

(19) (KR)
 (12) (A)

(51) . Int. Cl.⁷
 H05B 33/26

(11)
 (43)

10-2004-0070102
 2004 08 06

(21) 10-2004-0006399
 (22) 2004 01 31

(30) 10/356,271 2003 01 31 (US)

(71) 343

(72) - 14580 613

14534 16

14607 242

14580 706

(74)

:

(54) O L E D

2

, (EL) ;

, EL

;

;

,

1	(OLED)	
2	(Quarter Wave Stack, QWS)	(microcavity) OLED
3a	(全) Ag	OLED
3b		OLED
3c	QWS	OLED
3d		OLED
4a	Ag	OLED
4b		OLED
4c	QWS	OLED
4d		OLED
5	OLED	OLED
6	OLED	OLED
7	OLED	OLED
8	OLED	OLED

10: 12a, 12R, 12T:

14: EL 14b:

14c: 14d:

16a, 16R, 16T: 18: QWS

20: 22:

101: OLED

102, 103a, 103b, 103c: OLED

OLED

가 . 가
· . OLED

OLED

LED (Yokoyama) [Science, Vol. 256 (1992) p66], (Jordan) [Appl. Phys. Lett. 69, (1996) p1997].

가 (QWS) . QWS 1/4

(102) (12a), EL (14) OLED 2 QWS (102) (10), OLED QWS(18),
 5 SiO_2 n = 1.5 $\text{TiO}_2 : \text{SiO}_2 : \text{TiO}_2 : \text{SiO}_2 : \text{TiO}_2$ (16R) (R.H. Jordan) QWS(18) TiO_2 n = 2.4
 . 69, 1997 (1996)]). 550nm 1/4 [Appl. Phys. Lett 56nm 92
 nm , 550nm QWS OLED

. OLED
가

, 가 . , QWS

WS ([Science Vol 256, p66 (1992)]
 em) ([Synthetic Metals 76 (1996) 121]) AI Ca-Al
 LED ([Appl. Phys. Lett. 63, 2032 (1993)]) (36nm) Ag 3 250nm MgAg
 (Takada) ([Appl. Phys. Lett. 81, (2002) 1717]) 100nm Al
 (Jean) ([Appl. Phys. Lett. Vol 8 EP 1,154,676 A1
 OLED OLED
 (Lu) ([Appl. Phys. Lett. 81, 3921 (2002)])
 OLED
 Cr
 가
 가
 OLED
 OLED
 가
 가
 가
 ; (b) ; (c)
 EL EL ;
 Ag, Au, Al
 OLED
 가
 2

Q
 (Berggr
 P
 L
 OLED
 (Appl. Phys. Lett. Vol 8
 EL
 가
 Cr
 가
 2
 (a)
 Ag, Au
 2

EL

OLED

2

OLED 가
 Ag, Au, Al (1 50 %)) 가
 Ag, Au

OLED

OLED

가

QWS 가

2

Ohm)

가 OLED

QWS

가

가

EL

가 , EL
 / 4,720,432 , 6,208,
 075 EP 0 891 121 A1 EP 1 029 909 A1 EL
 o) [J. Phys. D. Vol 29 (1996) 2750] (Tokit
 287 5,776,622 , 5,776,623 , 6,137,223 6,140,763 5,608,
 Li, Cs, Ca Mg
 Li Cs Alq 가

OLED

가

EL

EL

EL

OLED
PLEDOLED
OLED

OLED

EL

EL

가

가 (ZTO), (SnO_x), (InO_x), (MoO_x), (ITO), (TeO_x), (through-fil
m) (SbO_x) (ZnO_x)

$$(5,937,272, 5,904,961, 5,688,511).$$

가 가 가

(scanning focused)

(TFT) 가
(5,684,365 , 5,550,066).
()

