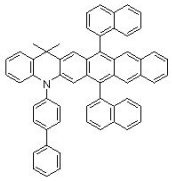
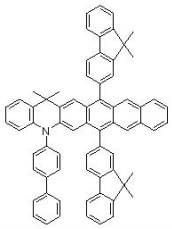
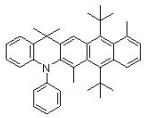
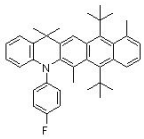
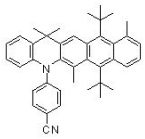
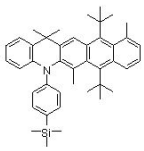
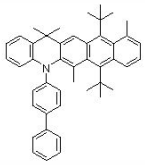
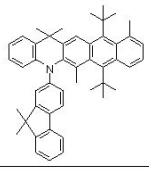
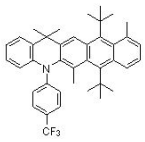
83		84	
85		86	
87		88	
89		90	
91		92	
93		94	

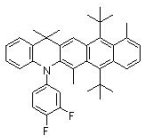
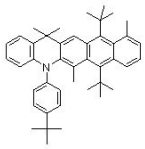
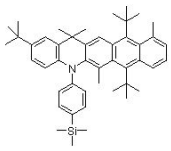
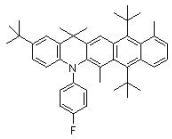
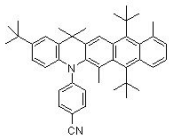
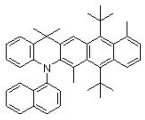
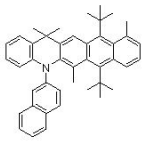
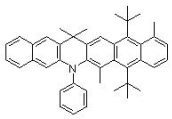
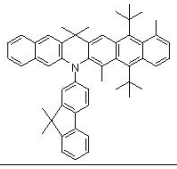
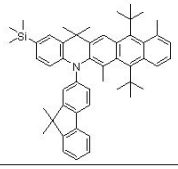
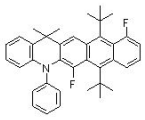
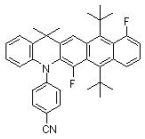
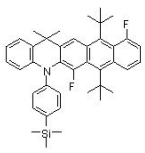
95		96	
97		98	
99		100	
101		102	
103		104	

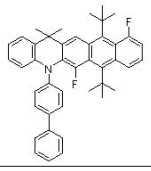
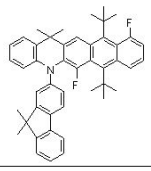
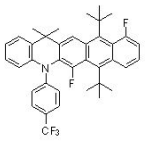
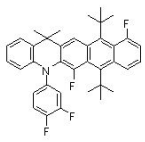
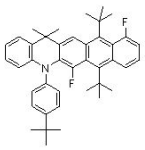
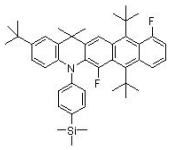
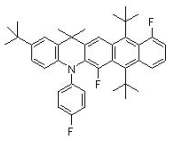
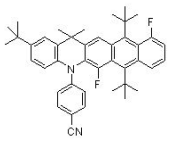
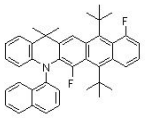
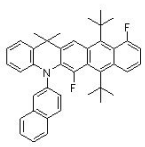
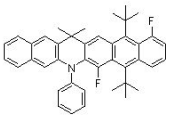
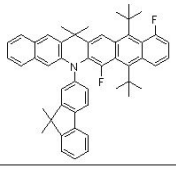
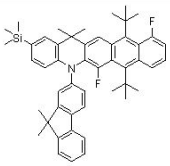
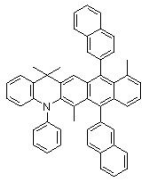
105		106	
107		108	
109		110	
111		112	
113		114	

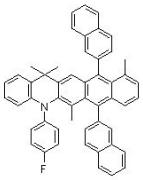
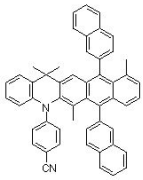
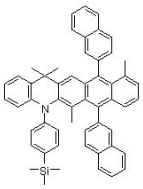
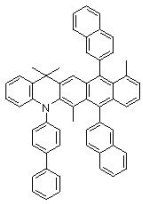
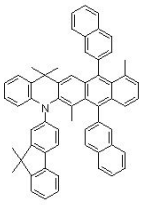
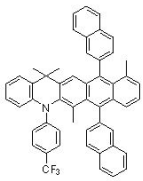
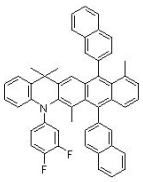
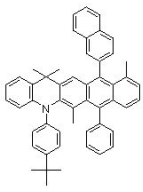
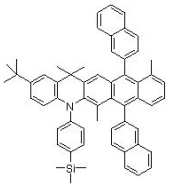
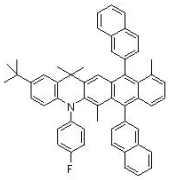
115		116	
117		118	
119		120	
121		122	
123		124	

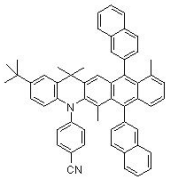
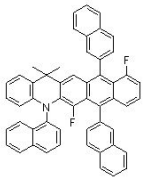
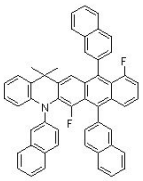
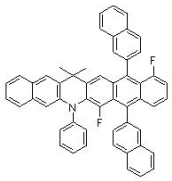
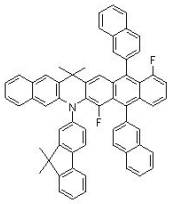
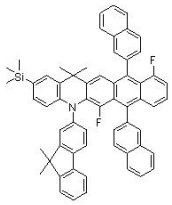
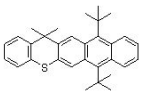
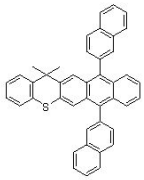
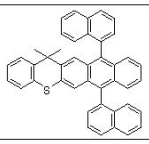
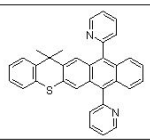
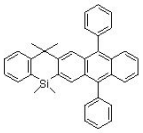
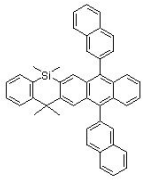
125		126	
127		128	
129		130	
131		132	
133		134	

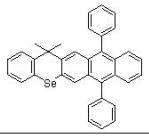
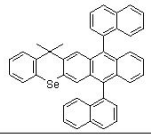
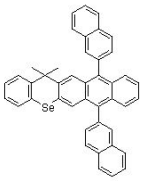
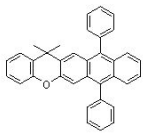
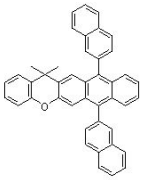
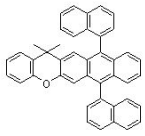
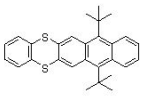
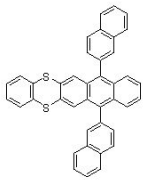
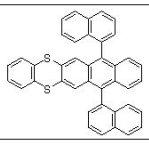
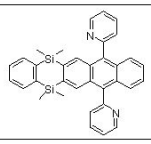
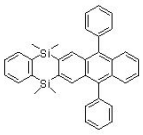
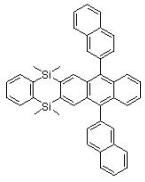
135		136	
137		138	
139		140	
141		142	
143		144	
145		146	

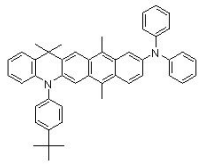
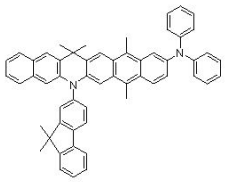
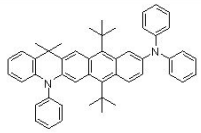
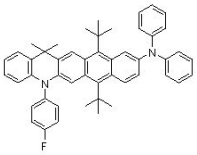
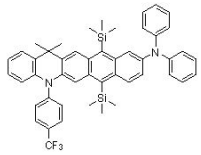
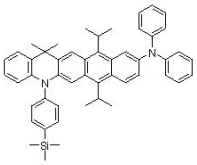
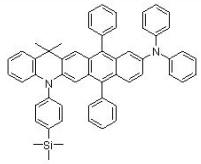
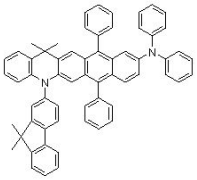
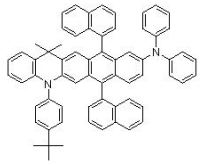
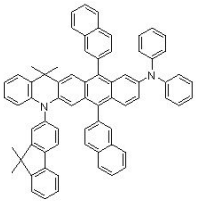
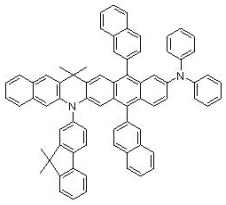
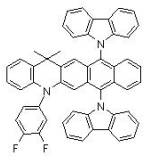
147		148	
149		150	
151		152	
153		154	
155		156	
157		158	
159		160	

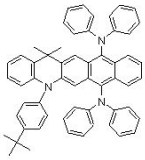
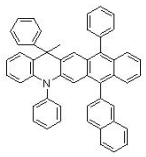
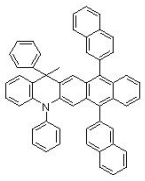
161		162	
163		164	
165		166	
167		168	
169		170	
171		172	
173		174	

175		176	
177		178	
179		180	
181		182	
183		184	

185		186	
187		188	
189		190	
191		192	
193		194	
195		196	

197		198	
199		200	
201		202	
203		204	
205		206	
207		208	

209		210	
211		212	
213		214	
215		216	
217		218	
219		220	

221		222	
223			

명 세 서

기 술 분 야

[0001] 본 발명은 유기발광화합물 및 이를 이용한 유기 광소자에 관한 것으로서, 보다 상세하게는 우수한 발광효율, 발광 휘도, 색순도 및 발광 수명을 구현할 수 있는 아민계 유도체 및 이를 이용한 유기 광소자 또는 태양광 발전용 광소자에 관한 것이다.

배 경 기 술

[0002] 유기전계발광소자 (이하, 유기 EL 소자라 함)는 정공주입전극인 제 1 전극 (애노드 전극)과 전자주입전극인 제2 전극 (캐소드 전극) 사이에 형성된 형광성 또는 유기 화합물 박막 (이하, 유기막이라고 함)에 전자 및 정공을 주입하면, 전자와 정공이 결합하여 쌍을 이룸으로써 생성된 엑시톤 (exciton)이 여기 상태로부터 기저 상태로 떨어지면서 소멸하여 발광하는 원리를 이용한 능동 발광형 표시 소자로서, 경량화가 가능하며, 부품이 간소하여 제작공정이 간단하고, 응답속도가 빠르며, 고화질의 넓은 시야각을 확보하고 있다는 등의 장점들을 갖는다.

[0003] 또한, 동영상을 완벽하게 구현할 수 있고, 고색순도 구현이 가능하며, 초박형화 및 초경량화가 가능하고, 소비전력 및 구동전압이 낮아서 휴대용 전자기기에 적합한 전기적 특성을 갖고 있다.

[0004] 초창기의 대표적 유기전계발광소자는 1969년 구르니 (Gurnee)에 의해서 공지된 단층구조의 것으로서 (미국등록특허 제3,172,862호 및 미국등록특허 제3,173,050호), 100V 이상의 과도한 구동전압을 필요로 하기 때문에 실용화되기 어렵다는 문제점이 있었다. 따라서, 이러한 문제점을 해결하고자, 1987년 이스트만 코닥사 (Eastman Kodak co.)의 Tang에 의해 약 6 내지 14V 정도의 현저히 낮은 구동전압을 갖는 다층구조의 유기전계발광소자가 개발되었으며 (C. W. Tang et al., Appl. Phys. Lett., 51, 913(1987); J. Applied Phys., 65, 3610(1989);US4,356,429), 현재는 정공주입층, 정공수송층, 전자수송층 및 전자주입층 등과 같은 다양한 기능성 적층구조들을 갖는 유기전계발광소자들이 지속적으로 개발되고 있는 추세이다.

[0005] 따라서 현재 다양한 적층구조의 유기전계발광소자에 사용될 수 있는 화합물에 관한 많은 연구가 이루어지고 있지만, 현재까지는 요구되는 휘도, 효율, 구동 안정성 및 수명 등의 특성을 충분히 만족시키지 못하고 있는 실정이며, 따라서 이를 해결하기 위한 다양한 기술개발이 시급한 실정이다. 특히, 발광층 호스트 (host)에 도펀트 (dopant)를 도핑하는 호스트-게스트 시스템에 있어서, 발광층 도판트 물질로서 새로운 화합물에 대한 많은 연구가 필요한 상황이다.

발명의 내용

해결하려는 과제

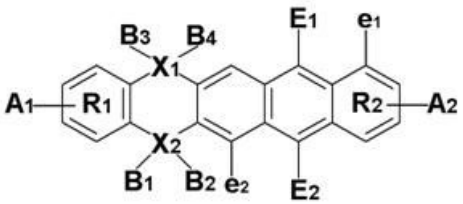
[0006] 본 발명이 이루고자 하는 첫 번째 기술적 과제는 유기 광소자, 특히 유기 전계 발광소자에 적용할 수 있는 새로운 유기발광화합물을 제공하는 것이다.

[0007] 본 발명이 이루고자 하는 두 번째 기술적 과제는 상기 신규 화합물을 포함하여 구동전압이 낮고, 발광효율, 휘도, 색순도, 열적 안정성 및 수명이 향상된 유기 전계 발광 소자 및 태양광 발전을 위한 유기 광소자를 제공하는 것이다.

과제의 해결 수단

[0008] 본 발명에 따른 유기발광화합물 및 이를 이용한 유기 광소자는 하기 화학식 F의 유기발광화합물을 기초로 한다:

[0009] <화학식 F>

[0010] 

[0011] 상기 화학식 F에서

[0012] 상기 X1은 C, Si, N, O, S 또는 Se이고, X2는 Si, N, O, S 또는 Se이고,

[0013] X1 또는 X2가 O, S 또는 Se인 경우, 상기 B1, B2, B3 및 B4는 0(zero)이고,

[0014] X1 또는 X2가 N인 경우, 상기 B2 및 B4는 0(zero)이고, 상기 B1 및 B3는 각각 독립적으로 C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기,

C5~C40의 디아릴아미노기, 실레인기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기로 이루어진 군에서 선택되거나; 또는 인접하는 기와 축합(fused) 지방족 고리, 축합 방향족 고리, 축합 헤테로지방족 고리 또는 축합 헤테로방향족 고리를 형성하는 기이고,

[0015] X1 또는 X2가 C 또는 Si인 경우, 상기 B1, B2, B3 및 B4는 각각 독립적으로 C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기, C5~C40의 디아릴아미노기, 실레인기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기로 이루어진 군에서 선택되거나; 또는 인접하는 기와 축합(fused) 지방족 고리, 축합 방향족 고리, 축합 헤테로지방족 고리 또는 축합 헤테로방향족 고리를 형성하는 기이고,

[0016] 상기 A1, A2, E1, E2, e1 및 e2는 각각 독립적으로 H, D, F, C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기, C5~C40의 디아릴아미노기, 실레인기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기로 이루어진 군에서 선택되거나; 또는 인접하는 기와 축합(fused) 지방족 고리, 축합 방향족 고리, 축합 헤테로지방족 고리 또는 축합 헤테로방향족 고리를 형성하는 기이거나,

[0017] 상기 A1 및 A2는 각각 독립적으로 인접하는 고리 R1 및 R2와 축합(fused) 지방족 고리, 축합 방향족 고리, 축합 헤테로지방족 고리 또는 축합 헤테로방향족 고리를 형성하는 기이다.

[0018] 또 본 발명에 따른 유기 광화합물 및 이를 이용한 유기 광소자는 하기 화학식 1 내지 223에 해당하는 유기 광화합물을 기초로 한다.

발명의 효과

[0019] 본 발명에 따른 유기 광소자는 높은 발광 효율, 높은 발광 휘도, 높은 색순도 및 현저히 향상된 발광 수명을 제공하며,

[0020] 아울러 본 발명은 이를 유기 발광 소자 및 유기 발광 화합물, 또는 태양광 발전을 위한 유기 광소자 및 광화합물을 제공한다.

발명을 실시하기 위한 구체적인 내용

[0021] 이하 본 발명을 상세히 설명하도록 한다.

[0022] 본 발명은 다양한 변경을 가할 수 있고 여러 가지 형태를 가질 수 있는 바, 구현예(態樣, aspect)(또는 실시예)들을 본문에 상세하게 설명하고자 한다. 그러나 이는 본 발명을 특정한 개시 형태에 대해 한정하려는 것이 아니며, 본 발명의 사상 및 기술범위에 포함되는 모든 변경, 균등물 내지 대체물을 포함하는 것으로 이해되어야 한다.

[0023] 본 명세서에서 사용한 용어는 단지 특정한 구현예(태양, 態樣, aspect)(또는 실시예)를 설명하기 위해 사용된 것으로, 본 발명을 한정하려는 의도가 아니다. 단수의 표현은 문맥상 명백하게 다르게 뜻하지 않는 한, 복수의 표현을 포함한다. 본 출원에서, ~포함하다~ 또는 ~이루어진다~ 등의 용어는 명세서 상에 기재된 특징, 숫자, 단계, 동작, 구성요소, 부분품 또는 이들을 조합한 것이 존재함을 지정하려는 것이지, 하나 또는 그 이상의 다른 특징들이나 숫자, 단계, 동작, 구성요소, 부분품 또는 이들을 조합한 것들의 존재 또는 부가 가능성을 미리 배제하지 않는 것으로 이해되어야 한다.

[0024] 다르게 정의되지 않는 한, 기술적이거나 과학적인 용어를 포함해서 여기서 사용되는 모든 용어들은 본 발명이 속하는 기술 분야에서 통상의 지식을 가진 자에 의해 일반적으로 이해되는 것과 동일한 의미를 가지고 있다. 일반적으로 사용되는 사전에 정의되어 있는 것과 같은 용어들은 관련 기술의 문맥 상 가지는 의미와 일치하는 의미를 가지는 것으로 해석되어야 하며, 본 출원에서 명백하게 정의하지 않는 한, 이상적이거나 과도하게 형식적인 의미로 해석되지 않는다.

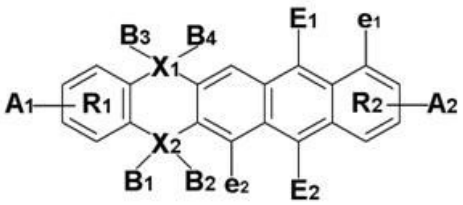
[0025] 본 발명은 아민계 유도체를 개발하여 전자수송층(ETM), 발광층(EML), 정공수송층(HTM) 등, 제1전극과 상기 제2전극 사이의 각종 유기막과 같이 다각적으로 쓰일 수 있는 물질을 제시하고, 효율 증가와 구동 전압의 감소와 같은 성능의 개선 및 OLED 재료로서의 능력을 극대화시킨 물질을 개발하고자 한다.

[0026] 본 명세서에서 유기발광화합물은 유기 광소자에 사용되는 화합물이라는 의미로서 반드시 발광이 가능한 화합물로 그 범위가 한정되지 않으며, 그 적용 범위도 유기 발광층에 한정되지 않고, 전하 주입층 및 전하 수송층 등 유기 광소자를 구성하는 어느 층에나 모두 사용될 수 있다.

[0027] 또 본 명세서에서 '광화합물' 및 '광소자'라는 용어는 사전적인 또는 관습적인 정의와 무관하게 본 발명이 유기발광 소자 및 태양광 발전을 위한 소자에 모두 적용되는 경우를 고려하여, 이를 포괄하고자 선정한 용어이다.

[0028] 본 발명의 제 1태양에 따르는 유기 광소자는, 제1전극; 제2전극; 및 상기 제1전극과 상기 제2전극 사이에 적어도 한 층의 유기막을 포함하는 유기 광소자로서, 상기 유기막이 하기 화학식 F의 유기발광화합물을 포함한다.

[0029] <화학식 F>



[0030]

[0031] 상기 화학식 F에서

[0032] 상기 X1은 C, Si, N, O, S 또는 Se이고, X2는 Si, N, O, S 또는 Se이고,

[0033] X1 또는 X2가 O, S 또는 Se인 경우, 상기 B1, B2, B3 및 B4는 0(zero)이고,

[0034] X1 또는 X2가 N인 경우, 상기 B2 및 B4는 0(zero)이고, 상기 B1 및 B3는 각각 독립적으로 C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기, C5~C40의 디아릴아미노기, 실레인기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기로 이루어진 군에서 선택되거나; 또는 인접하는 기와 축합(fused) 지방족 고리, 축합 방향족 고리, 축합 헤테로지방족 고리 또는 축합 헤테로방향족 고리를 형성하는 기이고,

[0035] X1 또는 X2가 C 또는 Si인 경우, 상기 B1, B2, B3 및 B4는 각각 독립적으로 C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기, C5~C40의 디아릴아미노기, 실레인기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기로 이루어진 군에서 선택되거나; 또는 인접하는 기와 축합(fused) 지방족 고리, 축합 방향족 고리, 축합 헤테로지방족 고리 또는 축합 헤테로방향족 고리를 형성하는 기이고,

[0036] 상기 A1, A2, E1, E2, e1 및 e2는 각각 독립적으로 H, D, F, C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기, C5~C40의 디아릴아미노기, 실레인기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기로 이루어진 군에서 선택되거나; 또는 인접하는 기와 축합(fused) 지방족 고리, 축합 방향족 고리, 축합 헤테로지방족 고리 또는 축합 헤테로방향족 고리를 형성하는 기이거나,

[0037] 상기 A1 및 A2는 각각 독립적으로 인접하는 고리 R1 및 R2와 축합(fused) 지방족 고리, 축합 방향족 고리, 축합 헤테로지방족 고리 또는 축합 헤테로방향족 고리를 형성하는 기이다.

[0038] 본 발명의 발명자는 상기 화학식 F의 유기발광화합물의 치환기에서 A1, A2, E1, E2, e1, e2, B1, B2, B3 및 B4와 X1 및 X2를 선택 특정한,

[0039] 다양한 유도체를 개발하여 전자수송층(ETM), 발광층(EML), 정공수송층(HTM) 등, 제1전극과 상기 제2전극 사이의 각종 유기막으로 사용될 수 있는 유기발광화합물 및

[0040] 이를 이용한 유기 광소자를 개발하고,

[0041] 유기발광소자로 활용될 경우 효율 증가와 구동 전압의 감소와 같은 성능의 개선 및 OLED 재료로서의 능력을 극대화시킬 수 있고, 특히 발광 수명이 현저히 향상됨을 발견하였으며,

[0042] 이를 태양광 발전을 위한 광소자 및 광화합물 분야에 응용 적용할 경우 우수한 발전 효율을 얻을 수 있을 것으로 기대된다.

[0043] 이하에서는 화학식 F의 유기발광화합물을 유기 발광 소자와 관련하여 설명할 것이나, 이에 의하여 본 발명이 제한 해석 되어서는 안 된다.

[0044] 상기 화학식 F의 유기발광화합물은 유기 광소자 중 제1전극과 제2전극 사이에 개재된 유기막을 이루는 물질로 적합하다. 상기 화학식 F의 유기발광화합물은 유기 발광 소자의 유기막, 특히 정공수송층, 정공주입층 또는 발광층에 사용되기 적합하며 호스트 재료뿐만 아니라 도판트 재료로서도 사용된다.

[0045] 상기 A1, A2, E1, E2, e1, e2, B1, B2, B3 및 B4의 상기 C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기, C5~C40의 디아릴아미노기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기는

[0046] 각각 독립적으로 D, F, 할로겐, 니트릴기, 니트로기, C1~C40의 알킬기, C5~C40의 아릴옥시기, C2~C40의 알케닐기, C1~C40의 알콕시기, C1~C40의 아미노기, C3~C40의 시클로알킬기, C3~C40의 헤테로시클로알킬기, C6~C40의 아릴기, C3~C40의 헤테로아릴기, 실레인기 및 트리플로로메틸기로 이루어진 군에서 선택되는 하나 이상으로 치환되거나 비치환된 것이 바람직하다.

[0047] 또 상기 A1, A2, E1, E2, e1, e2, B1, B2, B3 및 B4의 상기 C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기, C5~C40의 디아릴아미노기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기에 도입되는 치환기 중에서

[0048] C1~C40의 알킬기, C5~C40의 아릴옥시기, C2~C40의 알케닐기, C1~C40의 알콕시기, C1~C40의 아미노기, C3~C40의 시클로알킬기, C3~C40의 헤테로시클로알킬기, C6~C40의 아릴기, C3~C40의 헤테로아릴기, 실레인기는

[0049] 각각 독립적으로 D, F, 할로겐, 니트릴기, 니트로기, C1~C40의 알킬기, C2~C40의 알케닐기, C1~C40의 알콕시기, C1~C40의 아미노기, C3~C40의 시클로알킬기, C3~C40의 헤테로시클로알킬기, C6~C40의 아릴기 및 C3~C40의 헤테로아릴기로 이루어진 군에서 선택되는 하나 이상의 제2치환기로 추가적으로 치환되거나; 또는 인접하는 기와 축합 지방족 고리, 축합 방향족 고리, 축합 헤테로지방족 고리 또는 축합 헤테로방향족 고리를 형성하거나 스피로 결합을 하는 것이 바람직하다.

[0050] 나아가 상기 A1, A2, E1, E2, e1, e2, B1, B2, B3 및 B4의 상기 C1~C40의 알킬기, C5~C40의 아릴기, C3~C40의 헤테로아릴기, C5~C40의 아릴옥시기, C1~C40의 알킬옥시기, C5~C40의 아릴아미노기, C5~C40의 디아릴아미노기, C6~C40의 아릴알킬기, C3~C40의 시클로알킬기 및 C3~C40의 헤테로시클로알킬기에 도입되는 치환기는

[0051] D, F, 페닐기, 톨일기, 비페닐기, 펜타레닐기, 인데닐기, 나프틸기, 비페닐레닐기, 안트라세닐기, 벤조안트라세닐기, 아즈레닐기, 헵타레닐기, 아세나프틸레닐기, 페나레닐기, 메틸안트릴기, 페난트레닐기, 트리페닐레닐기, 피레닐기, 크리세닐기, 피세닐기, 페릴레닐기, 클로로페릴레닐기, 펜타페닐기, 펜타세닐기, 테트라페닐레닐기, 헥사페닐기, 헥사세닐기, 루비세닐기, 코로네닐기, 트리나프틸레닐기, 헵타페닐기, 헵타세닐기, 플루오레닐기, 피란트레닐기, 오바레닐기, 카르바졸릴기, 디벤조퓨라닐기, 디벤조티오페닐기, 티오페닐기, 인돌일기, 푸리닐기, 벤즈이미다졸일기, 퀴놀리닐기, 벤조티오페닐기, 파라티아지닐기, 피롤일기, 피라졸릴기, 이미다졸릴기, 이미다졸리닐기, 옥사졸릴기, 티아졸릴기, 트리아졸릴기, 테트라졸일기, 옥사디아졸릴기, 피리디닐기, 피리다지닐기, 피리미디닐기, 피라지닐기, 티안트레닐기(thianthrenyl), 사이클로펜틸기, 사이클로헥실기, 옥시라닐

기, 피롤리디닐기, 피라졸리디닐기, 이미다졸리디닐기, 피페리디닐기, 피페라지닐기, 모르폴리닐기, 디(C6-C50아릴)아미노기, 실레인기 및 이들의 유도체로 이루어진 군으로부터 선택된 것이 바람직하다.

[0052] 상기 아릴기는 방향족 고리 시스템을 갖는 1가 그룹으로서, 2 이상의 고리시스템을 포함할 수 있으며, 상기 2이상의 고리 시스템은 서로 결합 또는 축합된 형태로 존재할 수 있다. 상기 헤테로아릴기는 상기 아릴기 중 하나 이상의 탄소가 N, O, S, P, Si 및 Se로 이루어진 군으로부터 선택된 하나 이상으로 치환된 그룹을 가리킨다.

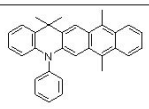
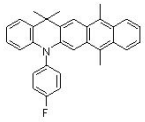
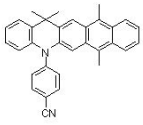
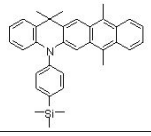
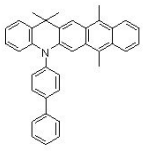
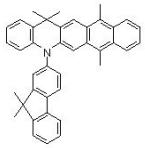
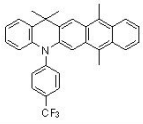
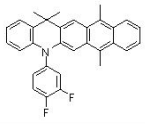
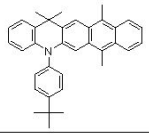
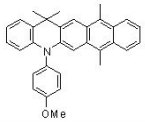
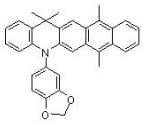
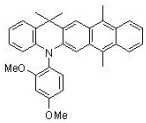
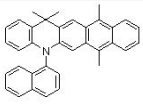
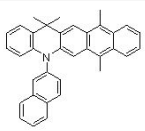
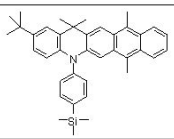
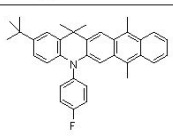
[0053] 한편, 사이클로알킬기는 고리 시스템을 갖는 알킬기를 가리키며, 상기 헤테로사이클로알킬기는 상기 사이클로알킬기 중 하나 이상의 탄소가 N, O, S, P, Si 및 Se로 이루어진 군으로부터 선택된 하나 이상으로 치환된 그룹을 가리킨다.

[0054] 상기 아릴기 및 헤테로아릴기의 하나 이상의 수소가 치환될 경우, 이들의 치환기는 C1-C50알킬기; C1-C50알콕시기; 비치환 또는 C1-C50알킬기 또는 C1-C50알콕시기로 치환된 C6-C50아릴기; 비치환 또는 C1-C50알킬기 또는 C1-C50알콕시기로 치환된 C2-C50헤테로아릴기; 비치환 또는 C1-C50알킬기 또는 C1-C50알콕시기로 치환된 C5-C50사이클로알킬기및 비치환 또는 C1-C20알킬기 또는 C1-C20알콕시기로 치환된 C5-C50헤테로사이클로알킬기, 또는 실레인기로 표시되는 그룹으로 이루어진 군으로부터 선택된 하나 이상일 수 있다.

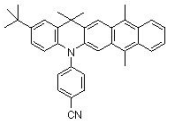
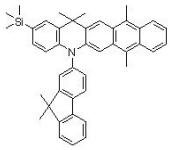
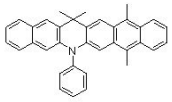
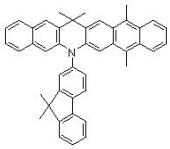
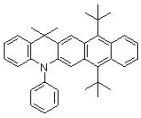
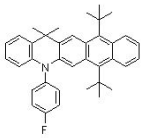
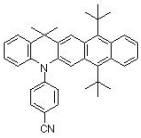
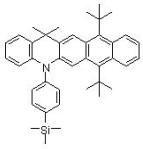
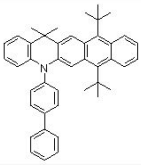
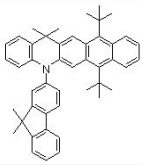
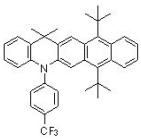
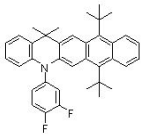
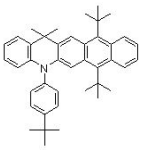
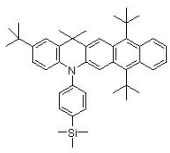
[0055] 본 발명의 제 1태양에 따르는 유기 광소자는, 제1전극; 제2전극; 및 상기 제1전극과 상기 제2전극 사이에 적어도 한 층의 유기막을 포함하는 유기 광소자이다.

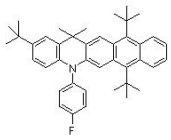
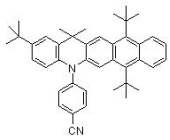
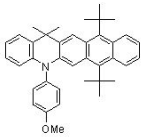
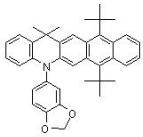
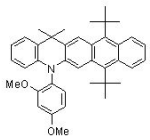
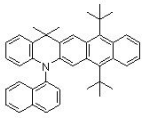
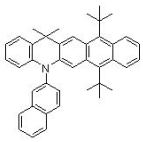
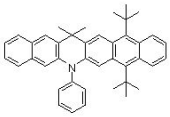
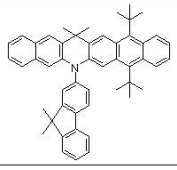
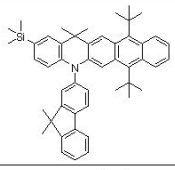
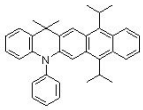
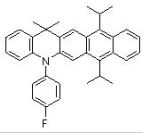
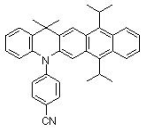
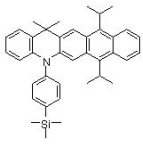
[0056] 본 발명의 유기 광소자에 사용되는 유기발광화합물은 하기 화학식 1 내지 223의 구조(이하 화학식들에서 '화학식'은 생략하고 숫자만 기재함)를 가질 수 있으나 이에 한정되는 것은 아니다:

[0057]

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

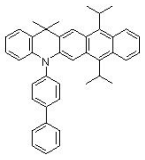
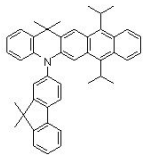
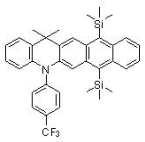
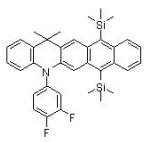
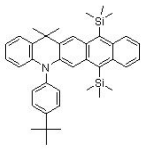
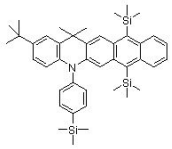
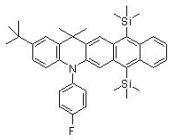
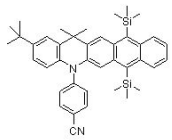
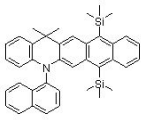
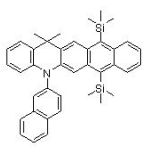
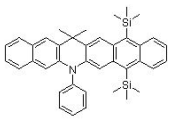
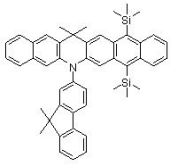
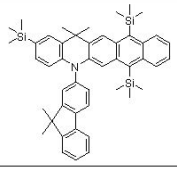
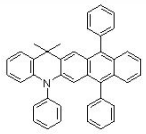
[0058]

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

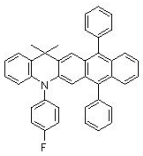
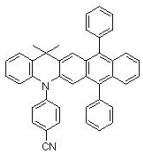
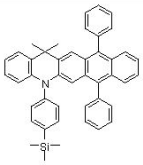
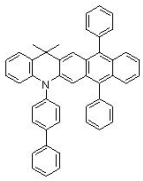
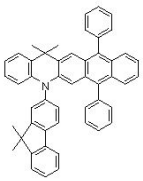
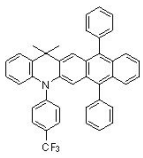
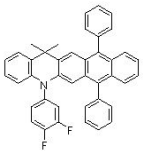
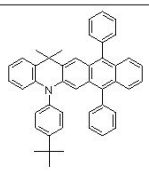
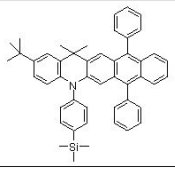
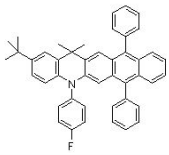
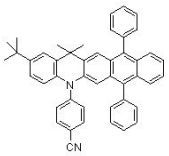
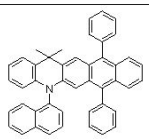
31		32	
33		34	
35		36	
37		38	
39		40	
41		42	
43		44	

[0059]

[0060]

45		46	
47		48	
49		50	
51		52	
53		54	
55		56	
57		58	

[0061]

59		60	
61		62	
63		64	
65		66	
67		68	
69		70	

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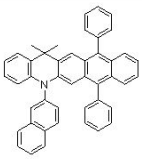
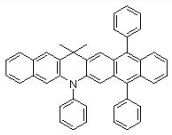
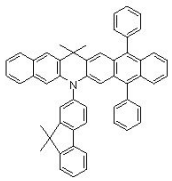
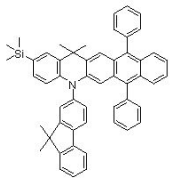
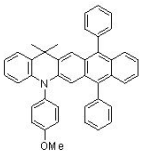
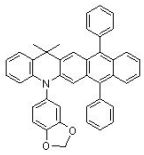
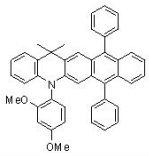
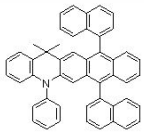
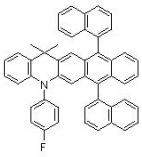
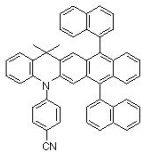
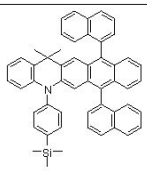
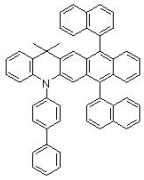
71		72	
73		74	
75		76	
77		78	
79		80	
81		82	

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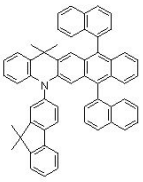
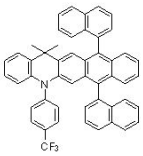
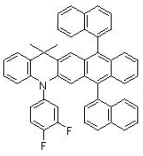
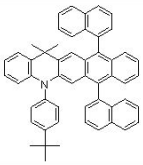
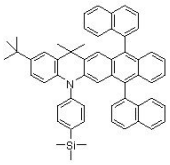
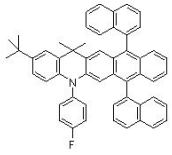
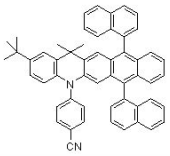
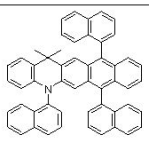
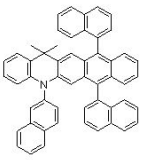
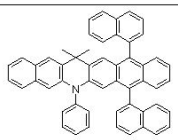
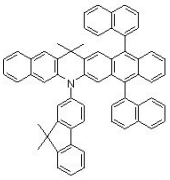
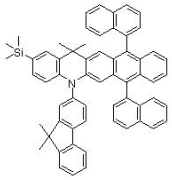
83		84	
85		86	
87		88	
89		90	
91		92	
93		94	

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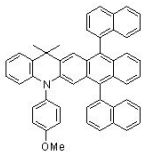
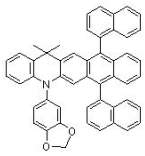
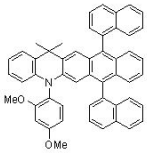
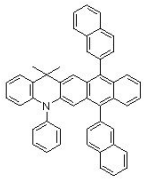
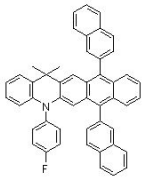
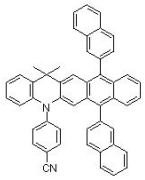
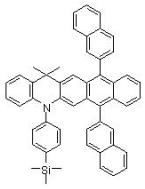
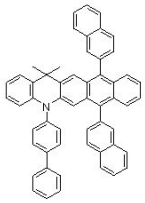
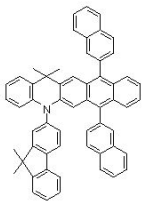
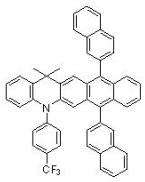
95		96	
97		98	
99		100	
101		102	
103		104	