TFT

, ()가 . ,

3a (103a) (20), EL (14) OLED (103a) (10), (16R) (16R) 2

2T), (12T) (10) TFT 가 3a 2

	(10)		가		(12T)	(10)	
	Ag, Au, Al				(16R)	1.5	(16R)
		(16R)					
	Ag, Au				(12T)	OLED	(12T)
b),		EL	(14)	(14e)(	(14c)		(103a)
4)	(14d)		(20)	)	OLED		
						1	

$$1 \\ 2 \sum n_i L_i + 2 n_s L_s + (Q_{m1} + Q_{m2}) \lambda / 2\pi = m \lambda$$

	n_i		,				
	L_i	EL	(14)	i	,		
	n_s		,				
	L_s		(20)	0	,		
	Q_{m1}	Q_{m2}	2	EL	-	(phase shift)	,
	m		(-)				
			,	m	1	0	1

$$2 \\ (1) \\ (16R) \\ (14c) \\ 2 \\ (14c)() \\ 2$$

$$2 \\ \sum n_i L_i + Q_{m1} \lambda / 2\pi = m_D \lambda$$

	n_i		,				
	L_i	EL	(14)	i	,		
	Q_{m1}	EL	-				

m_D (-)

$$1, \quad 2, \quad . \quad . \quad (12T) \quad (20) \quad (14c) \quad (16R)$$

$$2n_A L_A + n_T L_T = (m_A + 1/2) \lambda$$

$$n_A \quad L_A$$

$$n_T \quad L_T$$

m_A (-)

m A

0, 2

1.6

OLED

OLED

(EL)
(Maxwell's Equation)

(O.H. Crawford) [J. Chem. Phys. 89, 6017 (1988)], (K.B. Kahan) [Appl. Phys. Lett. 78, 1649 (2001)].

가

(photoluminescence, PL)

nm

가

(ellipsometry)

[Handbook of Optical Constants of Solids, ed. by E.D. Palik (Academic Press, 1985)], [Handbook of Optical Constants of Solids II, ed. by E.D. Palik (Academic Press, 1991)], [CRC Handbook of Chemistry and Physics, 83rd ed., edited by D.R. Lide (CRC Press, Boca Raton, 2002)]

10 CIE

. E1

EI

1 , 2
QWS , (a)
OLED (103c) OLED (103b) (103b)
OLED (103a) , (103a)
OLED (103b) (103a) 가 (12T) ITO (12a)
OLED (103a) 가 .
,
OLED (103c) QWS (18) (10) (12a)
OLED (103b) QWS (18) (10) (12a)
1.5 $TiO_2 : SiO_2 : TiO_2 : SiO_2 : TiO_2$ TiO_2 $56nm$ $TiO_2 n = 2.45$ SiO_2 $92nm$
([Appl. Phys. Lett. 69, 1997 (1996)].
OLED QWS

3 (14) 14c)	NPB 가	(10) (14b), 10nm 가	(14c) 가	Alq 가	(16R) (14d) 가	400nm Ag 가	EL 가	()
0 .	가	가	가	.	.	(20)	3	,
380	780nm	가	.	.	.	.	.	.
1 x, FWHM)	OLED (103b)	QWS .	QWS 0.239(	).	OLED 0.385	OLED Ag	OLED (103c)	(103c)가 (full-width-half-ma Ag 2 (103a)
QWS	OLED (103c)	0.239(	).	Ag	OLED Ag	OLED (103c)	(103a)	

[1]

디바이스	설명	기판	QWS	양극 (ITO) nm	양극 (Ag) nm	NPB nm	평탄 대역 발광총 nm	Alq nm	음극 (Ag) nm	취도 임의 단위	피크 위치 nm	피크 높이 임의 단위	FWHM nm
103a	공동 없음	유리		100.7		43.1	10	53.1	400	0.239	547	2.4	N.A.
103b	QWS	유리	있음	50.0		26.6	10	54.9	400	0.385	564	16.8	17.0
103	전 Ag	유리			17.5	45.9	10	54.3	400	0.425	567	6.6	73.0