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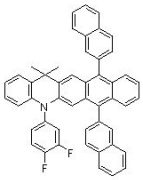
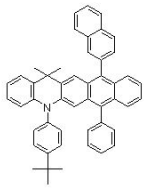
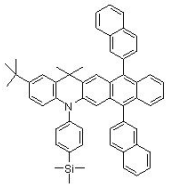
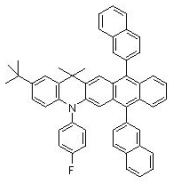
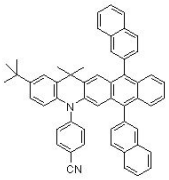
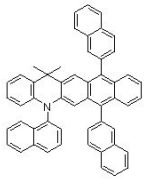
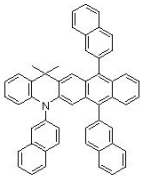
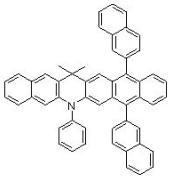
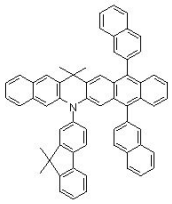
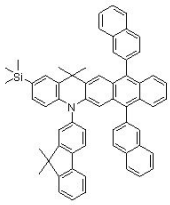
105		106	
107		108	
109		110	
111		112	
113		114	

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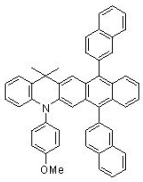
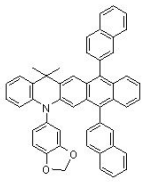
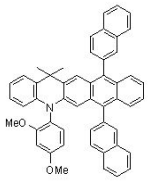
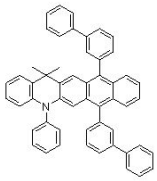
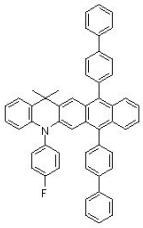
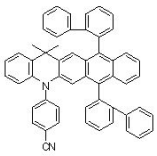
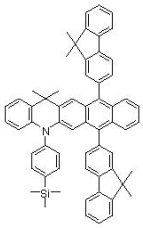
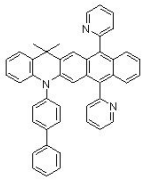
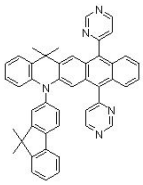
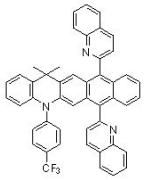
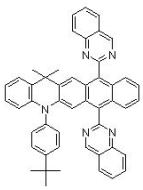
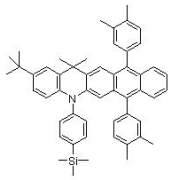
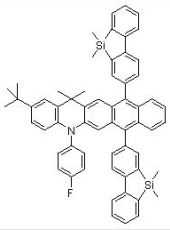
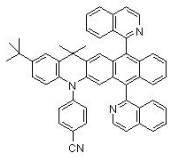
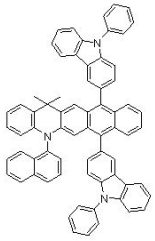
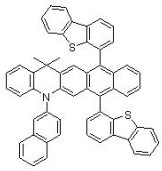
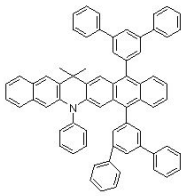
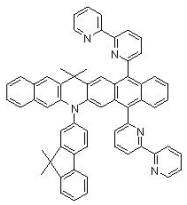
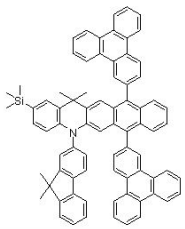
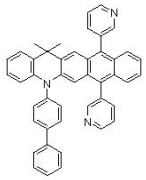
115		116	
117		118	
119		120	
121		122	
123		124	

125		126	
127		128	
129		130	
131		132	
133		134	

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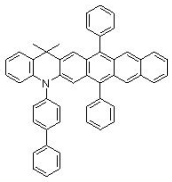
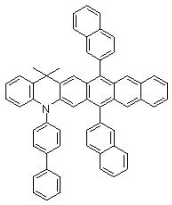
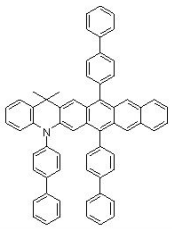
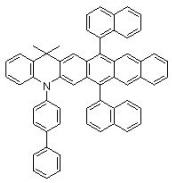
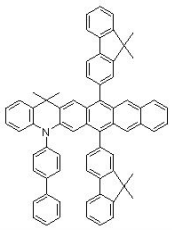
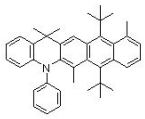
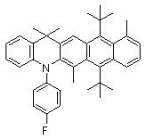
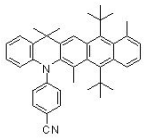
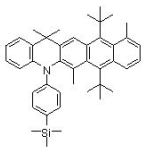
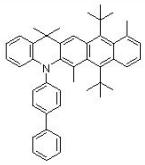
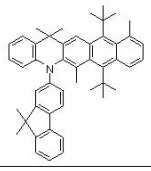
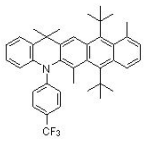
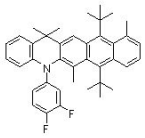
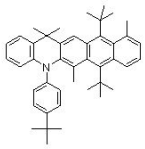
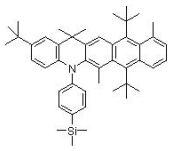
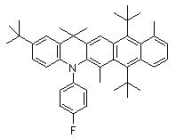
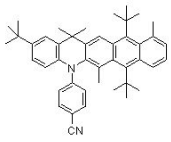
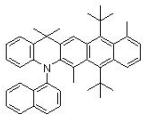
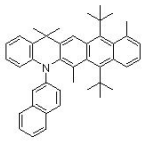
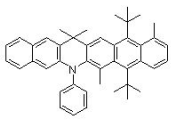
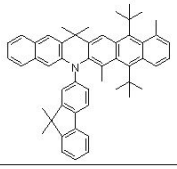
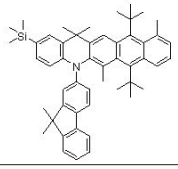
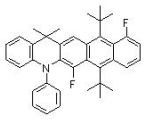
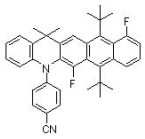
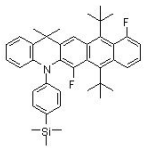
135		136	
137		138	
139		140	
141		142	
143		144	
145		146	

147		148	
149		150	
151		152	
153		154	
155		156	
157		158	
159		160	

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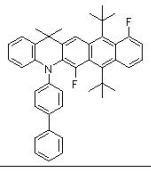
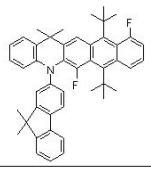
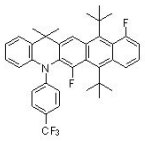
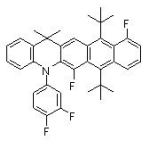
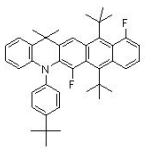
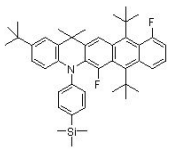
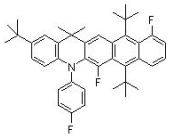
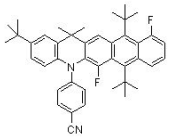
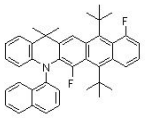
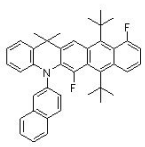
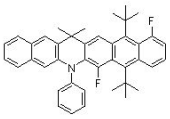
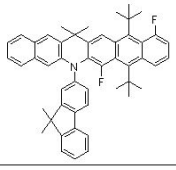
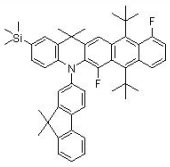
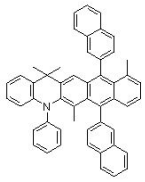
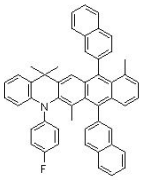
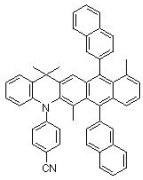
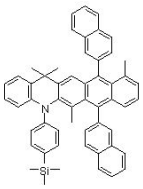
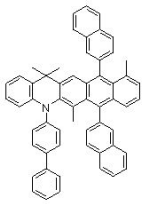
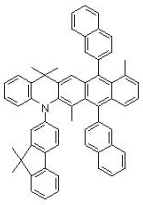
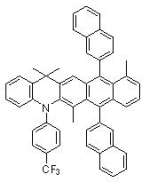
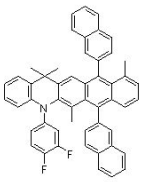
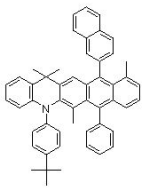
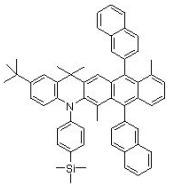
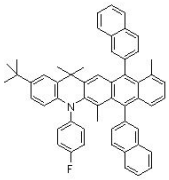
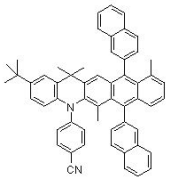
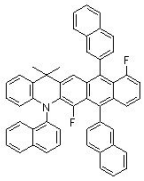
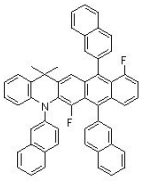
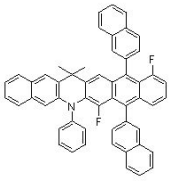
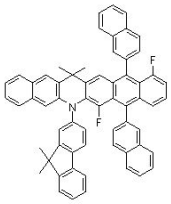
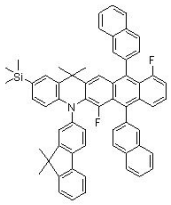
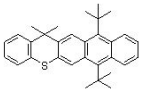
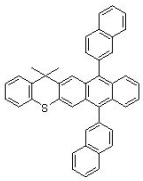
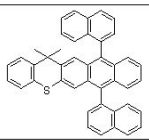
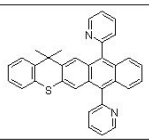
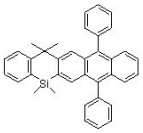
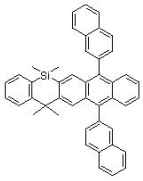
161		162	
163		164	
165		166	
167		168	
169		170	
171		172	
173		174	

[0071]

175		176	
177		178	
179		180	
181		182	
183		184	

[0072]

185		186	
187		188	
189		190	
191		192	
193		194	
195		196	

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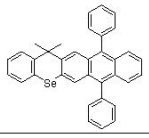
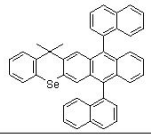
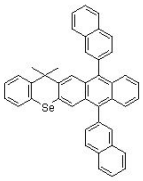
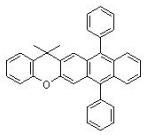
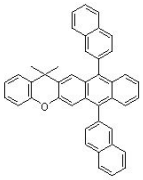
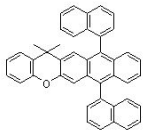
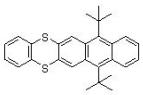
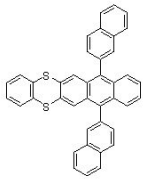
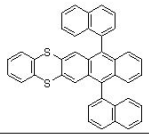
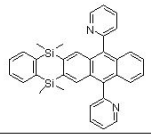
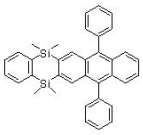
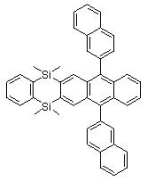
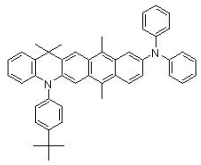
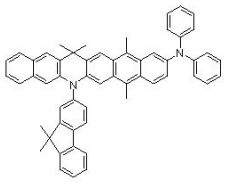
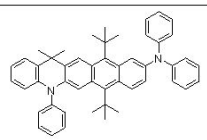
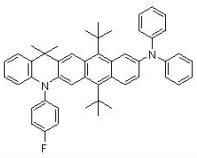
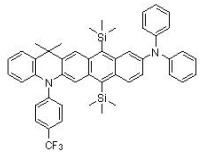
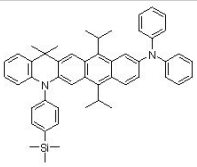
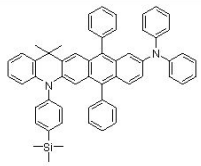
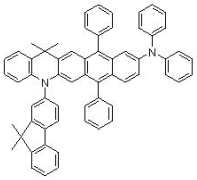
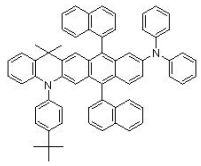
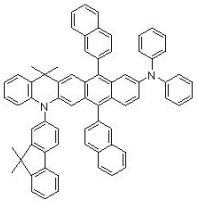
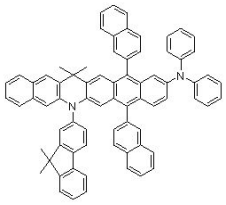
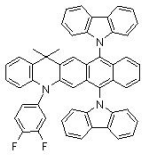
197		198	
199		200	
201		202	
203		204	
205		206	
207		208	

209		210	
211		212	
213		214	
215		216	
217		218	
219		220	

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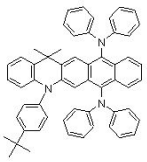
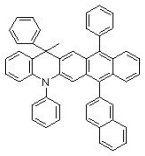
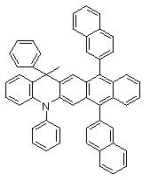
221		222	
223			

[0075]

[0076] 상기 화학식 F의 화합물로 표시되는 본 발명에 따른 유기발광화합물은 통상의 합성 방법을 이용하여 합성될 수 있으며,상기 화합물의 보다 상세한 합성 경로는 하기 합성예의 반응식들을 참조한다. 상기 화학식 F의 화합물은

유기 광소자의 유기막, 특히 정공수송층, 정공주입층 또는 발광층에 사용되기 적합하다. 본 발명을 따르는 유기 발광 소자의 구조는 매우 다양하다. 상기 제1전극과 제2전극 사이에 정공주입층, 정공수송층, 정공저지층, 전자저지층, 전자수송층 및 전자주입층으로 이루어진 군으로부터 선택된 하나 이상의 층을 더 포함할 수 있다.

[0077] 보다 구체적으로, 본 발명을 따르는 유기 발광 소자의 구현예는

[0078] 먼저, 유기 발광 소자는 제1전극/정공주입층/발광층/전자수송층/전자주입층/제2전극으로 이루어진 구조를 가질 수 있고,

[0079] 또 유기 발광 소자는 제1전극/정공주입층/정공수송층/발광층/전자수송층/전자주입층/제2전극으로 이루어진 구조를 가질 수 있으며,

[0080] 나아가 유기 발광 소자는 제1전극/정공주입층/정공수송층/발광층/정공저지층/전자수송층/전자주입층/제2전극의 구조를 가질 수 있다.

[0081] 이때, 상기 정공수송층, 정공주입층 및 발광층 중 하나 이상은 본 발명을 따르는 화합물을 포함할 수 있다.

[0082] 본 발명을 따르는 유기 광소자의 발광층은 적색, 녹색, 청색 또는 백색을 포함하는 인광 또는 형광 도펀트를 포함할 수 있다. 이 중, 상기 인광 도펀트는 Ir, Pt, Os, Ti, Zr, Hf, Eu, Tb 및 Tm으로 이루어진 군으로부터 선택된 하나 이상의 원소를 포함하는 유기금속화합물일 수 있다. 또한, 본 발명에 따르는 화합물은 발광층에서 형광 도펀트로도 사용될 수 있다.

[0083] 이하, 본 발명을 따르는 유기 광소자의 제조 방법을 유기 광소자를 참조하여, 살펴보기로 한다. 먼저 기판 상부에 높은 일함수를 갖는 제1전극용 물질을 증착법 또는 스퍼터링법 등에 의해 형성하여 제1전극을 형성한다. 상기 제1전극은 애노드(Anode)일 수 있다. 여기에서 기판으로는 통상적인 유기 광소자에서 사용되는 기판을 사용하는데 기계적 강도, 열적 안정성, 투명성, 표면 평활성, 취급용이성 및 방수성이 우수한 유리 기판 또는 투명 플라스틱 기판이 바람직하다. 제1전극용 물질로는 투명하고 전도성이 우수한 산화인듐주석(ITO), 산화인듐아연(IZO), 산화주석(SnO2), 산화아연(ZnO) 등을 사용한다.

[0084] 다음으로, 상기 제1전극 상부에 진공증착법, 스핀코팅법, 캐스트법, LB법 등과 같은 다양한 방법을 이용하여 정공주입층(HIL)을 형성할 수 있다.

[0085] 진공증착법에 의하여 정공주입층을 형성하는 경우, 그 증착 조건은 정공주입층의 재료로서 사용하는 화합물, 목적으로 하는 정공주입층의 구조 및 열적 특성 등에 따라 다르지만, 일반적으로 증착온도 100 내지 500℃, 진공도 10^{-5} 내지 10^{-3} torr, 증착속도 0.01 내지 100Å/sec, 막 두께는 통상 100Å 내지 1㎛ 범위에서 적절히 선택하는 것이 바람직하다.

[0086] 스핀코팅법에 의하여 정공주입층을 형성하는 경우, 그 코팅 조건은 정공주입층의 재료로서 사용하는 화합물, 목적하는 하는 정공주입층의 구조 및 열적 특성에 따라 상이하지만, 약 2000rpm 내지 5000rpm의 코팅 속도, 코팅 후 용매 제거를 위한 열처리 온도는 약 80℃ 내지 200℃의 온도 범위 에서 적절히 선택하는 것이 바람직하다.

[0087] 상기 정공주입층 물질은 전술한 바와 같은 화학식 a를 갖는 화합물일 수 있다.

[0088] 또는, 예를 들어, 미국특허 제4,356,429호에 개시된 구리프탈로시아닌 등의 프탈로시아닌 화합물 또는 Advanced Material, 6, p.677(1994)에 기재되어 있는 스타버스트형 아민 유도체류인 TCTA, m-MTDATA, m-MTDAPB, 2-TNATA(4,4',4" -tris(N-(2-naphtyl)-N-phenylamino)triphenylamine:4,4 ,4 -트리스(N-(나프틸)-N-페닐아미노)트리페닐아민), 용해성이 있는 전도성 고분자인 Pani/DBSA (Polyaniline/Dodecylbenzenesulfonic acid:폴리아닐린/도데실벤젠술폰산) 또는 PEDOT/PSS (Poly(3,4-ethylenedioxythiophene)/Poly(4-styrenesulfonate):폴리(3,4-에틸렌디옥시티오펜)/폴리(4-스티렌술포네이트)), PANI/CSA (Polyaniline/Camphor sulfonicacid:폴리아닐린/캠퍼술폰산) 또는 PANI/PSS

[0089] (Polyaniline)/Poly(4-styrenesulfonate):폴리아닐린)/폴리(4-스티렌술포네이트)) 등과 같은 공지된 정공주입 물질을 사용할 수 있다.

[0090] 상기 정공주입층의 두께는 약 100Å 내지 10000Å, 바람직하게는 100Å 내지 1000Å일 수 있다. 상기 정공주입층의 두께가 100Å 미만인 경우, 정공주입 특성이 저하될 수 있으며, 상기 정공주입층의 두께가 10000Å를 초과하는 경우, 구동전압이 상승할 수 있기 때문이다.

[0091] 다르게는, 상기 정공주입층은 진공기상증착법에 의해 형성할 수 있다. 구체적인 증착조건은 사용하는 화합물에 따라 다르지만, 일반적인 정공주입층의 형성과 거의 동일한 조건범위 중에서 선택된다. 예를 들어 DNTPD(N,N-bis-[4-(di-m-tolylamino)phenyl]-N,N -diphenylbiphenyl-4,4 -diamine) 등이 사용될 수 있다.

[0092] 다음으로 상기 정공주입층 상부에 진공증착법, 스핀코팅법, 캐스트법, LB법 등과 같은 다양한 방법을 이용하여 정공수송층(HTL)을 형성할 수 있다. 진공증착법 및 스핀팅법에 의하여 정공수송층을 형성하는 경우, 그 증착조건 및 코팅조건은 사용하는 화합물에 따라 다르지만, 일반적으로 정공주입층의 형성과 거의 동일한 조건범위 중에서 선택된다.

[0093] 상기 정공수송층 물질은 전술한 바와 같은 화학식 a의 화합물을 포함할 수 있다. 또는, 예를 들어, N-페닐카르바졸, 폴리비닐카르바졸 등의 카르바졸 유도체, N,N'-비스(3-메틸페닐)-N,N'-디페닐-[1,1-비페닐]-4,4'-디아민(TPD), N,N'-디(나프탈렌-1-일)-N,N'-디페닐 벤지딘(α-NPD) 등의 방향족 축합환을 가지는 통상적인 아민 유도체 등과 같은 공지된 정공수송 물질을 사용할 수 있다.상기 정공수송층의 두께는 약 50Å 내지 1000Å, 바람직하게는 100Å 내지 600Å일 수 있다. 상기 정공수송층의 두께가 50Å 미만인 경우, 정공수송 특성이 저하될 수 있으며, 상기 정공수송층의 두께가 1000Å를 초과하는 경우, 구동전압이 상승할 수 있기 때문이다.

[0094] 다음으로 상기 정공수송층 상부에 진공증착법, 스핀코팅법, 캐스트법, LB법 등과 같은 방법을 이용하여 발광층(EML)을 형성할 수 있다. 진공증착법 및 스핀코팅법에 의해 발광층을 형성하는 경우, 그 증착조건은 사용하는 화합물에 따라 다르지만, 일반적으로 정공주입층의 형성과 거의 동일한 조건범위 중에서 선택된다.

[0095] 상기 발광층은 전술한 바와 같이 본 발명을 따르는 화학식 a의 화합물을 포함할 수 있다. 이 때, 화학식 a의 화합물은 적합한 공지의 호스트 재료와 함께 사용될 수 있거나, 공지의 도펀트 재료와 함께 사용될 수 있다.

[0096] 상기 화학식 a의 화합물을 단독으로 사용하는 것도 가능하다. 호스트 재료의 경우, 예를 들면, Alq3(tris(8-hydroxy-quinolatealuminium) 또는 CBP(4,4'-N,N'-디카바졸-비페닐), 또는 PVK(폴리(n-비닐카바졸)) 등을 사용할 수 있다.

[0097] 도펀트 재료의 경우, 형광 도펀트로서는 이데미츠사(Idemitsu사)에서 구입 가능한 IDE102, IDE105 및 하야시바라사에서 구입 가능한 C545T 등을 사용할 수 있으며, 인광 도펀트로서는 적색 인광 도펀트 PtOEP, UDC사의 RD61, 녹색 인광 도판트 Ir(PPy)3(PPy=2-phenylpyridine), 청색 인광 도펀트인 F2Irpic, UDC사의 적색 인광 도펀트 RD 61 등을 사용할 수 있다. MQD(N-methylquinacridone), 쿠마린(Coumarine)유도체 등도 사용할 수 있다.

[0098] 도핑 농도는 특별히 제한 되지 않으나 통상적으로 호스트100 중량부를 기준으로 하여 상기 도펀트의 함량은 0.01 ~ 15 중량부이다.상기 발광층의 두께는 약 100Å 내지 1000Å, 바람직하게는 200Å 내지 600Å일 수 있다.

[0099] 상기 발광층의 두께가 100Å 미만인 경우, 발광 특성이 저하될 수 있으며, 상기 발광층의 두께가 1000Å를 초과하는 경우, 구동전압이 상승할 수 있기 때문이다.

[0100] 발광층에 발광 화합물이 인광 도펀트와 함께 사용할 경우에는 삼중항 여기자 또는 정공이 전자수송층으로 확산되는 현상을 방지하기 위하여, 상기 발광층 상부에 진공증착법, 스핀코팅법, 캐스트법, LB법 등과 같은 방법을 이용하여 정공저지층(HBL)을 형성할 수 있다. 진공증착법 및 스핀코팅법에 의해 정공저지층을 형성하는 경우, 그 조건은 사용하는 화합물에 따라 다르지만, 일반적으로 정공주입층의 형성과 거의 동일한 조건범위 중에서 선택된다. 사용가능한 공지의 정공저지재료, 예를 들면 옥사디아졸 유도체나 트리아졸 유도체, 페난트롤린 유도체, BCP 등을 들 수 있다.

[0101] 상기 정공저지층의 두께는 약 50Å 내지 1000Å, 바람직하게는 100Å 내지 300Å일 수 있다. 상기 정공저지층의 두께가 50Å 미만인 경우, 정공저지 특성이 저하될 수 있으며, 상기 정공저지층의 두께가 1000Å를 초과하는 경우, 구동전압이 상승할 수 있기 때문이다.상기 정공저지층이 생략될 경우 도 1b에 도시된 구조를 가지는 유기발광 소자가 얻어진다.

[0102] 다음으로 전자수송층(ETL)을 진공증착법, 또는 스핀코팅법, 캐스트법 등의 다양한 방법을 이용하여 형성한다.

[0103] 진공증착법 및 스핀코팅법에 의해 전자수송층을 형성하는 경우, 그 조건은 사용하는 화합물에 따라 다르지만, 일반적으로 정공주입층의 형성과 거의 동일한 조건범위 중에서 선택된다. 상기 전자수송층 재료는 전자주입전극(Cathode)로부터 주입된 전자를 안정하게 수송하는 기능을 하는 것으로서 퀴놀린 유도체, 특히 트리스(8-퀴놀리노레이트)알루미늄(Alq3), TAZ, Balq, PBD등과 같은 공지의 재료를 사용할 수도 있다.

[0104] 상기 전자수송층의 두께는 약 100Å 내지 1000Å, 바람직하게는 200Å 내지 500Å일 수 있다. 상기 전자수송층의 두께가 100Å 미만인 경우, 전자수송 특성이 저하될 수 있으며, 상기 전자수송층의 두께가 1000Å를 초과하는 경우, 구동전압이 상승할 수 있기 때문이다.

[0105] 또한 전자수송층 상부에 음극으로부터 전자의 주입을 용이하게 하는 기능을 가지는 물질인 전자주입층(EIL)이 적층될 수 있으며 이는 특별히 재료를 제한하지 않는다.

[0106] 전자 주입층으로서는 LiF, NaCl, CsF, Li2O, BaO 등과 같은 전자주입층 형성 재료로서 공지된 임의의 물질을 이용할 수 있다. 상기 전자주입층의 증착조건은 사용하는 화합물에 따라 다르지만, 일반적으로 정공주입층의 형성과 거의 동일한 조건범위 중에서 선택된다.

[0107] 상기 전자주입층의 두께는 약 1Å 내지 100Å, 바람직하게는 5Å 내지 50Å일 수 있다. 상기 전자주입층의 두께가 1Å 미만인 경우, 전자주입 특성이 저하될 수 있으며, 상기 전자주입층의 두께가 100Å를 초과하는 경우, 구동전압이 상승할 수 있기 때문이다.

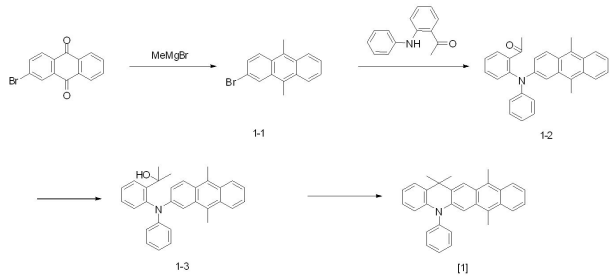
[0108] 마지막으로 전자주입층 상부에 진공증착법이나 스퍼터링법 등의 방법을 이용하여 제2전극을 형성할 수 있다.

[0109] 상기 제2전극은 캐소드(Cathode)로 사용될 수 있다. 상기 제2전극 형성용 금속으로는 낮은 일함수를 가지는 금속, 합금, 전기전도성 화합물 및 이들의 혼합물을 사용할 수 있다. 구체적인 예로서는 리튬(Li), 마그네슘(Mg), 알루미늄(Al), 알루미늄-리튬(Al-Li), 칼슘(Ca), 마그네슘-인듐(Mg-In), 마그네슘-은(Mg-Ag)등을 들 수 있다. 또한 전면 발광소자를 얻기 위하여 ITO, IZO를 사용한 투과형 캐소드를 사용할 수도 있다.

[0110] 본 발명의 다른 구현예에 따르는 유기 전계 발광 화합물은 상기 화학식 a로 표현될 수 있으며, 보다 구체적으로는 상기 화학식 1 내지 223으로 표현될 수 있다. 상기 화합물들에 대한 구체적인 내용은 상술한 유기 발과 소자에 대하여 설명한 부분과 동일하다.

[0111] 이하에서, 본 발명의 반응예 및 비교예를 구체적으로 예시하지만, 본 발명이 하기의 합성예 및 실시예로 한정되는 것은 아니다. 이하의 반응예에서 중간체 화합물은 최종 생성물의 번호에 일련번호를 추가하는 방식으로 표기한다. 예를 들어, 화합물 1은 화합물 [1] 로 상기 화합물의 중간체 화합물은 [1-1] 등으로 표기한다. 본 명세서에서 화학물의 번호는 화학식의 번호로서 표기한다. 예를 들어, 화학식 1로 표시되는 화합물은 화합물 1로 표기한다.

[0112] **[반응 예 1] 화합물 [1]의 합성**

[0113] 

[0114] 중간체화합물 [1-1]의 합성

[0115] 반응플라스크에 2-브로모안트라퀴논 20g(69.66mmol), 무수테트라히드로퓨란 400mL을 넣고 상온교반시킨다. 질소분위기에서 메틸마그네슘브로마이드(1.4M in diethyl ether) 149.3ml(208.98mmol)를 천천히 적가시키고 반응온도를 승온하여 12시간 동안 환류 교반시킨다. 반응이 종료되면 상온에서 반응액을 1N 염산 수용액에 붓고 에틸아세테이트로 추출한다. 유기층 분리 후 디클로로메탄과 메탄올로 재결정화하여 노란색 고체의 중간체 화합물 [1-1] 14.1g(71%)을 수득하였다.

[0117] 중간체화합물[1-2]의 합성

[0118] 반응플라스크에 중간체 화합물[1-1] 13.5g(47.34mmol), 1-(2-(페닐아미노)페닐)에타논 11g(52.07mmol), 요오드화(I)구리 0.1g(0.47mmol), 인산칼륨 15.1g(71.01mmol), 톨루엔 200ml을 넣고 질소분위기에서 상온교반한다. 10분뒤 1,2-다이아미노사이클로헥산 8.7ml(71.01mmol)을 넣고 12시간동안 환류교반한다. 반응종결 후 반응액을 염화암모늄수용액에 천천히 넣으면서 교반하고 층분리하여 얻은 유기층을 감압증류한다. 얻은 농축액을 컬럼크로마토그라프로 분리정제하여 노란색고체의 중간체화합물 [1-2] 12.4g(63%)을 수득하였다.

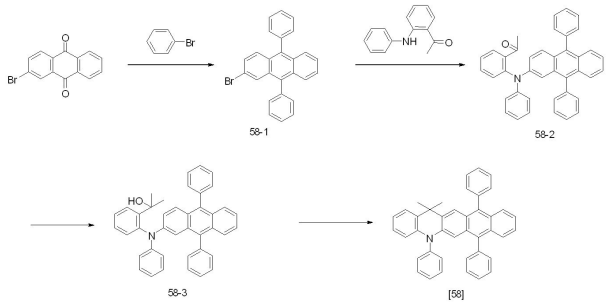
[0119] 중간체화합물[1-3]의 합성

[0120] 반응플라스크에 중간체화합물 [1-2] 11.9g(28.64mmol), 무수테트라히드로퓨란 200mL을 넣고 상온교반시킨다. 질소분위기에서 메틸마그네슘브로마이드(1.4M in diethyl ether) 40.9ml(57.27mmol)를 천천히 적가시키고 12시간 동안 교반시킨다. 반응이 종료되면 반응액을 1N 염산 수용액에 붓고 에틸아세테이트로 추출한다. 유기층 분리 후 컬럼크로마토그라프로 분리정제하여 노란색고체의 중간체화합물 [1-3] 10.6g(86%)을 수득하였다.

[0121] 화합물[1]의 합성

[0122] 반응플라스크에 중간체 화합물[1-3] 10.1g(23.4mmol), 디클로로메탄 150ml을 넣고 교반한다. 질소분위기에서 메탄술폰산 4.56ml(70.21mmol)을 넣고 상온교반한다. 반응종결 후 상수에 반응액을 천천히 넣어 교반 후 에틸아세테이트로 추출한다. 유기층 분리 후 컬럼크로마토그라프로 분리정제하여 노란색고체의 목적화합물 [1] 7.8g(81%)을 수득하였다.

[0123] **[반응 예 2] 화합물 [58]의 합성**

[0124] 

[0125] 반응플라스크에 브로모벤젠 24g(153.25mmol)을 무수테트라히드로퓨란 300mL로 교반한다. -78℃에서 n-부틸리튬(2.5M in hexane) 61.3mL(153.25mmol)를 적가시키고 30분후 2-브로모안트라퀴논 20g(69.66mmol)을 고체로 첨가시키고 반응온도를 상온까지 서서히 12시간 동안 올린다. 반응이 종료되면 에틸아세테이트와 포화암모늄 수용액으로 추출하여 유기층을 분리하고 무수황산마그네슘으로 건조 후 여과 한다. 여과액을 감압농축 후 디클로로메탄과 헥산으로 재결정화하여 얻은 고체, 요오드화 칼륨46.2g(278.64mmol) 치아인산나트륨 1수화물 59.1g(557.58mmol), 아세트산 200ml를 넣고 환류교반한다. 반응종료 후 상온에서 생성된 고체를 여과하고 디클로로메탄과 메탄올로 재결정화하여 연두빛 노란색고체의 중간체화합물[58-1] 13.4g(47%)을 수득하였다.

[0126] 중간체화합물[58-2]의 합성

[0127] 반응플라스크에 중간체 화합물[58-1] 12.9g(31.51mmol), 1-(2-(페닐아미노)페닐)에타논 7.3g(34.67mmol), 요오드화(I)구리 0.06g(0.31mmol), 인산칼륨 10g(47.27mmol), 톨루엔 300ml을 넣고 질소분위기에서 상온교반한다. 10분뒤 1,2-다이아미노사이클로헥산 5.8ml(47.27mmol)을 넣고 12시간동안 환류교반한다. 반응종결 후 반응액을 염화암모늄수용액에 천천히 넣으면서 교반하고 층분리하여 얻은 유기층을 감압증류한다. 얻은 농축액을 컬럼크로마토그라프로 분리정제하여 노란색고체의 중간체화합물 [58-2] 9.7g(57%)을 수득하였다.

[0128] 중간체화합물[58-3]의 합성

[0129] 반응플라스크에 중간체화합물 [58-2] 9.2g(17.05mmol), 무수테트라히드로퓨란 200mL을 넣고 상온교반시킨다. 질소분위기에서 메틸마그네슘브로마이드(1.4M in diethyl ether) 24.3ml(34.1mmol)를 천천히 적가시키고 12시간 동안 교반시킨다. 반응이 종료되면 반응액을 1N 염산 수용액에 붓고 에틸아세테이트로 추출한다. 유기층 분리 후 컬럼크로마토그라프로 분리정제하여 노란색고체의 중간체화합물 [58-3] 7.0g(74%)을 수득하였다.

[0130] 화합물[58]의 합성

[0131] 반응플라스크에 중간체 화합물[58-3] 6.6g(11.87mmol), 디클로로메탄 150ml을 넣고 교반한다. 질소분위기에서 메탄술폰산 2.31ml(35.63mmol)을 넣고 상온교반한다. 반응종결 후 상수에 반응액을 천천히 넣어 교반 후 에틸아세테이트로 추출한다. 유기층 분리 후 컬럼크로마토그라프로 분리정제하여 노란색고체의 목적화합물 [58] 5.1g(80%)을 수득하였다.

[0132] 상기 반응예 1과 2의 방법에따라 1~223의 화합물을 제조하였으며, 하기 [제1표군(群)]에 그 결과를 나타내었다.

[0133] [제1표군(群)]

화합물 번호	^{1}H NMR (300 MHz, $CDCl_3$) (δ)	MS/FAB (M^+)
1	7.88(m, 2H), 7.44(s, 1H), 7.25(m, 2H), 7.10(t, 2H), 6.95~6.87(m, 3H), 6.71~6.63(m, 2H), 6.53(m, 2H), 6.45(m, 1H), 2.54(s, 6H), 1.68(s, 6H)	413
2	7.88(m, 2H), 7.44(s, 1H), 7.25(m, 2H), 6.95~6.87(m, 5H), 6.63(m, 1H), 6.51~6.45(m, 3H), 2.54(s, 6H), 1.68(s, 6H)	431
3	7.88(m, 2H), 7.44(s, 1H), 7.29~7.25(m, 4H), 6.95~6.87(m, 3H), 6.71~6.63(m, 3H), 6.45(m, 1H), 2.54(s, 6H), 1.68(s, 6H)	438
4	7.88(m, 2H), 7.44(s, 1H), 7.25(m, 2H), 7.05(d, 2H), 6.95~6.87(m, 3H), 6.63(m, 1H), 6.51~6.45(m, 3H), 2.54(s, 6H), 1.68(s, 6H), 0.15(s, 9H)	485
5	7.88(m, 2H), 7.44~7.41(m, 7H), 7.31~7.25(m, 3H), 6.95~6.87(m, 3H), 6.63~6.59(m, 3H), 6.45(m, 1H), 2.54(s, 6H), 1.68(s, 6H)	489
6	7.88(m, 2H), 7.77(m, 1H), 7.52(d, 1H), 7.45~7.44(m, 2H), 7.28~7.18(m, 4H), 6.95~6.87(m, 3H), 6.65~6.63(m, 2H), 6.48~6.45(m, 2H), 2.54(s, 6H), 1.68~1.62(s, 12H)	529
7	7.88(m, 2H), 7.44(s, 1H), 7.27~7.25(m, 4H), 6.95~6.87(m, 3H), 6.63(m, 1H), 6.46~6.45(m, 3H), 2.54(s, 6H), 1.68(s, 6H)	481
8	7.88(m, 2H), 7.44(s, 1H), 7.25(m, 3H), 6.95~6.87(m, 3H), 6.63(m, 1H), 6.45(m, 2H), 6.28(m, 1H), 2.54(s, 6H), 1.68(s, 6H)	449
9	7.88(m, 2H), 7.44(s, 1H), 7.25(m, 2H), 6.95~6.87(m, 5H), 6.63(m, 1H), 6.45(d, 3H), 2.54(s, 6H), 1.68(s, 6H), 1.25(s, 9H)	469
10	7.88(m, 2H), 7.44(s, 1H), 7.25(m, 2H), 6.95~6.87(m, 3H), 6.64~6.63(m, 3H), 6.45~6.42(m, 3H), 3.73(s, 3H), 2.54(s, 6H), 1.68(s, 6H)	650
11	7.88(m, 2H), 7.44(s, 1H), 7.25(m, 2H), 6.95~6.87(m, 3H), 6.63(m, 1H), 6.53(d, 1H), 6.45(m, 1H), 5.98~5.97(m, 4H), 2.54(s, 6H), 1.68(s, 6H)	457
12	7.88(m, 2H), 7.44(s, 1H), 7.25(m, 2H), 6.95~6.87(m, 3H), 6.63(m, 1H), 6.45(m, 1H), 6.31(d, 1H), 6.23~6.20(m, 2H), 3.73(s, 6H), 2.54(s, 6H), 1.68(s, 6H)	473
13	7.97~7.88(m, 4H), 7.47~7.44(m, 4H), 7.28~7.25(m, 3H), 6.95~6.87(m, 4H), 6.63(m, 1H), 6.45(m, 1H), 2.54(s, 6H), 1.68(s, 6H)	463