2			(22)	.	.		
a)	(22)	가	OLED	(103d)	.	OLED	(103d)
	(10)	.	.	ITO	(12T)	.	OLED
			(22)		(22)	.	.
4		,			(22)		
가				1			
(22)		Ag	OLED	(103a)		0.425	2
						0.453	가

[2]

디바이스	설명	기판	흡수 감소층 (ITO) nm	양극 (Ag) nm	NPB	평탄 대역 발광층 nm	Alq	음극 (Ag) nm	휘도 임의 단위	피크 위치 nm	피크 높이 임의 단위	FWHM nm
103a	흡수 감소층 없음	유리		17.5	45.9	10	54.3	400	0.425	567	6.6	73
103d	흡수 감소층 있음	유리	82.2	18.5	48.1	10	54.3	400	0.453	565	7.0	75

3

3, 2 QWS, (a) OLED (104c) OLED (104b) (b) OLE
D (104a)

4a OLED (104a) (10), Ag (16T) OLED (104a) (12R), (20), EL (14) Ag

4b OLED (104b) Ag (16T) ITO OLED (16a) (104a) 50nm
가) , OLED (104b) ITO
, , OLED 가
50nm
OLED
가

4c OLED (104c) QWS (18) ITO (16a) (104b) 50nm
가) QWS (18) $TiO_2 n = 2.45$ $SiO_2 n = 1.5$ $TiO_2 : SiO_2 : TiO_2 : SiO_2 : TiO_2$ ([Appl. Phys. Lett. 69, 1997 (1996)]).
 TiO_2 가 56nm SiO_2 가 92nm QWS OLED QWS

3 (14b), 10nm (14c) Alq (12R) 400nm Ag EL (14) NPB
가 (14d) 가 가 (14c) 가
380 (20) ITO
780nm 가

[3]

디바이스	양극	ITO	NPB	평탄 대역 발광층	Alq	음극	음극	휘도	피크 위치	피크 높이	FWHM
	Ag	nm	nm	nm	nm	재료	nm	임의 단위	nm	임의 단위	nm
104c	400	19.7	30	10	67.0	ITO	86.8	0.318	555	3.8	141
104b	400	23.1	30	10	29.8	ITO+QWS	50	0.335	563	18.9	13
104a	400	20.2	30	10	44.6	Ag	13.7	0.411	568	6.2	75

3 3
104c) 18.9() 가 QWS FWHM OLED 3.4 (, 100nm)
QWS QWS가 , Ag OLED
가 (14a) 2

4

4

4d (22) OLED (104d)
 가 (16T) (22) OLED (104a)
 , ZnS:20%SiO₂ (n = 2.15 + 0.003i)
 OLED 0.411 0.500 4
 가 (22)

[4]

디바이스	양극	ITO	NPB	Alq	음극	ZnS:SiO ₂	휘도	피크 위치	피크 높이	FWHM
	Ag	nm	nm	nm	재료	nm	nm	nm	nm	nm
104a	400	20.2	30	44.6	Ag	13.7	0	0.411	568	6.2
104d	400	19.6	30	58.3	Ag	20.3	61.4	0.504	560	9

5

5 (12R)
 4d Ag EL (14)
 NPB (14b), 10nm (14c) Alq (16T) 가
 가 (14d) 가
 가 (20), ZnS:(20%)SiO₂ (22) ITO
 30nm NPB (14b) (14b)