[0134]

[0135]

14	7.88(m, 2H), 7.78~7.64(m, 4H), 7.44~7.39(m, 3H), 7.26~7.25(m, 3H), 6.95~6.87(m, 3H), 6.63(m, 1H), 6.45(m, 1H), 2.54(s, 6H), 1.68(s, 6H)	463
15	7.88(m, 2H), 7.44(s, 1H), 7.25(m, 2H), 7.05(m, 3H), 6.87(s, 1H), 6.73(m, 1H), 6.51(d, 2H), 6.37(d, 1H), 2.54(s, 6H), 1.68(s, 6H), 1.25(s, 9H), 0.15(s, 9H)	541
16	7.88(m, 2H), 7.44(s, 1H), 7.25(m, 2H), 7.05(m, 1H), 6.89~6.87(m, 3H), 6.73(m, 1H), 6.51(m, 2H), 6.37(m, 1H), 2.54(s, 6H), 1.68(s, 6H), 1.25(s, 9H)	487
17	7.88(m, 2H), 7.44(s, 1H), 7.29~7.25(m, 4H), 7.05(m, 1H), 6.87(s, 1H), 6.73~6.71(m, 3H), 6.37(d, 1H), 2.54(s, 6H), 1.68(s, 6H), 1.25(s, 9H)	494
18	7.88(m, 2H), 7.77(m, 1H), 7.52(d, 1H), 7.45~7.44(m, 2H), 7.28~7.18(m, 4H), 7.02(m, 1H), 6.87(m, 2H), 6.65(m, 1H), 6.48~6.43(m, 2H), 2.54(s, 6H), 1.68~1.62(s, 12H), 0.15(s, 9H)	601
19	7.88(d, 2H), 7.75~7.68(m, 2H), 7.58(s, 1H), 7.44(s, 1H), 7.36(t, 1H), 7.25~7.20(m, 4H), 7.10(t, 2H), 6.87(s, 1H), 6.71(t, 1H), 6.53(d, 2H), 2.54(s, 6H), 1.74(s, 6H)	463
20	7.88(d, 2H), 7.77~7.68(m, 3H), 7.58(s, 1H), 7.52(d, 1H), 7.45~7.44(m, 2H), 7.36~7.18(m, 7H), 6.87(s, 1H), 6.65(d, 1H), 6.48(d, 1H), 2.54(s, 6H), 1.74(s, 6H), 1.62(s, 6H)	579
21	7.88(d, 2H), 7.44(s, 1H), 7.25(t, 2H), 7.10(t, 2H), 6.95~6.87(m, 3H), 6.71(t, 1H), 6.63(t, 1H), 6.53(d, 2H), 6.45(d, 1H), 1.68(s, 6H), 1.38(s, 9H), 1.31(s, 9H)	497
22	7.88(d, 2H), 7.44(s, 1H), 7.25(t, 2H), 6.95~6.87(m, 5H), 6.63(t, 1H), 6.51~6.45(m, 3H), 1.68(s, 6H), 1.38(s, 9H), 1.31(s, 9H)	515
23	7.88(d, 2H), 7.44(s, 1H), 7.29~7.25(m, 4H), 6.95~6.87(m, 3H), 6.71(d, 2H), 6.63(t, 1H), 6.45(d, 1H), 1.68(s, 6H), 1.38(s, 9H), 1.31(s, 9H)	522
24	7.88(d, 2H), 7.44(s, 1H), 7.25(t, 2H), 7.05(d, 2H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.51~6.45(m, 3H), 1.68(s, 6H), 1.38(s, 9H), 1.31(s, 9H), 0.15(s, 9H)	569
25	7.88(d, 2H), 7.44~7.41(m, 7H), 7.31~7.25(m, 3H), 6.95~6.87(m, 3H), 6.63~6.59(m, 3H), 6.45(d, 1H), 1.68(s, 6H), 1.38(s, 9H), 1.31(s, 9H)	573

[0136]

26	7.88(d, 2H), 7.77(d, 1H), 7.52(d, 1H), 7.45~7.44(m, 2H), 7.28~7.18(m, 4H), 6.95~6.87(m, 3H), 6.65~6.63(m, 2H), 6.48~6.45(m, 2H), 1.68(s, 6H), 1.62(s, 6H), 1.38(s, 9H), 1.31(s, 9H)	613
27	7.88(d, 2H), 7.44(s, 1H), 7.27~7.25(m, 4H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.46~6.45(m, 3H), 1.68(s, 6H), 1.38(s, 9H), 1.31(s, 9H)	565
28	7.88(d, 2H), 7.44(s, 1H), 7.25(t, 3H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.45(d, 2H), 6.28(m, 1H), 1.68(s, 6H), 1.38(s, 9H), 1.31(s, 9H)	533
29	7.88(d, 2H), 7.44(s, 1H), 7.25(t, 2H), 6.95~6.87(m, 5H), 6.63(t, 1H), 6.45(d, 3H), 1.68(s, 6H), 1.38(s, 9H), 1.31(s, 9H), 1.25(s, 9H)	553
30	7.88(d, 2H), 7.44(s, 1H), 7.25(t, 2H), 7.05(d, 3H), 6.87(s, 1H), 6.73(d, 1H), 6.51(d, 2H), 6.37(d, 1H), 1.68(s, 6H), 1.38(s, 9H), 1.31(s, 9H), 1.25(s, 9H), 0.15(s, 9H)	626
31	7.88(d, 2H), 7.44(s, 1H), 7.25(t, 2H), 7.05(t, 1H), 6.89~6.87(m, 3H), 6.73(d, 1H), 6.51(d, 2H), 6.37(d, 1H), 1.68(s, 6H), 1.38(s, 9H), 1.31(s, 9H), 1.25(s, 9H)	571
32	7.88(d, 2H), 7.44(s, 1H), 7.29~7.25(m, 4H), 7.05(s, 1H), 6.87(s, 1H), 6.73~6.71(m, 3H), 6.37(d, 1H), 1.68(s, 6H), 1.38(s, 9H), 1.31(s, 9H), 1.25(s, 9H)	578
33	7.88(d, 2H), 7.44(s, 1H), 7.25(t, 2H), 6.95~6.87(m, 3H), 6.64~6.63(m, 3H), 6.45~6.42(m, 3H), 3.73(s, 3H), 1.68(s, 6H), 1.38(s, 9H), 1.31(s, 9H)	527
34	7.88(d, 2H), 7.44(s, 1H), 7.25(t, 2H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.53(d, 1H), 6.45(d, 1H), 5.98(d, 1H), 5.97(s, 3H), 1.68(s, 6H), 1.38(s, 9H), 1.31(s, 9H)	541
35	7.88(d, 2H), 7.44(s, 1H), 7.25(t, 2H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.53(d, 1H), 6.45(d, 1H), 5.98(d, 1H), 5.97(s, 3H), 1.68(s, 6H), 1.38(s, 9H), 1.31(s, 9H)	541
36	7.97~7.88(m, 4H), 7.47~7.43(m, 4H), 7.28~7.25(m, 3H), 6.95~6.87(m, 4H), 6.63(t, 1H), 6.45(d, 1H), 1.68(s, 6H), 1.38(s, 9H), 1.31(s, 9H)	547
37	7.88(d, 2H), 7.78~7.74(m, 2H), 7.67~7.64(m, 2H), 7.44~7.39(m, 3H), 7.26~7.25(m, 3H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.45(d, 1H), 1.68(s, 6H), 1.38(s, 9H), 1.31(s, 9H)	547
38	7.88(d, 2H), 7.75~7.68(m, 2H), 7.58(s, 1H), 7.44(s, 1H), 7.36(t, 1H), 7.25~7.20(m, 4H), 7.10(t, 2H), 6.87(s, 1H), 6.71(t, 1H), 6.53(d, 2H) 1.68(s, 6H), 1.28(s, 18H)	547

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39	7.88(d, 2H), 7.77~7.75(m, 2H), 7.68(d, 1H), 7.58(s, 1H), 7.52(d, 1H), 7.45~7.44(m, 2H), 7.36(t, 1H), 7.28~7.18(m, 6H), 6.87(s, 1H), 6.65(s, 1H) 6.48(d, 1H), 1.68(s, 6H), 1.65(s, 6H), 1.28(s, 18H)	663
40	7.88(d, 2H), 7.77(d, 1H), 7.52(d, 1H), 7.45~7.44(m, 2H), 7.28~7.18(m, 4H), 7.02(s, 1H), 6.87~6.86(m, 2H), 6.65(s, 1H), 6.48~6.43(m, 2H), 1.68(s, 6H), 1.65(s, 6H), 1.28(s, 18H), 0.15(s, 9H)	686
41	7.88(d, 2H), 7.44(s, 1H), 7.25~7.23(m, 2H), 7.10(t, 2H), 6.95~6.87(m, 3H), 6.71~6.63(m, 2H), 6.53(d, 2H), 6.45(d, 1H), 2.77(m, 2H), 1.68(s, 6H), 1.23(s, 12H)	469
42	7.88(d, 2H), 7.44(s, 1H), 7.25~7.23(m, 2H), 6.95~6.87(m, 5H), 6.63(t, 1H), 6.51~6.45(m, 3H), 2.77(m, 2H), 1.68(s, 6H), 1.23(s, 12H)	487
43	7.88(d, 2H), 7.44(s, 1H), 7.29~7.25(m, 4H), 6.95~6.87(m, 3H), 6.71(d, 2H), 6.63(t, 1H), 6.45(d, 1H), 2.77(m, 2H), 1.68(s, 6H), 1.23(s, 12H)	494
44	7.88(d, 2H), 7.44(s, 1H), 7.25~7.23(m, 2H), 7.05(d, 2H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.51~6.45(m, 3H), 2.77(m, 2H), 1.68(s, 6H), 1.23(s, 12H), 015(s, 9H)	541
45	7.88(d, 2H), 7.44~7.41(m, 7H), 7.31~7.25(m, 3H), 6.95~6.87(m, 3H), 6.63~6.59(m, 3H), 6.45(d, 1H), 2.77(m, 2H), 1.68(s, 6H), 1.23(s, 12H)	545
46	7.88(d, 2H), 7.71(d, 1H), 7.52(d, 1H), 7.45~7.44(m, 2H), 7.28~7.18(m, 4H), 6.95~6.87(m, 3H), 6.65~6.63(m, 2H), 6.48~6.45(m ,2H), 2.77(m, 2H) 1.68(s, 6H), 1.65(s, 6H), 1.23(s, 12H)	585
47	7.81(d, 2H), 7.44(s, 1H), 7.29~7.27(m, 4H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.46~6.45(m, 3H), 1.68(s, 6H), 0.15(s, 18H)	597
48	7.81(d, 2H), 7.44(s, 1H), 7.29~7.25(m, 3H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.55(d, 2H), 6.28(d, 1H), 1.68(s, 6H), 0.15(s, 18H)	565
49	7.81(d, 2H), 7.44(s, 1H), 7.29~7.27(m, 2H), 6.95~6.87(m, 5H), 6.63(t, 1H), 6.55(d, 3H), 1.68(s, 6H), 1.25(s, 9H), 0.15(s, 18H)	585
50	7.81(d, 2H), 7.44(s, 1H), 7.29~7.27(m, 2H), 7.05~7.03(m, 3H), 6.87(s, 1H), 6.73(d, 1H), 6.51(d, 2H), 6.37(d, 1H), 1.68(s, 6H), 1.27(s, 9H), 0.15(s, 27H)	658
51	7.81(d, 2H), 7.44(s, 1H), 7.29~7.27(m, 2H), 7.05(s, 1H), 6.89~6.87(m, 3H), 6.73(d, 1H), 6.51(d, 2H), 6.37(d, 1H), 1.68(s, 6H), 1.27(s, 9H), 0.15(s, 18H)	603

52	7.81(d, 2H), 7.44(s, 1H), 7.29~7.27(m, 4H), 7.05(s, 1H), 6.87(s, 1H), 6.73~6.71(m, 3H), 6.37(d, 1H), 1.68(s, 6H), 1.27(s, 9H), 0.15(s, 18H)	610
53	7.97~7.92(m, 2H), 7.81(d, 2H), 7.47~7.43(m, 4H), 7.29~7.28(m, 3H), 6.95~6.88(m, 4H), 6.63(t, 1H), 6.45(d, 1H), 1.68(s, 6H), 0.15(s, 18H)	579
54	7.81~7.74(m, 4H), 7.67~7.64(m, 2H), 7.44~7.40(m, 3H), 7.29~7.25(m, 3H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.45(d, 1H), 1.68(s, 6H), 0.15(s, 18H)	579
55	7.81~7.75(m, 3H), 7.68(d, 1H), 7.58(s, 1H), 7.44(s, 1H), 7.36~7.25(m, 4H), 7.20(s, 1H), 7.10(t, 2H), 6.87(s, 1H), 6.71(t, 1H), 6.53(d, 2H), 1.68(s, 6H), 0.15(s, 18H)	579
56	7.81~7.75(m, 4H), 7.68(d, 1H), 7.58(s, 1H), 7.52(d, 1H), 7.45~7.44(m, 2H), 7.36~7.18(m, 7H), 6.87(s, 1H), 6.65(s, 1H), 6.48(s, 1H), 1.74(s, 6H), 1.62(s, 6H), 0.15(s, 18H)	696
57	7.81~7.77(m, 3H), 7.52(d, 1H), 7.45~7.44(m, 2H), 7.29~7.28(m, 3H), 7.18(t, 1H), 7.02(s, 1H), 6.88~6.87(m, 2H), 6.65(s, 1H), 6.48~6.43(m, 2H), 1.68(s, 6H), 1.62(s, 6H), 0.15(s, 27H)	718
58	7.81(d, 2H), 7.44~7.41(m, 9H), 7.31~7.29(m, 4H), 7.10(t, 2H), 6.95~6.87(m, 3H), 6.71(t, 1H), 6.63(t, 1H), 6.53(d, 2H), 6.45(d, 1H), 1.68(s, 6H)	537
59	7.81(d, 2H), 7.44~7.41(m, 9H), 7.31~7.29(m, 4H), 6.95~6.87(m, 5H), 6.63(t, 1H), 6.51~6.45(m, 3H), 1.68(s, 6H)	555
60	7.81(d, 2H), 7.44~7.41(m, 9H), 7.31~7.29(m, 6H), 6.95~6.87(m, 3H), 6.71(d, 2H), 6.63(t, 1H), 6.45(d, 1H), 1.68(s, 6H)	562
61	7.81(d, 2H), 7.44~7.41(m, 9H), 7.31~7.29(m, 4H), 7.05(d, 2H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.51(d, 2H), 6.45(d, 1H), 1.68(s, 6H), 0.15(s, 9H)	609
62	7.81(d, 2H), 7.44~7.41(m, 15H), 7.31~7.29(m, 5H), 6.95~6.87(m, 3H), 6.63~6.59(m, 3H) 6.45(d, 1H), 1.68(s, 6H)	613
63	7.81~7.77(m, 3H), 7.52(d, 1H), 7.45~7.41(m, 10H), 7.31~7.28(m, 5H), 7.18(t, 1H), 6.95~6.87(m, 3H), 6.65~6.63(m, 2H), 6.45(t, 2H), 1.68(s, 6H), 1.62(s, 6H)	653
64	7.81(d, 2H), 7.44~7.41(m, 9H), 7.31~7.27(m, 6H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.46~6.45(m, 3H), 1.68(s, 6H)	605
65	7.81(d, 2H), 7.44~7.41(m, 9H), 7.31~7.25(m, 5H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.46~6.45(m, 2H), 6.28(d, 1H), 1.68(s, 6H)	573

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66	7.81(d, 2H), 7.44~7.41(m, 9H), 7.31~7.29(m, 4H), 6.95~6.87(m, 5H), 6.63(t, 1H), 6.45(d, 3H), 1.68(s, 6H), 1.25(s, 9H)	593
67	7.81(d, 2H), 7.44~7.41(m, 9H), 7.31~7.29(m, 4H), 7.06~7.05(m, 3H), 6.87(s, 1H), 6.73(d, 1H), 6.51(d, 2H), 6.37(d, 1H), 1.68(s, 6H), 1.25(s, 9H), 0.15(s, 9H)	665
68	7.81(d, 2H), 7.44~7.41(m, 9H), 7.31~7.29(m, 4H), 7.05(s, 1H), 6.89~6.87(m, 3H), 6.73(d, 1H), 6.51(d, 2H), 6.37(d, 1H), 1.68(s, 6H), 1.25(s, 9H)	611
69	7.81(d, 2H), 7.44~7.41(m, 9H), 7.31~7.29(m, 6H), 7.05(s, 1H), 6.87(s, 1H), 6.73~6.71(m, 3H), 6.37(d, 1H), 1.68(s, 6H), 1.25(s, 9H)	618
70	7.97~7.92(m, 2H), 7.81(d, 2H), 7.47~7.41(m, 12H), 7.31~7.28(m, 5H), 6.95~6.87(m, 4H), 6.63(t, 1H), 6.45(d, 2H), 1.68(s, 6H)	587
71	7.81~7.64(m, 6H), 7.44~7.26(m, 16H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.45(d, 1H), 1.68(s, 6H)	587
72	7.81~7.68(m, 4H), 7.58(s, 1H), 7.44~7.20(m, 16H), 7.10(t, 2H), 6.87(s, 1H), 6.71(t, 1H), 6.53(d, 2H), 1.74(s, 6H)	587
73	7.81~7.68(m, 5H), 7.58(s, 1H), 7.52(d, 1H), 7.45~7.18(m, 19H), 6.87(s, 1H), 6.65(s, 1H), 6.48(d, 1H), 1.74(s, 6H), 1.62(s, 6H)	703
74	7.81~7.77(m, 3H), 7.52(d, 1H), 7.45~7.41(m, 10H), 7.31~7.28(m, 5H), 7.18(t, 1H), 7.02(s, 1H), 6.88~6.87(m, 2H), 6.65(s, 1H), 6.48~6.43(m, 2H), 1.68(s, 6H), 1.62(s, 6H), 0.15(s, 9H)	726
75	7.81(d, 2H), 7.44~7.29(m, 13H), 6.95~6.87(m, 3H), 6.64~6.63(m, 3H), 6.45~6.42(m, 3H), 3.73(s, 3H), 1.68(s, 6H)	567
76	7.81(d, 2H), 7.44~7.29(m, 13H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.53(d, 1H), 6.45(d, 1H), 5.98~5.97(m, 4H), 1.68(s, 6H)	581
77	7.81(d, 2H), 7.44~7.29(m, 13H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.45(d, 1H), 6.31(d, 1H), 6.26~6.23(m, 2H), 3.73(s, 6H), 1.68(s, 6H)	597
78	8.45(d, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.81(d, 2H), 7.51~7.44(m, 7H), 7.29(m, 2H), 7.20(m, 2H), 6.95~6.87(m, 3H), 6.71~6.63(m, 2H), 6.53 (m, 2H), 6.45(d, 1H), 1.68(s, 6H)	637
79	8.45(d, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.81(d, 2H), 7.51~7.44(m, 7H), 7.29(m, 2H), 6.95~6.87(m, 5H), 6.63(t, 1H), 6.51~6.45(m, 3H), 1.68(s, 6H)	655
80	8.45(d, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.81(d, 2H), 7.51~7.44(m, 7H), 7.29(m, 4H), 6.95~6.87(m, 3H), 6.71~6.63(m, 3H), 6.45(d, 1H), 1.68(s, 6H)	662