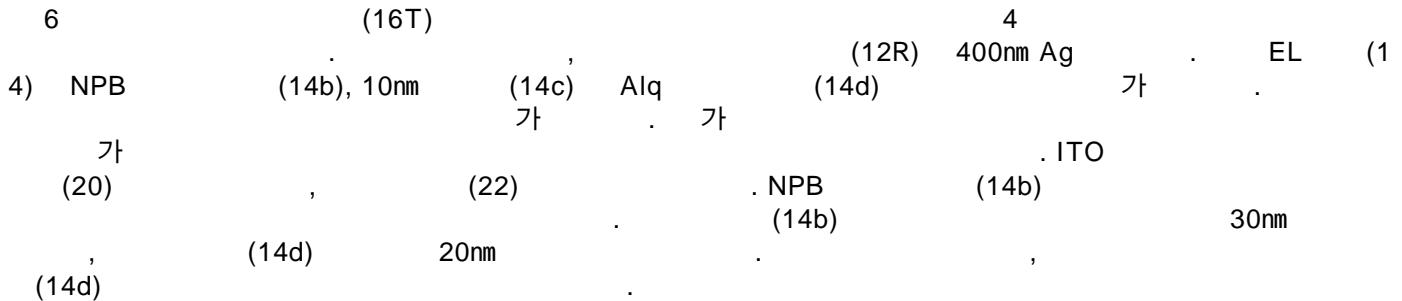
[5]

양극	ITO	NPB	발광층	Alq	음극	음극	ZnS:SiO ₂	휘도	피크 λ	피크 높이	FWHM
	nm	nm	nm	nm	재료	nm	nm	nm	nm	nm	nm
Ag	19.6	30	10	58.3	Ag	20.3	61.4	0.504	560	9	58
Al	29.4	30	10	58.0	Ag	19.7	60.8	0.481	558	8	63
Au	16.2	30	10	60.8	Ag	19.0	63.8	0.435	558	7.7	70
MgAg	23.7	30	10	56.1	Ag	15.7	65.8	0.429	558	6.7	72
Cu	16.5	30	10	63.5	Ag	14.5	62.3	0.310	593	4.9	96
Cr	29.2	30	10	62.7	Ag	10	60.6	0.239	555	2.8	160
Mo	29.8	30	10	71.8	Ag	0	71.3	0.199	565	2.2	186
Zr	7.9	30	10	10.0	Ag	0	0	0.096	588	0.9	

5
 Zr Ag 5
 o Au MgAg , FWHM
 M Ag, Al,

6

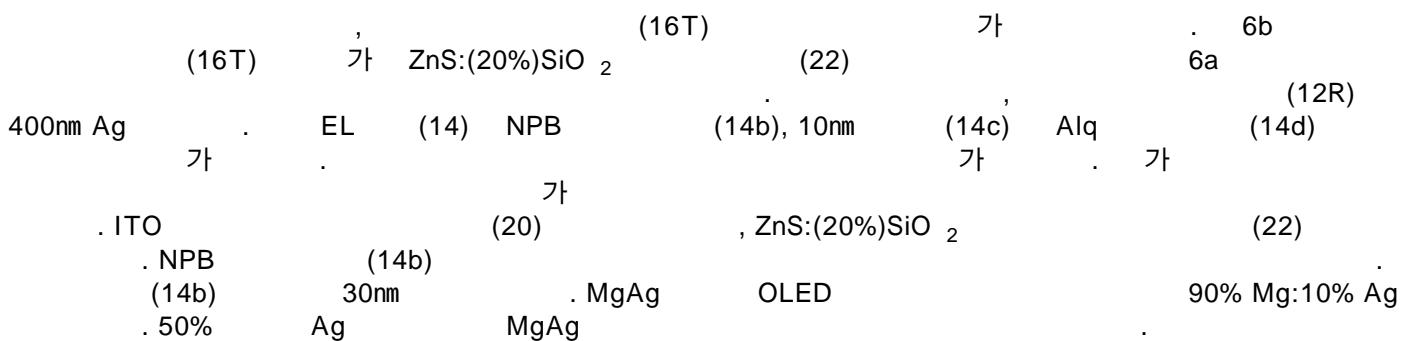
6



[6a]