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81	8.45(d, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.81(d, 2H), 7.51~7.44(m, 7H), 7.29(m, 2H), 7.05(m, 2H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.51~6.45(m, 3H), 1.68(s, 6H), 0.15(s, 9H)	709
82	8.45(d, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.81(d, 2H), 7.51~7.29(m, 16H), 6.95~6.87(m, 3H), 6.63~6.59(m, 3H), 6.45(d, 1H), 1.68(s, 6H)	713
83	8.45(d, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.81~7.77(m, 3H), 7.52~7.44(m, 9H), 7.29~7.28(m, 3H), 7.18(t, 1H), 6.95~6.87(m, 3H), 6.65~6.63(m, 2H), 6.48~6.45(m, 2H), 1.68(s, 6H), 1.62(s, 6H)	753
84	8.45(d, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.81(d, 2H), 7.51~7.44(m, 7H), 7.29~7.27(m, 4H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.46~6.45(m, 3H), 1.68(s, 6H)	705
85	8.45(d, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.81(d, 2H), 7.51~7.44(m, 7H), 7.29~7.25(m, 3H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.45(m, 2H), 6.28(d, 1H), 1.68(s, 6H)	673
86	8.45(d, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.81(d, 2H), 7.51~7.44(m, 7H), 7.29(m, 2H), 6.95~6.87(m, 5H), 6.63(t, 1H), 6.45(m, 3H), 1.68(s, 6H), 1.25(s, 9H)	693
87	8.45(d, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.81(d, 2H), 7.51~7.44(m, 7H), 7.29(m, 2H), 7.05(m, 3H), 6.87(s, 1H), 6.73(d, 1H), 6.51(m, 2H), 6.37(d, 1H), 1.68(s, 6H), 1.25(s, 9H), 0.15(s, 9H)	766
88	8.45(d, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.81(d, 2H), 7.51~7.44(m, 7H), 7.29(m, 2H), 7.05(s, 1H), 6.89~6.87(m, 3H), 6.73(d, 1H), 6.51(m, 2H), 6.37(d, 1H), 1.68(s, 6H), 1.25(s, 9H)	711
89	8.45(d, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.81(d, 2H), 7.51~7.44(m, 7H), 7.29(m, 4H), 7.05(s, 1H), 6.87(s, 1H), 6.73~6.71(m, 3H), 6.37(d, 1H), 1.68(s, 6H), 1.25(s, 9H)	718
90	8.45(d, 2H), 8.32(d, 2H), 7.98~7.92(m, 6H), 7.81(d, 2H), 7.51~7.43(m, 10H), 7.29~7.28(m, 3H), 6.95~6.87(m, 4H), 6.63(s, 1H), 6.45(d, 1H), 1.68(s, 6H)	687
91	8.45(d, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.81~7.64(m, 6H), 7.51~7.39(m, 9H), 7.29~7.26(m, 3H), 6.95~6.87(m, 3H), 6.63(s, 1H), 6.45(d, 1H), 1.68(s, 6H)	687
92	8.45(d, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.81~7.68(m, 4H), 7.51~7.25(m, 13H), 7.10(m, 2H), 6.87(s, 1H), 6.71(t, 1H), 6.53(m, 2H), 1.68(s, 6H)	687

93	8.45~8.43(m, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.81~7.68(m, 5H), 7.52~7.18(m, 17H), 6.87(s, 1H), 6.65(s, 1H), 6.48(d, 1H), 1.74(s, 6H), 1.62(s, 6H)	804
94	8.45~8.43(m, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.81~7.77(m, 3H), 7.52~7.44(m, 9H), 7.29~7.27(m, 3H), 7.18(t, 1H), 7.02(s, 1H), 6.87~6.85(m, 2H), 6.65(s, 1H), 6.48~6.43(m, 2H), 1.68(s, 6H) , 1.62(s, 6H), 0.15(s, 9H)	826
95	8.45~8.43(m, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.81~7.79(m, 2H), 7.51~7.45(m, 7H), 7.29~7.27(m, 2H), 6.95~6.87(m, 3H), 6.64~6.63(m, 3H), 6.45~6.42(m, 3H), 3.73(s, 3H) , 1.68(s, 6H)	667
96	8.45~8.43(m, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.81~7.79(m, 2H), 7.51~7.44(m, 7H), 7.29~7.27(m, 2H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.53(d, 1H), 6.45(d, 1H), 6.08~6.07(m, 4H) , 1.68(s, 6H)	681
97	8.45~8.43(m, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.81~7.79(m, 2H), 7.51~7.44(m, 7H), 7.29~7.27(m, 2H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.45(d, 1H), 6.31(d, 1H), 6.23~6.20(m, 2H) , 3.73(s, 6H), 1.68(s, 6H)	696
98	7.90~7.81(m, 8H), 7.63(d, 2H), 7.49~7.44(m, 7H), 7.29~7.27(m, 2H), 7.10~7.08(m, 2H), 6.95~6.87(m, 3H), 6.71~6.63(m, 2H), 6.53(d, 2H), 6.45(d, 1H) , 1.68(s, 6H)	637
99	7.90~7.81(m, 8H), 7.63(d, 2H), 7.49~7.44(m, 7H), 7.29~7.27(m, 2H), 6.95~6.87(m, 5H), 6.63(t, 1H), 6.51~6.45(m, 3H) , 1.68(s, 6H)	655
100	7.90~7.81(m, 8H), 7.63(d, 2H), 7.49~7.44(m, 7H), 7.29~7.25(m, 4H), 6.95~6.87(m, 3H), 6.71~6.63(m, 3H), 6.45(d, 1H) , 1.68(s, 6H)	662
101	7.90~7.81(m, 8H), 7.63(d, 2H), 7.49~7.44(m, 7H), 7.29~7.27(m, 2H), 7.05(d, 2H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.51~6.45(m, 3H) , 1.68(s, 6H), 0.15(s, 9H)	709
102	7.90~7.81(m, 8H), 7.63(d, 2H), 7.49~7.29(m, 16H), 6.95~6.87(m, 3H), 6.63~6.59(m, 3H), 6.45(d, 1H) , 1.68(s, 6H)	713
103	7.90~7.77(m, 9H), 7.63(d, 2H), 7.52~7.44(m, 9H), 7.29~7.27(m, 3H), 7.18(t, 1H), 6.95~6.87(m, 3H), 6.65~6.63(m, 2H), 6.48~6.43(m, 2H) , 1.68(s, 6H), 1.62(s, 6H)	753
104	7.90~7.81(m, 8H), 7.63(d, 2H), 7.49~7.44(m, 7H), 7.29~7.27(m, 4H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.46~6.44(m, 3H) , 1.68(s, 6H)	705
105	7.90~7.81(m, 8H), 7.63(d, 2H), 7.49~7.44(m, 7H), 7.29~7.25(m, 3H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.45~6.43(m, 2H), 6.28(d, 1H), 1.68(s, 6H)	673

[0141]

106	7.90~7.81(m, 5H), 7.63(d, 1H), 7.49~7.41(m, 8H), 7.31~7.29(m, 3H), 6.95~6.87(m, 5H), 6.63(t, 1H), 6.45~6.43(m, 3H), 6.28(d, 1H), 1.68(s, 6H), 1.25(s, 9H)	643
107	7.90~7.81(m, 8H), 7.63(d, 2H), 7.49~7.44(m, 7H), 7.29~7.27(m, 2H), 7.05~7.03(m, 2H), 6.87(s, 1H), 6.73(d, 1H), 6.51(d, 2H), 6.37(d, 1H), 1.68(s, 6H), 1.25(s, 9H), 0.15(s, 9H)	766
108	7.90~7.81(m, 8H), 7.63(d, 2H), 7.49~7.44(m, 7H), 7.29~7.27(m, 2H), 7.05(s, 1H), 6.89~7.87(m, 3H), 6.73(d, 1H), 6.51~6.49(m, 2H), 6.36(d, 1H), 1.68(s, 6H), 1.25(s, 9H)	718
109	7.90~7.81(m, 8H), 7.63(d, 2H), 7.49~7.44(m, 7H), 7.29~7.25(m, 4H), 7.05(s, 1H), 6.87(s, 1H), 6.73~6.71(m, 3H), 6.37(d, 1H), 1.68(s, 6H), 1.25(s, 9H)	718
110	7.97~7.81(m, 10H), 7.63(d, 2H), 7.49~7.43(m, 10H), 7.29~7.27(m, 3H), 6.95~6.87(m, 4H), 6.63(t, 1H), 6.45(d, 1H), 1.68(s, 6H)	687
111	7.90~7.64(m, 14H), 7.49~7.39(m, 9H), 7.29~7.27(m, 3H), 6.95~6.87(m, 3H), 6.63(t, 1H), 6.45(d, 1H), 6.45(d, 1H), 1.68(s, 6H)	687
112	8.02~7.70(m, 13H), 7.61~7.56(m, 7H), 7.48~7.32(m, 5H), 7.22(t, 2H), 6.99(s, 1H), 6.83(t, 1H), 6.65(d, 2H), 1.86(s, 6H)	687
113	8.02~7.56(m, 23H), 7.48~7.30(m, 7H), 6.99(s, 1H), 6.77(s, 1H), 6.60(d, 1H), 1.86(s, 6H), 1.74(s, 6H)	804
114	8.02~7.89(m, 9H), 7.75(d, 2H), 7.64~7.57(m, 9H), 7.41~7.40(m, 3H), 7.30(t, 1H), 7.14(s, 1H), 6.99(s, 2H), 6.77(s, 1H), 6.60~6.55(m, 2H), 1.80~1.74(d, 12H), 0.27(s, 9H)	826
115	8.02~7.93(m, 8H), 7.75(d, 2H), 7.61~7.56(m, 7H), 7.41(m, 2H), 7.07~6.99(m, 3H), 6.76~6.75(t, 3H), 6.57~6.54(t, 3H), 3.85(s, 3H), 1.80(s, 6H)	667
116	8.02~7.93(m, 8H), 7.75(d, 2H), 7.61~7.56(m, 7H), 7.41(m, 2H), 7.07~6.99(m, 3H), 6.75(t, 1H), 6.65(d, 1H), 6.57(d, 1H), 6.10~6.09(d, 4H), 1.80(s, 6H)	681
117	8.02~7.93(m, 8H), 7.75(d, 2H), 7.61~7.56(m, 7H), 7.41(m, 2H), 7.07~6.99(m, 3H), 6.75(t, 1H), 6.57(d, 1H), 6.43(d, 1H), 6.35~6.32(m, 2H), 3.85(s, 6), 1.80(s, 6H)	697
118	7.93(m, 2H), 7.72(s, 2H), 7.59~7.43(m, 19H), 7.22(t, 2H), 7.07~6.99(m, 3H), 6.83~6.75(m, 2H), 6.65(d, 2H), 6.57(d, 1H), 1.80(s, 6H)	689

[0142]

119	7.93(m, 2H), 7.56~7.43(m, 13H), 7.27(s, 8H), 7.07~6.99(m, 5H), 6.75(t, 1H), 6.57~6.63(m, 3H), 1.80(s, 6H)	707
120	7.93~7.81(m, 10H), 7.53~7.41(m, 15H), 7.07~6.99(m, 3H), 6.83~6.75(m, 3H), 6.57(d, 1H), 1.80(s, 6H)	714
121	7.95~7.89(m, 6H), 7.79(s, 2H), 7.65(d, 2H), 7.57~7.56(d, 3H), 7.41~7.40(m, 4H), 7.30(t, 2H), 7.17(d, 2H), 7.07~6.99(m, 3H), 6.75(t, 1H), 6.57~6.63(m, 3H), 1.80~1.74(d, 18H), 0.27(s, 9H)	842
122	8.52(d, 2H), 7.93(m, 2H), 7.56~7.41(m, 12H), 7.28(d, 2H), 7.07~6.99(m, 5H), 6.71~6.75(m, 3H), 6.57(d, 1H), 1.80(s, 6H)	615
123	9.29(s, 2H), 8.88(d, 2H), 8.13(d, 2H), 7.93~7.89(m, 3H), 7.64~7.56(m, 3H), 7.41~7.40(m, 3H), 7.30(t, 1H), 7.07~6.99(m, 3H), 6.77~6.75(t, 2H), 6.60~6.57(t, 2H), 1.80~1.74(d, 12H)	657
124	8.12~8.08(m, 4H), 8.00~7.93(m, 4H), 7.80(t, 2H), 7.62~7.56(m, 3H), 7.41~7.37(m, 6H), 7.07~6.99(m, 3H), 6.75(t, 1H), 6.58~6.57(m, 3H), 1.80(s, 6H)	707
125	9.73(s, 2H), 8.18(d, 2H), 7.93~7.85(m, 6H), 7.60~7.56(m, 3H), 7.40(m, 2H), 7.07~6.99(m, 5H), 6.75(t, 1H), 6.57(d, 3H), 1.80(s, 6H), 1.37(s, 9H)	697
126	7.93(m, 2H), 7.69(s, 2H), 7.56(s, 1H), 7.41(m, 2H), 7.19~7.17(m, 7H), 6.99(s, 1H), 6.85(d, 1H), 6.63(d, 2H), 6.49(d, 1H), 2.36(s, 12H), 1.80(s, 6H), 1.37(s, 9H), 0.27(s, 9H)	722
127	7.97~7.91(m, 6H), 7.84(s, 2H), 7.63(t, 2H), 7.56~7.54(d, 3H), 7.41~7.35(m, 6H), 7.17(s, 1H), 7.01~6.99(t, 3H), 6.85(d, 1H), 6.63(t, 2H), 6.49(d, 1H), 1.80(s, 6H), 1.37(s, 9H), 0.68(s, 12H)	876
128	8.44(d, 2H), 7.94~7.93(m, 4H), 7.65(m, 2H), 7.56~7.41(m, 9H), 7.17~7.12(t, 3H), 6.99(s, 1H), 6.85~6.83(t, 3H), 6.49(d, 1H), 1.80(s, 6H), 1.37(s, 9H)	720
129	8.20~8.02(m, 8H), 7.93(m, 2H), 7.79(s, 2H), 7.65~7.31(m, 23H), 7.07~6.99(m, 4H), 6.75(t, 1H), 6.57(d, 1H), 1.80(s, 6H)	918
130	8.55~8.51(m, 4H), 8.30(d, 2H), 8.08~7.84(m, 8H), 7.68~7.59(m, 9H), 7.49~7.46(m, 3H), 7.15~7.07(m, 3H), 6.83(t, 1H), 6.65(d, 1H), 1.88(s, 6H)	800
131	8.01~7.95(m, 3H), 7.87(d, 1H), 7.78~7.76(m, 7H), 7.62~7.40(m, 26H), 7.30(t, 2H), 7.07(s, 1H), 6.91(t, 1H), 6.73(d, 2H), 1.94(s, 6H)	892

[0143]

132	9.40(d, 2H), 9.00(d, 2H), 8.63(d, 2H). 8.01~7.64(m, 13H), 7.56~7.35(m, 7H), 7.24(t, 2H), 7.10~7.07(m, 3H), 6.85(s, 1H), 6.65(d, 1H), 1.94(s, 6H), 1.82(s, 6H)	860
133	9.25(s, 2H), 9.03(d, 4H), 8.28~8.14(m, 8H), 8.01~8.92(m, 11H), 7.72~7.64(m, 3H), 7.49~7.48(m, 3H), 7.38(t, 1H), 7.22(s, 1H), 7.07(t, 2H), 6.85(s, 1H), 6.68~6.63(m, 2H) 1.88~1.82(s, 12H), 0.35(s, 9H)	1026
134	9.34(s, 2H), 8.80(d, 2H), 8.52(d, 2H), 8.01(s, 2H), 7.67~7.49(m, 12H), 7.15~7.07(m, 3H), 6.83~6.79(m, 3H), 6.65(d, 1H), 1.88(s, 6H)	615
135	8.41(s, 2H), 8.01(s, 2H), 7.64~7.49(m, 20H), 7.15~7.07(m, 3H), 6.83~6.79(m, 3H), 6.65(d, 1H), 1.88(s, 6H)	663
136	8.41(s, 2H), 8.10~8.01(n, 8H), 7.83(d, 2H), 7.69~7.49(m, 16H), 7.15~7.07(m, 3H), 6.83~6.79(m, 3H), 6.65(d, 1H), 1.87(s, 6H)	763
137	8.41(s, 2H), 8.01(s, 2H), 7.64~7.49(m, 20H), 7.35(s, 8H), 7.15~7.07(m, 3H), 6.83~6.79(m, 3H), 6.65(d, 1H), 1.88(s, 6H)	816
138	8.65(s, 2H), 8.52(d, 2H), 8.41(s, 2H), 8.18~8.14(d, 4H), 8.01(s, 2H), 7.71~7.49(m, 16H), 7.15~7.07(m, 3H), 6.83~6.79(m, 3H), 6.65(s, 1H), 1.88(s, 6H)	763
139	8.41(s, 2H), 8.03~7.97(m, 6H), 7.87(s, 2H), 7.73(d, 2H), 7.65~7.61(m, 9H), 7.51~7.48(m, 5H), 7.38(t, 2H), 7.15~7.07(m, 3H), 6.83~6.79(m, 3H), 6.65(d, 1H), 1.88~1.82(s, 18)	896
140	7.92(d, 1H), 7.48(s, 1H), 7.32~7.23(m, 4H), 7.15~7.12(m, 2H), 6.91(t, 1H), 6.83(t, 1H), 6.73(d, 2H), 6.65(d, 1H), 2.99(s, 3H), 2.74(s, 3H), 1.88(s, 6H), 1.58(s, 18H)	525
141	7.92(d, 1H), 7.48(s, 1H), 7.32(t, 1H), 7.23(t, 1H), 7.15~7.09(m, 4H), 6.83(t, 1H), 6.71~6.65(m, 3H), 2.99(s, 3H), 2.74(s, 3H), 1.88(s, 6H), 1.58(s, 18H)	543
142	7.92(d, 1H), 7.49~7.48(d, 3H), 7.32(t, 1H), 7.23(d, 1H), 7.15~7.12(m, 2H), 6.91(d, 2H), 6.83(t, 1H), 6.65(d, 1H), 2.99(s, 3H), 2.74(s, 3H), 1.88(s, 6H),1.58(s, 18H)	550
143	7.92(d, 1H), 7.48(s, 1H), 7.32~7.23(m, 4H), 7.15~7.12(m, 2H), 6.83(t, 1H), 6.71~6.65(m, 3H), 2.99(s, 3H), 2.74(s, 3H), 1.88(s, 6H), 1.58(s, 18H), 0.35(s, 9H)	597
144	7.92(d, 1H), 7.64~7.61(m, 6H), 7.51~7.48(m, 2H), 7.32(t, 1H), 7.23(d, 1H), 7.15~7.12(m, 2H), 6.83~6.79(m, 3H), 6.65(d, 1H), 2.98(s, 3H), 2.74(s, 3H), 1.88(s, 6H), 1.58(s, 18H)	601

[0144]

[0145]