양극	ITO 투명 전도성 페이스층 nm	NPB 두께 nm	발광층 두께 nm	Alq 두께 nm	음극 음극 두께 nm	음극 두께 nm	취도 임의 단위	피크 파장 nm	피크 높이 임의 단위	FWHM nm
Ag	20.2	30	10	44.6	Ag	13.7	0.411	567.5	6.2	75
Ag	21.5	30	10	44.5	Au	21.3	0.385	582.5	5.9	94
Ag	11.4	30	10	10.0	MgAg	0	0.345	567.5	3.4	N.A.
Ag	11.4	30	10	10.0	Al	0	0.345	567.5	3.4	N.A.
Ag	11.4	30	10	10.0	Cu	0	0.345	567.5	3.4	N.A.
Ag	11.4	30	10	10.0	Cr	0	0.345	567.5	3.4	N.A.
Ag	11.4	30	10	10.0	Mo	0	0.345	567.5	3.4	N.A.
Ag	11.4	30	10	10.0	Zr	0	0.345	567.5	3.4	N.A.

6a (16T) (16T) Au Ag



[6b]

양극	ITO nm	NPB nm	발광층 nm	Alq nm	음극 재료	음극 nm	ZnS:SiO ₂ nm	취도 임의 단위	피크 λ nm	피크 높이 임의 단위	FWHM nm
Ag	19.6	30	10	58.3	Ag	20.3	61.4	0.504	560	9	58
Ag	19.9	30	10	56.5	Au	21.5	62.7	0.486	565	8.3	62
Ag	20.4	30	10	60.1	MgAg	12.3	67.2	0.470	558	7.3	66
Ag	19.5	30	10	65.0	Al	5.5	69.1	0.440	558	7.3	63
Ag	18.9	30	10	63.8	Cu	14.7	64.0	0.418	565	5.9	95
Ag	19.6	30	10	77.3	Cr	0	64.9	0.396	560	5.3	101
Ag	19.6	30	10	77.3	Mo	0	64.9	0.396	560	5.3	101
Ag	19.6	30	10	77.3	Zr	0	64.9	0.396	560	5.3	101
Ag	23.1	30	10	29.8	ITO+QWS	50.0		0.335	568	19.4	13

7a(OLED -)

/ITO(42)/CF_x(1)/NPB(65)/Alq(75)/Li(1)/Aq(50)

, FWHM 5 nm, $20\text{mA}/\text{cm}^2$, 108nm , 7.1V , $\text{CIE-}x = 0.352$, $\text{CIE-}y = 0.550$, $3.2\text{cd}/\text{A}$

7b()

nm	OLED	4mTorr	Ar	DC	Ag	Ag	72
1nm	CF _x (가)	RF		CHF ₃			
6 Torr							
(1) N,N'- (- 1 -)-N,N'-		-	(NPB)	45nm	,		
(2) (8-)		(III)(Alq)	65nm		()
(3) Li	1nm	,					
(4) Ag	22.5nm	,					
(5) Alq	85nm	,					

/Ag(72)/CF_x(1)/NPB(45)/Alq(65)/Li(1)/Ag(22.5)/Alq(85)

20mA/cm² 7.0V 9.3cd/A, FWHM
 36nm , CIE-x = 0.351, CIE-y = 0.626 20mA/cm² 5 b
 . 7a , , , , , FW
 HM

, 1 6
2.8
2.57 FWHM CIE

8a(OLED -)

OLED
68 / , ITO
CHF₃ 10⁻⁶ Torr 가 (heated boat)
(1) N,N'- (-1-)-N,N'- (NPB) 65nm
(2) 1.5% 4-(-p-)-4'-[(-p-)] 2-(t-)-9,10- -(2-
) (TBADN) 20nm ,
(3) (8-) (III)(Alq) 35nm
(4) Li 1nm ,
(5) Ag 50nm

/ITO(42)/CF_x(1)/NPB(65)/TBADN:1.5% 4-(-p-)-4'-[(-p-)]] (20)/Alq(35)/Li(1)/Ag(50)

, FWHM 20mA/cm² 64nm , 6.6V CIE-x = 0.16, CIE-y = 0.24 , 20mA/cm² 4.72cd/A
6 a

8b()