145	7.97~7.92(m, 2H), 7.72(d, 1H), 7.65(d, 1H), 7.48(t, 2H), 7.38~7.32(m, 2H), 7.23(d, 1H), 7.15~7.12(m, 2H), 6.85~6.83(m, 2H), 6.68~6.65(m, 2H), 2.98(s, 3H), 2.74(s, 3H), 1.88(s, 6H), 1.82(s, 6H), 1.58(s, 18H),	641
146	7.98(d, 1H), 7.48~7.47(d, 3H), 7.32(t, 1H), 7.23(d, 1H), 7.15~7.12(m, 2H), 6.83(t, 1H), 6.66~6.65(m, 3H), 2.99(s, 3H), 2.74(s, 3H), 1.88(s, 6H), 1.58(s, 18H)	593
147	7.92(d, 1H), 7.48~7.45(m, 2H), 7.32(t, 1H), 7.23(d, 1H), 7.15~7.12(m, 2H), 6.83(t, 1H), 6.65(s, 2H), 6.48(d, 1H), 2.99(s, 3H), 2.74(s, 3H), 1.88(s, 6H), 1.58(s, 18H)	561
148	7.72(m, 1H), 7.28(m, 1H), 7.12(m, 1H), 7.03(m, 1H), 6.95~6.01(m, 4H), 6.63(m, 1H), 6.45(m, 3H), 7.03~6.89(m, 8H), 2.79(s, 1H), 2.54(s, 1H), 1.68(s, 2H), 1.38(s, 18H), 1.25(s, 9H)	581
149	7.72(m, 1H), 7.28(m, 1H), 7.12~7.03(m, 5H), 6.73(m, 1H), 6.51(m, 2H), 6.37(m, 1H), 2.79(s, 3H), 2.54(s, 3H), 1.68(s, 6H), 1.38(s, 18H), 1.25(s, 9H), 0.15(s, 9H)	653
150	7.72(m, 1H), 7.28(m, 1H), 7.12(m, 1H), 7.05~7.03(m, 2H), 6.89(m, 2H), 6.73(m, 1H), 6.51(m, 2H), 6.37(m, 1H), 2.79(s, 3H), 2.54(s, 3H), 1.68(s, 6H), 1.38(s, 18H), 1.25(s, 9H)	599
151	7.72(m, 1H), 7.29~7.28(m, 3H), 7.12(m, 1H), 7.05~7.03(m, 2H), 6.73~6.71(m, 3H), 6.37(m, 1H), 2.79(s, 3H), 2.54(s, 3H), 1.68(s, 6H), 1.38(s, 18H), 1.25(s, 9H)	606
152	7.95~7.92(m, 2H), 7.72(m, 1H), 7.47~7.43(m, 3H), 7.28(m, 2H), 7.12(m, 1H), 7.03(m, 1H), 6.95~6.92(m, 3H), 6.63(m, 1H), 6.47(m, 1H), 2.79(s, 3H), 2.54(s, 3H), 1.68(s, 6H), 1.38(s, 18H)	575
153	7.78~7.64(m, 5H), 7.40~7.39(m, 2H), 7.28~7.26(m, 2H), 7.12(m, 1H), 7.03(m, 1H), 6.95~6.92(m, 2H), 6.63(m, 1H), 6.45(m, 1H), 2.79(s, 3H), 2.54(s, 3H), 1.68(s, 6H), 1.38(s, 18H)	575
154	7.75~7.68(m, 3H), 7.58(m, 1H), 7.36(m, 1H), 7.28~7.25(m, 2H), 7.25~7.20(m, 1H), 7.12~7.03(m, 4H), 6.71(m, 1H), 6.53(m, 2H), 2.79(s, 3H), 2.54(s, 3H), 1.74(s, 6H), 1.38(s, 18H)	575
155	7.75~7.68(m, 4H), 7.58(m, 1H), 7.52(m, 1H), 7.45(m, 1H), 7.36(m, 1H), 7.28~7.25(m, 3H), 7.20~7.12(m, 3H), 7.03(m, 1H), 6.65(m, 1H), 6.48(m, 1H), 2.79(s, 3H), 2.54(s, 3H), 1.74(s, 6H), 1.62(s, 6H), 1.38(s, 18H)	691

156	7.77~7.72(m, 2H), 7.52(m, 1H) 7.45(m, 1H), 7.28 (m, 2H), 7.18~7.12(m, 2H), 7.03~7.02(m, 2H), 6.87(m, 1H), 6.65(m, 1H), 6.48~6.43(m, 2H), 2.79(s, 3H), 2.54(s, 3H), 1.68(s, 6H), 1.62(s, 6H), 1.38(s, 18H), 0.15(s, 9H)	713
157	7.65(m, 1H), 7.23~7.21(m, 2H), 7.10(m, 2H), 6.96~6.92(m, 3H), 6.71(m, 1H), 6.63(m, 1H), 6.53(m, 2H), 6.45(m, 1H), 1.68(s, 6H), 1.38(s, 18H)	533
158	7.65(m, 1H), 7.23~7.21(m, 2H), 6.96~6.89(m, 5H), 6.63(m, 1H), 6.51~6.45(m, 3H), 1.68(s, 6H), 1.38(s, 18H)	551
159	7.65(m, 1H), 7.29~7.21(m, 4H), 6.96~6.92(m, 3H), 6.71(m, 2H), 6.63(m, 1H), 6.45(m, 1H), 1.68(s, 6H), 1.38(s, 18H)	558
160	7.65(m, 1H), 7.23~7.21(m, 2H), 7.05(m, 2H), 6.96~6.92(m, 3H), 6.63(m, 1H), 6.51~6.45(m, 3H), 1.68(s, 6H), 1.38(s, 18H), 0.25(s, 9H)	605
161	7.65(m, 1H), 7.44~7.41(m, 6H), 7.31(m, 1H), 7.23~7.21(m, 2H), 6.96~6.92(m, 3H), 6.63~6.59(m, 3H), 6.45(m, 1H), 1.68(s, 6H), 1.38(s, 18H)	609
162	7.77(m, 1H), 7.65(m, 1H), 7.52(m, 1H), 7.45(m, 1H), 7.28~7.21(m, 4H), 6.96~6.92(m, 3H), 6.65~6.63(m, 2H), 6.48~6.45(m, 2H), 1.68(s, 6H), 1.62(s, 6H), 1.38(s, 18H)	649
163	7.65(m, 1H), 7.27~7.21(m, 4H), 6.96~6.92(m, 3H), 6.63(m, 1H), 6.46~6.45(m, 3H), 1.68(s, 6H), 1.38(s, 18H)	601
164	7.65(m, 1H), 7.25~7.21(m, 3H), 6.96~6.92(m, 3H), 6.63(m, 1H), 6.45(m, 2H), 6.28(m, 1H), 1.68(s, 6H), 1.38(s, 18H)	569
165	7.65(m, 1H), 7.23~7.21(m, 2H), 6.96~6.91(m, 5H), 6.63(m, 1H), 6.45(m, 3H), 1.68(s, 6H), 1.38(s, 18H), 1.25(s, 9H)	589
166	7.65(m, 1H), 7.23~7.21(m, 2H), 7.05(m, 3H), 6.96 (m, 1H), 6.73(m, 1H), 6.51(m, 1H), 6.37(m, 1H), 1.68(s, 6H), 1.38(s, 18H), 1.25(s, 9H)	661
167	7.45(d, 1H), 7.32~7.30(m, 2H), 7.15(s, 1H), 7.05~6.98(m, 3H), 6.82(d, 1H), 6.60(d, 2H), 6.46(d, 1H), 1.67(s, 6H), 1.47(s, 18H), 1.34(s, 9H)	607
168	7.45(d, 1H), 7.38~7.30(m, 4H), 7.15(s, 1H), 7.05(d, 1H), 6.82~6.80(m, 3H), 6.46(d, 1H), 1.67(s, 6H), 1.47(s, 18H), 1.34(s, 9H)	614
169	7.77~7.72(m, 2H), 7.45(d, 1H), 7.57~7.52(m, 3H), 7.37~7.30(m, 3H), 7.05~6.97(m, 4H), 6.72(t, 1H), 6.54(d, 1H), 1.67(s, 6H), 1.47(s, 18H)	583

[0146]

170	7.58~7.53(m, 2H), 7.47~7.45(m, 3H), 7.49~7.30(m, 5H), 7.05~7.01(m, 3H), 6.72(t, 1H), 6.54(d, 1H), 1.67(s, 6H), 1.47(s, 18H)	583
171	7.84(d, 1H), 7.77~7.74(m, 2H), 7.67(s, 1H), 7.45(t, 1H), 7.34~7.29(m, 4H), 7.19(t, 2H), 7.05(t, 1H), 6.80(t, 1H), 6.62(d, 2H), 1.67(s, 6H), 1.47(s, 18H)	583
172	7.86~7.84(m, 2H), 7.77~7.74(m, 2H), 7.67(s, 1H), 7.61(d, 1H), 7.54(d, 1H), 7.45(t, 1H), 7.34~7.27(m, 6H), 7.05(d, 1H), 6.74(s, 1H), 6.57(d, 1H), 1.87(s, 6H), 1.67(s, 6H), 1.47(s, 18H)	699
173	7.86(d, 1H), 7.74(d, 1H), 7.61(d, 1H), 7.54(d, 1H), 7.32~7.05(m, 6H), 6.96(d, 1H), 6.74(s, 1H), 6.57~6.52(m, 2H), 1.87(s, 6H), 1.67(s, 6H), 1.47(s, 18H), 0.24(s, 9H)	722
174	7.99~7.91(m, 3H), 7.74~7.72(m, 2H), 7.58~7.57(m, 6H), 7.37(s, 1H), 7.25~7.01(m, 6H), 6.80~6.72(m, 2H), 6.62(d, 2H), 6.54(d, 1H), 2.89(s, 3H), 2.63(s, 3H), 1.67(s, 6H)	665
175	7.99~7.91(m, 6H), 7.74~7.72(m, 3H), 7.58~7.57(m, 6H), 7.37(s, 1H), 7.25(t, 1H), 7.17(d, 1H), 7.04~6.98(m, 4H), 6.72(t, 1H), 6.60~6.54(m, 3H), 2.87(s, 3H), 2.63(s, 3H), 1.67(s, 6H)	683
176	7.99~7.91(m, 6H), 7.74~7.72(m, 3H), 7.58~7.37(m, 9H), 7.25(t, 1H), 7.17(d, 1H), 7.04~7.01(m, 2H), 6.72~6.80(m, 3H), 6.54(d, 1H), 2.87(s, 3H), 2.63(s, 3H), 1.67(s, 6H)	690
177	7.99~7.91(m, 6H), 7.74~7.57(m, 9H), 7.37(s, 1H), 7.25(t, 1H), 7.16~7.01(m, 5H), 6.72(t, 1H), 6.60~6.54(m, 3H), 2.87(s, 3H), 2.63(s, 3H), 1.67(s, 6H), 0.24(s, 9H)	738
178	7.99~7.91(m, 6H), 7.74~7.38(m, 17H), 7.25(t, 1H), 7.16(d, 1H), 7.04~7.01(m, 2H), 6.72~6.68(m, 3H). 6.54(d, 1H), 2.88(s, 3H), 2.63(s, 3H), 1.67(s, 6H)	741
179	7.99~7.86(m, 7H), 7.74~7.57(m, 11H), 7.37(m, 2H), 7.27~7.25(m, 2H), 7.16(d, 1H), 7.04~7.01(m, 2H), 6.74~6.54(m, 4H), 2.88(s, 3H), 2.63(s, 3H), 1.67(s, 12H)	782
180	7.99~7.91(m, 6H), 7.74~7.57(m, 9H), 7.37~7.36(m, 3H), 7.25(t, 1H), 7.16(d, 1H), 7.04~7.01(m, 2H), 6.72(t, 1H), 6.55~6.54(m, 3H), 2.87(s, 3H), 2.63(s, 3H), 1.67(s, 6H)	733
181	7.99~7.91(m, 6H), 7.74~7.72(m, 3H), 7.58~7.57(m, 6H), 7.37~7.25(m, 3H), 7.16(d, 1H), 7.04~7.01(m, 2H), 6.72(t, 1H), 6.54(d, 2H), 6.37(d, 1H), 2.88(s, 3H), 2.63(s, 3H), 1.67(s, 6H)	701

[0147]

182	7.99(d, 2H), 7.91(d, 1H), 7.74~7.72(m, 2H), 7.58~7.37(m, 9H), 7.25(t, 1H), 7.16(d, 1H), 7.04~7.00(m, 4H), 6.72(t, 1H), 6.54(d, 3H), 2.88(s, 3H), 2.63(s, 3H), 1.67(s, 6H), 1.27(s, 9H)	671
183	7.99~7.91(m, 6H), 7.74~7.57(m, 9H), 7.37(s, 1H), 7.26(t, 1H), 7.16~7.14(m, 4H), 6.82(d, 1H), 6.60(d, 2H), 6.46(d, 1H), 2.88(s, 3H), 2.63(s, 3H), 1.67(s, 6H), 1.27(s, 9H), 0.24(s, 9H)	794
184	7.99~7.91(m, 6H), 7.74~7.57(m, 9H), 7.37(s, 1H), 7.25(t, 1H), 7.16(d, 1H), 6.98(d, 2H), 6.82(d, 2H), 6.60(d, 2H), 6.46(d, 1H), 2.88(s, 3H), 2.63(s, 3H), 1.67(s, 6H), 1.27(s, 9H)	739
185	7.90~7.82(m, 6H), 7.65~7.63(m, 3H), 7.49~7.48(m, 6H), 7.29~7.28(m, 3H), 7.16(t, 1H), 7.07~7.05(m, 2H), 6.73~6.71(m, 3H), 6.37(d, 1H), 2.79(s, 3H), 2.54(s, 3H), 1.68(s, 6H), 1.25(s, 9H)	746
186	7.97~7.82(m, 8H), 7.63~7.58(m, 3H), 7.49~7.43(m, 9H), 7.28~7.21(m, 3H), 7.00~6.88(m, 4H), 6.63(t, 1H), 6.45(d, 1H), 1.68(s, 6H)	723
187	7.90~7.58(m, 13H), 7.49~7.39(m, 8H), 7.27~7.21(m, 3H), 7.00~6.92(m, 3H), 6.63(t, 1H), 6.45(d, 1H), 1.68(s, 6H)	723
188	7.90~7.58(m, 12H), 7.49~7.48(m, 6H), 7.36~7.20(m, 5H), 7.10(t, 2H), 7.00(t, 1H), 6.71(t, 1H), 6.53(d, 2H), 1.74(s, 6H)	723
189	7.90~7.45(m, 21H), 7.36~7.18(m, 7H), 7.00(t, 1H), 6.65(d, 1H), 6.48(d, 1H), 1.74(s, 6H), 1.62(s, 6H)	840
190	7.90~7.77(m, 7H), 7.63~7.45(m, 11H), 7.28~7.18(m, 4H), 7.02~7.00(m, 2H), 6.87(d, 1H), 6.65(d, 1H), 6.48~6.43(m, 2H), 1.68~1.62(m, 12H), 0.15(s, 9H)	862
191	7.88(d, 2H), 7.69(s, 1H), 7.59(d, 1H), 7.40(s, 1H), 7.25~7.24(m, 3H), 7.01~7.00(m, 2H), 1.68(s, 6H), 1.38(s, 18H)	438
192	7.90~7.81(m, 8H), 7.69~7.59(m, 4H), 7.49~7.40(m, 7H), 7.29~7.24(m, 3H), 7.01~7.00(m, 2H), 1.68(s, 6H)	578
193	8.45(d, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.81~7.69(m, 3H), 7.59~7.40(m, 8H), 7.29~7.24(m, 3H), 7.01~7.00(m, 2H), 1.68(s, 6H)	578
194	8.40(d, 2H), 7.81(d, 2H), 7.69(s, 1H), 7.59(d, 1H), 7.41~7.40(m, 3H), 7.29~7.16(m, 5H), 7.01~7.00(m, 2H), 6.90(t, 2H), 1.68(s, 6H)	480
195	8.03(s, 1H), 7.81(d, 2H), 7.70(s, 1H), 7.42~7.28(m, 15H), 7.09(t, 1H), 1.68(s, 6H), 0.56(s, 6H)	504
196	8.03(s, 1H), 7.90~7.81(m, 8H), 7.70~7.63(m, 3H), 7.49~7.48(m, 6H), 7.37~7.28(m, 5H), 7.09(t, 1H), 1.68(s, 6H), 0.56(s, 6H)	604

[0148]

197	7.80(m, 3H), 7.60(s, 1H), 7.42~7.17(m, 15H), 7.10(d, 1H), 1.68(s, 6H)	525
198	8.45(d, 2H), 8.32(d, 2H), 7.98~7.94(m, 4H), 7.80(m, 3H), 7.60(s, 1H), 7.51~7.45(m, 6H), 7.30~7.17(m, 5H), 7.10(d, 1H), 1.68(s, 6H)	625
199	7.90~7.82(m, 9H), 7.74~7.73(m, 3H), 7.49~7.48(m, 6H), 7.39~7.17(m, 5H), 7.18(m, 1H), 1.68(s, 6H)	626
200	7.81(m, 2H), 7.55(s, 1H), 7.42~7.29(m, 12H), 7.16~7.13(m, 3H), 7.06(s, 1H), 6.99(m, 1H), 1.68(s, 6H)	462
201	7.90~7.81(m, 8H), 7.63(m, 2H), 7.55~7.48(m, 7H), 7.29(m, 2H), 7.16~7.13(m, 3H), 7.06(s, 1H), 6.99(m, 1H), 1.68(s, 6H)	638
202	8.45(m, 2H), 8.32(m, 2H), 7.98~7.94(m, 4H), 7.81(m, 2H), 7.55~7.45(m, 7H), 7.29(m, 2H), 7.16~7.06(m, 4H), 6.99(m, 1H), 1.68(s, 6H)	562
203	7.88(m, 2H), 7.55(s, 2H), 7.25(m, 2H), 7.11(m, 2H), 6.89(m, 2H), 1.38(s, 18H)	428
204	7.90~7.81(m, 8H), 7.63(m, 2H), 7.55~7.48(m, 8H), 7.29(m, 2H), 7.11(m, 2H), 6.89(m, 2H)	568
205	8.45(m, 2H), 8.32(m, 2H), 7.98~7.94(m, 4H), 7.81(m, 2H), 7.55~7.45(m, 8H), 7.29(m, 2H), 7.11(m, 2H), 6.89(m, 2H)	568
206	8.40(m, 2H), 8.19(s, 2H), 7.81(m, 2H), 7.46~7.37(m, 6H), 7.29(m, 2H), 7.16(m, 2H), 6.90(m, 2H), 0.65(s, 12H)	522
207	8.19(s, 2H), 7.81(m, 2H), 7.46~7.29(m, 16H), 0.65(s, 12H)	520
208	8.19(s, 2H), 7.90~7.81(m, 8H), 7.63(m, 2H), 7.49~7.46(m, 8H), 7.37(m, 2H), 7.29(m, 2H), 0.65(s, 12H)	620
209	7.72(d, 1H), 7.44(s, 1H), 7.10(m, 4H), 7.00~6.87(m, 6H), 6.71~6.63(m, 4H), 6.53(m, 4H), 6.45(m, 3H), 2.54(s, 6H), 1.68(s, 6H), 1.25(s, 9H)	636
210	7.77~7.68(m, 4H), 7.58(m, 1H), 7.52(m, 1H), 7.45~7.44(m, 2H), 7.36~7.10(m, 9H), 7.00(m, 1H), 6.87(s, 1H), 6.71~6.65(m, 4H), 6.53~6.48(m, 5H), 2.54(s, 6H), 1.74(s, 6H), 1.62(s, 6H)	746
211	7.72(d, 1H), 7.44(s, 1H), 7.10(m, 6H), 7.00~6.87(m, 4H), 6.71~6.63(m, 5H), 6.53(m, 6H), 6.45(m, 1H), 1.68(s, 6H), 1.38(s, 18H)	664
212	7.72(d, 1H), 7.44(s, 1H), 7.10(m, 4H), 7.00~6.87(m, 6H), 6.71~6.63(m, 4H), 6.53~6.45(m, 7H), 1.68(s, 6H), 1.38(s, 18H)	682

[0149]