OLED 93nm 4mTorr Ar DC 10⁻⁶ Torr Ag 가
(1) MoO₃ , 2nm MoO_x() ,
(2) N,N'- (-1-)-N,N'- (NPB) 160nm ,
(3) 1.5% 4-(-p-)-4'-[(-p-)] 2-(t-)-9,10- -(2-
) (TBADN) 20nm ,
(4) (8-) (III)(Alq) 30nm ,
(5) Li 1nm ,
(6) Ag 16nm ,
(7) Alq 72nm

/Ag(93)/MoO_x(2)/NPB(160)/TBADN:1.5% 4-(-p-)-4'-[(-p-)]] (20)/Alq(30)/Li(1)/Ag(16)/Alq(72)

6b FWHM 20mA/cm² 6.5V CIE-x = 0.119, CIE-y = 0.130 20mA/cm² 3.93cd/A
 b 24nm , , 8a , , , ,
 , , , , 4.72cd/A 3.93cd/A
 , , , , 가 4 가
 , , , , , , , ,

9a(OLED -)

68 / OLED ITO ITO 1mm , ITO RF
 . , ITO ITO 1mm CF_x()
 CHF₃ 10⁻⁶ Torr 가
 (1) MoO₃ , 3nm MoO_x()
 (2) N,N'- (- 1 -)-N,N'- (NPB) 75nm
 (3) 0.6% N,N- (DPQA) (8-) (III)(Alq)
 37.5nm ,
 (4) (8-) (III)(Alq) 37.5nm
 (5) Li 1nm
 (6) Ag 50nm

/ITO(42)/CF_x(1)/MoO_x(3)/NPB(75)/Alq:0.6%DPQA(37.5)/Alq(37.5)/Li(1)/Ag(50)

7 FWHM 20mA/cm² 9.6V CIE-x = 0.31, CIE-y = 0.65 20mA/cm² 13.5cd/A
 a 28nm , , , , , ,

9b()

93nm OLED 4mTorr Ar DC Ag
 . , , 10⁻⁶ Torr 가
 (1) MoO₃ , MoO_x() 3nm
 (2) N,N'- (- 1 -)-N,N'- (NPB) 190nm
 (3) 0.6% N,N- (DPQA) (8-) (III)(Alq)
 37.5nm ,
 (4) (8-) (III)(Alq) 40nm
 (5) Li 0.5nm
 (6) Ag 22.5nm
 (7) Alq 85nm

/Ag(93)/MoO_x (3)//NPB(190)/Alq:0.6%DPQA(20)/Alq(40)/Li(0.5)/Ag(22.5)/Alq(85)

7b (a) OLED
20mA/cm² 8.1V
FWHM 16nm CIE-x = 0.18, CIE-y = 0.77 20mA/cm²
b, FWHM
9a
24.6cd/A

10a(OLED -)

68 / OLED ITO ITO 1mm
ITO, ITO 42nm, ITO RF
CHF₃ ITO 1nm CF_x ()
10⁻⁶ Torr
가
(1) N,N'- (- 1 -)-N,N'- (NPB) 65nm
(2) 5.0% -1H,5H- 1.8% [ij] -9- [2-(1,1-)-4H- -4-)-6-[2-(2,3,6,7-](DCJTB) -1,1,7,7-
35nm
(3) (8-) (III)(Alq) 35nm
(4) Li 1nm
(5) Ag 50nm

/ITO(42)/CF_x (1)/NPB(65)/Alq(50%)TBADN(50%):5.0% + 1.8%DCJTB(20)/Alq(35)/Li(1)/Ag(50)

7 (a) OLED 20mA/cm² 7.9V
FWHM 84nm CIE-x = 0.63, CIE-y = 0.37 20mA/cm²
93nm
3.1cd/A

10b()