213	7.65(d, 1H), 7.44(s, 1H), 7.27(m, 2H), 7.10(m, 4H), 6.95~6.87(m, 4H), 6.73~6.63(m, 4H), 6.53(m, 4H), 6.46~6.45(m, 3H), 1.68(s, 6H), 0.25(s, 18H)	765
214	7.72(d, 1H), 7.44(s, 1H), 7.10~6.87(m, 10H), 6.71~6.63(m, 4H), 6.53~6.45(m, 7H), 2.77(m, 2H), 1.68(s, 6H), 1.23(m, 12H), 0.25(s, 9H)	709
215	7.65(d, 1H), 7.44~7.41(m, 9H), 7.31(m, 2H), 7.10~7.05(m, 6H), 6.95~6.87(m, 4H), 6.73~6.63(m, 4H), 6.53~6.42(m, 7H), 1.68(s, 6H), 0.25(s, 9H)	777
216	7.77(m, 1H), 7.65(d, 1H), 7.62(d, 1H), 7.44~7.28(m, 13H), 7.18~7.10(m, 5H), 6.95~6.87(m, 4H), 6.71~6.63(m, 5H), 6.53~6.45(m, 6H), 1.68(s, 6H), 1.62(s, 6H)	821
217	8.45(m, 2H), 8.42(m, 2H), 7.98~7.94(m, 4H), 7.65(m, 1H), 7.61~7.45(m, 7H), 7.10(m, 4H), 6.95~6.87(m, 6H), 6.71~6.63(m, 4H), 6.53~6.45(m, 7H), 1.68(s, 6H), 1.25(s, 9H)	861
218	7.90~7.77(m, 7H), 7.65~7.63(m, 3H), 7.62~7.45(m, 9H), 7.28(m, 1H), 7.18~7.10(m, 5H), 6.95~6.87(m, 4H), 6.71~6.63(m, 5H), 6.53~6.45(m, 6H), 1.68(s, 6H), 1.62(s, 6H)	921
219	7.90~7.45(m, 22H), 7.36~7.10(m, 9H), 6.93(m, 1H), 6.87(s, 1H), 6.73~6.65(m, 4H), 6.53~6.48(m, 5H), 1.74(s, 6H), 1.62(s, 6H)	971
220	8.45(m, 2H), 8.02(m, 2H), 7.84~7.80(m, 4H), 7.53(m, 2H), 7.40(m, 3H), 7.30~7.15(m, 9H), 6.95~6.90(m, 3H), 6.63(m, 1H), 6.45(m, 2H), 6.28(m, 1H), 1.68(s, 6H)	751
221	7.81(m, 2H), 7.37(s, 1H), 7.29(m, 2H), 7.10(m, 8H), 6.95~6.91(m, 4H), 6.80(s, 1H), 6.71~6.63(m, 5H), 6.53~6.45(m, 11H), 1.68(s, 6H), 1.25(s, 9H)	776
222	8.02~7.99(m, 2H), 7.93~7.90(m, 3H), 7.74(d, 1H), 7.59~7.50(m, 8H), 7.42~7.38(m, 5H), 7.28~7.23(m, 5H), 7.03~6.98(m, 3H), 6.81~6.78(m, 2H), 6.62~6.57(m, 3H), 2.34(s, 3H)	649
223	8.01~7.98(m, 4H), 7.94~7.89(m, 4H), 7.74~7.72(m, 2H), 7.61~7.55(m, 7H), 7.41~7.38(m, 4H), 7.27~7.21(m, 5H), 7.03~6.98(m, 3H), 6.80~6.77(m, 2H), 6.63~6.59(m, 3H), 2.34(s, 3H)	699

[0150]

[0151] 비교예 1

[0152] 하기 화학식 a로 표시되는 화합물 a를 형광 녹색 호스트로 사용하고, 하기 화학식 c로 표시되는 화합물을 형광 녹색 도판트로 사용하고, 2-TNATA(4,4',4"-tris(N-naphthalen-2-yl)-N-phenylamino)-triphenylamine)을 정공주입층 물질로 사용하고, α-NPD(N,N'-di(naphthalene-1-yl)-N,N'-diphenylbenzidine)을 정공수송층 물질로 사용하여, 다음과 같은 구조를 갖는 유기발광소자를 제작하였다: ITO/2-TNATA(80nm)/α-NPD(30nm)/화합물a+화합물c(30nm)/Alq3(30nm)/LiF(0.5nm)/ Al(60nm).

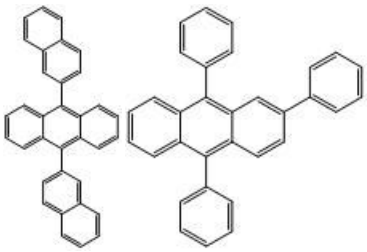
[0153] 애노드는 코닝(Corning)사의 15Ω/cm^2 (1000Å) ITO 유리 기판을 50mm x 50mm x 0.7mm크기로 잘라서 아세톤 이소프로필 알콜과 순수물 속에서 각 15분 동안 초음파 세정한 후, 30분 동안 UV 오존 세정하여 사용하였다. 상기 기판 상부에 2-TANATA를 진공 증착하여 80nm 두께의 정공주입층을 형성하였다. 상기 정공주입층 상부에, α-NPD를 진공 증착하여 30nm 두께의 정공수송층을 형성하였다. 상기 정공수송층 상부에 화학식 a로 표시되는 화합물 a 및 화학식 c로 표시되는 화합물 c(3% 도핑)를 진공 증착하여 30nm두께의 발광층을 형성하였다. 이후, 상기 발광층 상부에 Alq3 화합물을 30nm의 두께로 진공증착하여 전자수송층을 형성하였다. 상기 전자수송층 상부에 LiF 0.5nm(전자주입층)과 Al 60nm(캐소드)를 순차적으로 진공증착하여, 표 3에 표시된 바와 같은 유기발광소자를 제조하였다. 이를 비교샘플 1이라고 한다.

[0154] 비교예 2

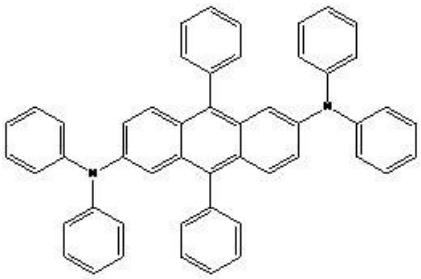
[0155] 하기 화학식 b로 표시되는 화합물 b를 형광 녹색 호스트로 사용하고, 하기 화학식 c로 표시되는 화합물을 형광 녹색 도판트로 사용하고, 2-TNATA(4,4',4"-tris(N-naphthalen-2-yl)-N-phenylamino)-triphenylamine)을 정공주입층 물질로 사용하고, α-NPD(N,N'-di(naphthalene-1-yl)-N,N'-diphenylbenzidine)을 정공수송층 물질로 사용하여, 다음과 같은 구조를 갖는 유기발광소자를 제작하였다: ITO/2-TNATA(80nm)/α-NPD(30nm)/화합물b+화합물c(30nm)/Alq3(30nm)/LiF(0.5nm)/ Al(60nm).

[0156] 애노드는 코닝(Corning)사의 15Ω/cm^2 (1000Å) ITO 유리 기판을 50mm x 50mm x 0.7mm크기로 잘라서 아세톤 이소프로필 알콜과 순수물 속에서 각 15분 동안 초음파 세정한 후, 30분 동안 UV 오존 세정하여 사용하였다. 상기 기판 상부에 2-TANATA를 진공 증착하여 80nm 두께의 정공주입층을 형성하였다. 상기 정공주입층 상부에, α-NPD를 진공 증착하여 30nm 두께의 정공수송층을 형성하였다. 상기 정공수송층 상부에 화학식 a로 표시되는 화합물 b 및 화학식 c로 표시되는 화합물 c(3% 도핑)를 진공 증착하여 30nm두께의 발광층을 형성하였다. 이후, 상기 발광층 상부에 Alq3 화합물을 30nm의 두께로 진공증착하여 전자수송층을 형성하였다. 상기 전자수송층 상부에 LiF 0.5nm(전자주입층)과 Al 60nm(캐소드)를 순차적으로 진공증착하여, 표 3에 표시된 바와 같은 유기발광소자를 제조하였다. 이를 비교샘플 2이라고 한다.

[0157] <화학식 a> <화학식 b>

[0158] 

[0159] <화학식 c>

[0160] 

[0161] 실시예 1~142

[0162] 상기 비교예 1 중, 발광층 형광 도판트 화합물로서 화합물 c 대신 하기 합성예에 개시된 화학식 1~221로 표시되는 화합물 1~221를 발광층 형광 녹색 도판트 화합물로 각각 이용한 것을 제외하고는 상기 비교예 1과 동일한 방법으로 ITO/2-TNATA(80nm)/α-NPD(30nm)/[화합물a + 형광 녹색 도판트 화합물 1~221 중 하나(3%)](30nm)/Alq3(30nm)/LiF(0.5nm)/Al(60nm)의 구조를 갖는 유기발광소자를 제조하였다. 이를 각각 샘플 1 내지 221라고 한다.

[0163] 평가예 1: 비교샘플 1, 2 및 샘플 1~221의 발광 특성 평가

[0164] 비교샘플 1, 2 및 샘플 1~221에 대하여, Keithley SMU 235, PR650를 이용하여 발광휘도, 발광효율, 발광피크를 각각 평가하여, 그 결과를 하기 [제2표군]에 나타내었다. 상기 샘플들은 516~524nm 범위에서 녹색 발광피크값을 보여주었다.

[0165] [제2표준]

샘플 No.	호스트 화합물 No.	도판트 화합물 No.	휘도 [cd/m^2]	효율 [cd/A]	발광피크 [nm]
비교샘플 1	a	c	2032	20.3	516
비교샘플 2	b	c	2208	22.1	520
1	a	1	2009	20.1	522
2	a	2	2433	24.3	521
3	a	3	1835	18.4	517
4	a	4	2207	22.1	524
5	a	5	2173	21.7	519
6	a	6	2144	21.4	518
7	a	7	1847	18.5	521
8	a	8	2304	23.0	516
9	a	9	1934	19.3	519
10	a	10	1869	18.7	520
11	a	11	2410	24.1	521
12	a	12	1875	18.8	522
13	a	13	2210	22.1	522
14	a	14	2465	24.7	519
15	a	15	2207	22.1	519
16	a	16	2384	23.8	523
17	a	17	1931	19.3	520
18	a	18	1859	18.6	522

[0166]

19	a	19	1878	18.8	523
20	a	20	2193	21.9	522
21	a	21	2447	24.5	519
22	a	22	1941	19.4	519
23	a	23	1937	19.4	520
24	a	24	1988	19.9	519
25	a	25	2303	23.0	517
26	a	26	2491	24.9	523
27	a	27	2063	20.6	523
28	a	28	2227	22.3	522
29	a	29	1888	18.9	517
30	a	30	1897	19.0	524
31	a	31	2422	24.2	522
32	a	32	2325	23.3	523
33	a	33	2497	25.0	524
34	a	34	1968	19.7	522
35	a	35	2003	20.0	517
36	a	36	1888	18.9	520
37	a	37	2171	21.7	516
38	a	38	2135	21.4	524
39	a	39	1911	19.1	518
40	a	40	2236	22.4	524
41	a	41	1901	19.0	523
42	a	42	2450	24.5	519
43	a	43	2154	21.5	516
44	a	44	2123	21.2	520
45	a	45	2242	22.4	524
46	a	46	2083	20.8	518
47	a	47	2302	23.0	524
48	a	48	1877	18.8	523
49	a	49	2366	23.7	523
50	a	50	2174	21.7	524
51	a	51	1908	19.1	516
52	a	52	2204	22.0	517
53	a	53	2488	24.9	516
54	a	54	2372	23.7	522

[0167]

55	a	55	2326	23.3	516
56	a	56	1921	19.2	523
57	a	57	2028	20.3	517
58	a	58	2072	20.7	522
59	a	59	1845	18.5	522
60	a	60	2467	24.7	516
61	a	61	1862	18.6	519
62	a	62	2292	22.9	522
63	a	63	2134	21.3	518
64	a	64	2298	23.0	517
65	a	65	2387	23.9	516
66	a	66	2128	21.3	520
67	a	67	2416	24.2	521
68	a	68	2140	21.4	520
69	a	69	1877	18.8	518
70	a	70	1853	18.5	516
71	a	71	2031	20.3	520
72	a	72	1958	19.6	520
73	a	73	2038	20.4	522
74	a	74	1912	19.1	518
75	a	75	1924	19.2	518
76	a	76	1991	19.9	522
77	a	77	2256	22.6	521
78	a	78	2020	20.2	517
79	a	79	1990	19.9	519
80	a	80	2450	24.5	522
81	a	81	1883	18.8	523
82	a	82	2365	23.7	517
83	a	83	2102	21.0	523
84	a	84	2007	20.1	518
85	a	85	2189	21.9	523
86	a	86	2461	24.6	523
87	a	87	2004	20.0	520
88	a	88	1903	19.0	518
89	a	89	2073	20.7	523
90	a	90	2457	24.6	517

[0168]

91	a	91	1946	19.5	523
92	a	92	2033	20.3	520
93	a	93	1860	18.6	524
94	a	94	1836	18.4	520
95	a	95	2187	21.9	519
96	a	96	1962	19.6	524
97	a	97	2430	24.3	518
98	a	98	2434	24.3	516
99	a	99	2091	20.9	524
100	a	100	1832	18.3	518
101	a	101	2243	22.4	520
102	a	102	2345	23.5	516
103	a	103	1888	18.9	521
104	a	104	1921	19.2	522
105	a	105	2396	24.0	521
106	a	106	2167	21.7	519
107	a	107	1981	19.8	516
108	a	108	2394	23.9	516
109	a	109	2497	25.0	517
110	a	110	1847	18.5	520
111	a	111	1824	18.2	523
112	a	112	1972	19.7	524
113	a	113	2014	20.1	521
114	a	114	2411	24.1	521
115	a	115	2324	23.2	516
116	a	116	2098	21.0	518
117	a	117	1855	18.6	516
118	a	118	2273	22.7	518
119	a	119	1882	18.8	521
120	a	120	2329	23.3	516
121	a	121	2013	20.1	523
122	a	122	1827	18.3	519
123	a	123	2228	22.3	519
124	a	124	1871	18.7	518
125	a	125	1909	19.1	516
126	a	126	2101	21.0	516

[0169]

127	a	127	2489	24.9	520
128	a	128	1829	18.3	524
129	a	129	2479	24.8	520
130	a	130	2264	22.6	516
131	a	131	2111	21.1	520
132	a	132	1810	18.1	520
133	a	133	2172	21.7	520
134	a	134	2036	20.4	517
135	a	135	2093	20.9	519
136	a	136	2430	24.3	521
137	a	137	2311	23.1	516
138	a	138	2027	20.3	516
139	a	139	2309	23.1	521
140	a	140	2055	20.6	518
141	a	141	1891	18.9	519
142	a	142	2127	21.3	520
143	a	143	2101	21.0	521
144	a	144	2063	20.6	523
145	a	145	2213	22.1	524
146	a	146	2186	21.9	521
147	a	147	2489	24.9	518
148	a	148	2413	24.1	523
149	a	149	2076	20.8	523
150	a	150	1879	18.8	518
151	a	151	2294	22.9	517
152	a	152	1817	18.2	519
153	a	153	2064	20.6	516
154	a	154	1886	18.9	516
155	a	155	1844	18.4	519
156	a	156	1998	20.0	521
157	a	157	2065	20.7	516
158	a	158	2323	23.2	522
159	a	159	1900	19.0	523
160	a	160	2376	23.8	516
161	a	161	1803	18.0	516
162	a	162	2481	24.8	522

[0170]

163	a	163	1830	18.3	522
164	a	164	2056	20.6	524
165	a	165	2165	21.7	519
166	a	166	2307	23.1	523
167	a	167	2467	24.7	522
168	a	168	2238	22.4	521
169	a	169	2403	24.0	516
170	a	170	1903	19.0	520
171	a	171	1883	18.8	521
172	a	172	2252	22.5	519
173	a	173	2047	20.5	521
174	a	174	2107	21.1	521
175	a	175	1998	20.0	520
176	a	176	2394	23.9	519
177	a	177	2257	22.6	524
178	a	178	2440	24.4	523
179	a	179	2460	24.6	524
180	a	180	1902	19.0	516
181	a	181	2014	20.1	524
182	a	182	2079	20.8	523
183	a	183	1997	20.0	516
184	a	184	2309	23.1	520
185	a	185	2303	23.0	524
186	a	186	1914	19.1	521
187	a	187	2479	24.8	520
188	a	188	2102	21.0	523
189	a	189	1912	19.1	523
190	a	190	2230	22.3	519
191	a	191	2179	21.8	520
192	a	192	2236	22.4	521
193	a	193	1801	18.0	518
194	a	194	2005	20.1	522
195	a	195	2029	20.3	521
196	a	196	2142	21.4	522
197	a	197	1840	18.4	519
198	a	198	2243	22.4	520

[0171]

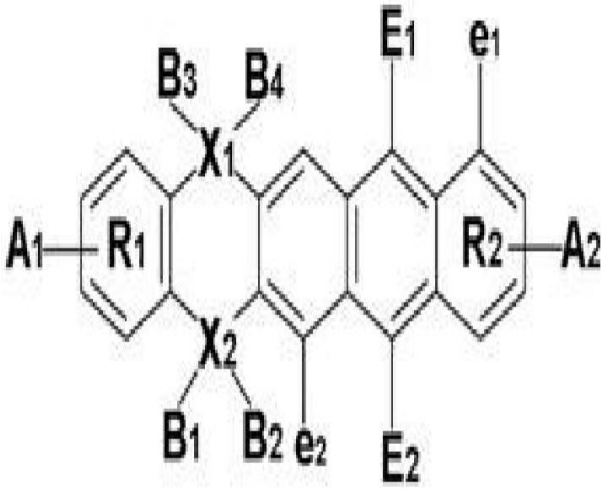
199	a	199	2172	21.7	524
200	a	200	1909	19.1	523
201	a	201	2189	21.9	520
202	a	202	1984	19.8	518
203	a	203	2275	22.8	517
204	a	204	1921	19.2	518
205	a	205	2096	21.0	524
206	a	206	2030	20.3	522
207	a	207	1942	19.4	521
208	a	208	1928	19.3	519
209	a	209	2066	20.7	519
210	a	210	2399	24.0	524
211	a	211	1869	18.7	517
212	a	212	1886	18.9	517
213	a	213	2040	20.4	516
214	a	214	2479	24.8	522
215	a	215	1995	20.0	517
216	a	216	2309	23.1	518
217	a	217	2195	22.0	523
218	a	218	1805	18.1	522
219	a	219	2418	24.2	517
220	a	220	2312	23.1	524
221	a	221	2090	20.9	521

[0172]

[0173] 상기 [제2표군]에 보여지는 바와 같이 샘플 1 내지 221은 비교샘플 1, 2에 비하여 향상된 발광 특성을 나타내는 화합물이 있었다.

[0174] 이상의 설명에서 통상의 공지된 기술을 생략되어 있으나, 당업자라면 용이하게 이를 추측 및 추론하고 재현할 수 있다.

专利名称(译)	有机发光化合物和使用其的有机光子器件		
公开(公告)号	KR1020130032414A	公开(公告)日	2013-04-02
申请号	KR1020110081873	申请日	2011-08-17
申请(专利权)人(译)	氛围有限公司凯		
当前申请(专利权)人(译)	氛围有限公司凯		
[标]发明人	KIM BOK YOUNG 김복영 AHN JUNG BOK 안중복 HYUN SEUNG HAK 현승학 CHIN SUNG MIN 진성민 AHN DO HWAN 안도환 KANG JI SOUNG 강지승 MIN BYUNG WOO 민병우 NAM KI SUN 남기선 PARK NO GIL 박노길 HAN KEUN HEE 한근희 LEE DAE KYUN 이대균		
发明人	김복영 안중복 현승학 진성민 안도환 강지승 민병우 남기선 박노길 한근희 이대균		
IPC分类号	C09K11/06 H01L51/50		
CPC分类号	C07D219/02 C09K11/06 H01L51/006 H01L51/0067 H01L51/0071 H01L51/0072 H01L51/5012 H01L51/5203 H05B33/14 Y02E10/549		
代理人(译)	李明博泽		
优先权	1020110047528 2011-05-19 KR		
外部链接	Espacenet		

摘要(译)

本发明涉及有机发光器件和用于其中的有机发光化合物。并且具有优异的发光效率，实现发光亮度的有机发光装置，色纯度和发光寿命以及用于该太阳能发电的光学装置和由此使用的光活性化合物中使用的有机发光化合物特别地，吡啶并咪唑基衍生物和使用其的有机发光器件更具体地开发，并且可以像第二电极和电子传输层（ETM）之间的所有种类的有机层那样多边使用的材料，光 - 发光层（EML），空穴传输层（HTM）等，开发出第一电极。可以最大化作为性能改善的能力，例如降低效率增加和驱动电压以及OLED材料。