93nm OLED 4mTorr Ar DC Ag
10⁻⁶ Torr
가
(1) MoO₃, MoO_x () 2nm
(2) N,N'- (- 1 -)-N,N'- (NPB) 40nm
(3) 5.0% -1H,5H- 1.8% [ij] -9- [2-(1,1-)-4H- -4-)-6-[2-(2,3,6,7-](DCJTB) -1,1,7,7-
35nm
(4) (8-) (III)(Alq) 68nm
(5) Li 1nm
(6) Ag 22.5nm

(7) Alq 85nm

/Ag(93)/MoO_x(2)//NPB(40)/Alq(50%)/TBADN(50%):5.0% + 1.8%DCJTB(20)/Alq(68)/Li(1)/Ag(22.5)/
Alq(85)

8b, FWHM 20mA/cm² 7.6V 13.7cd/A
b 44nm, CIE-x = 0.18, CIE-y = 0.77 20mA/cm²
가 FWHM 10a

가

가

(57)

1.

2

(a)

(b)

(c)

가 EL

EL

Ag, Au

Ag, Au, Al

2.

1

Ag

가 10 30nm

3.

1

4.

3

가

5.

4

1.6

6.

4

가 Al, Cu, , 50% Ag MgAg 가

7.

1

,

8.

6

,

가

9.

8

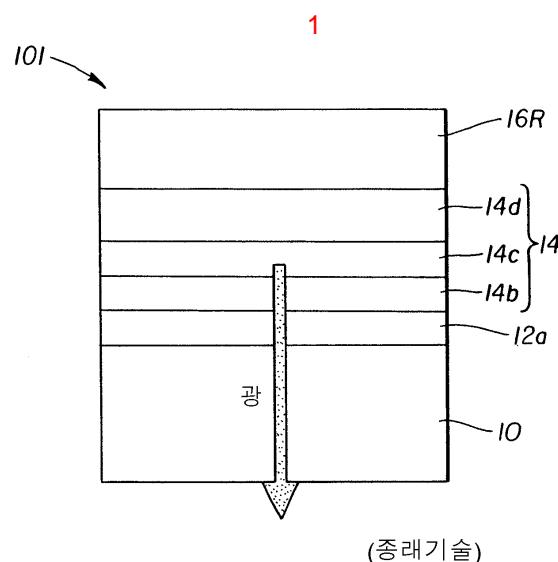
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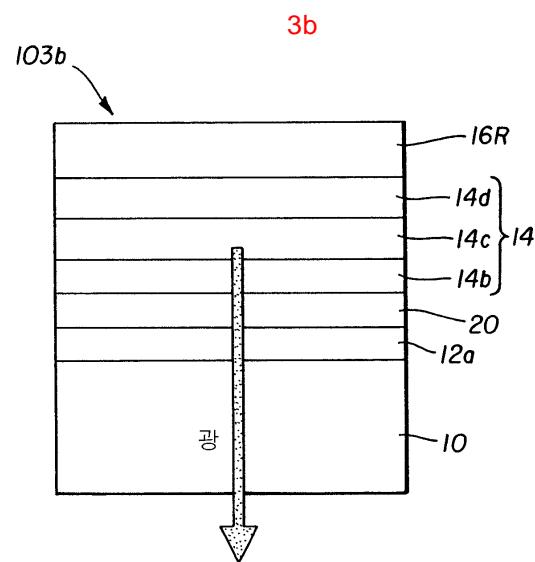
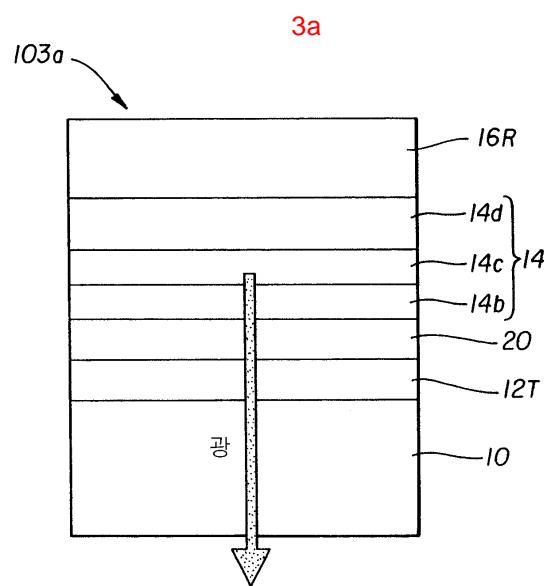
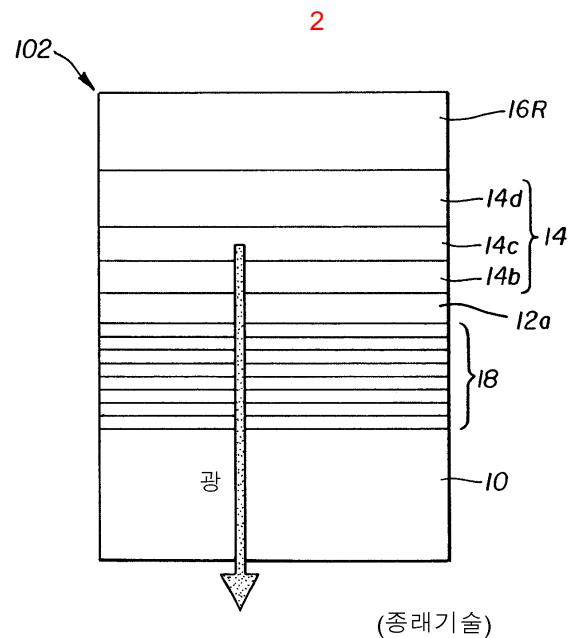
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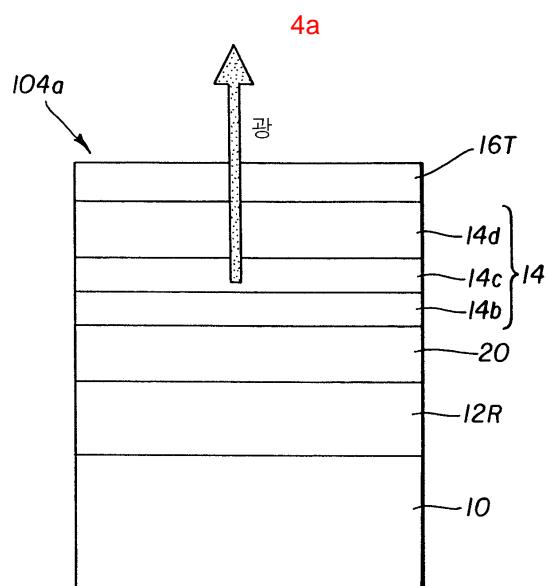
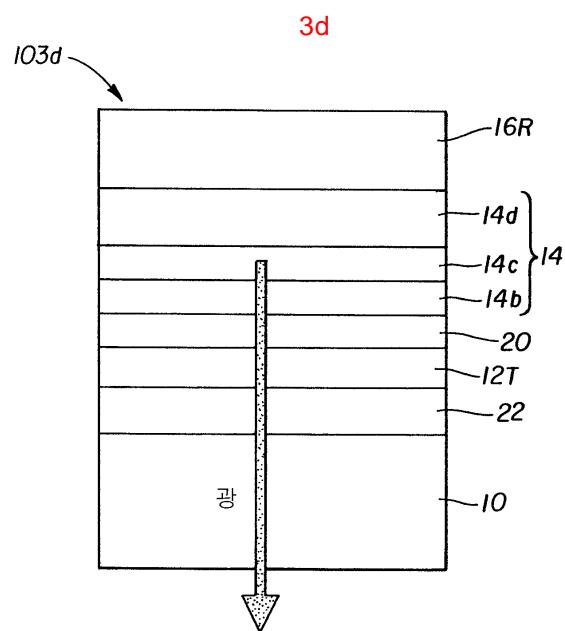
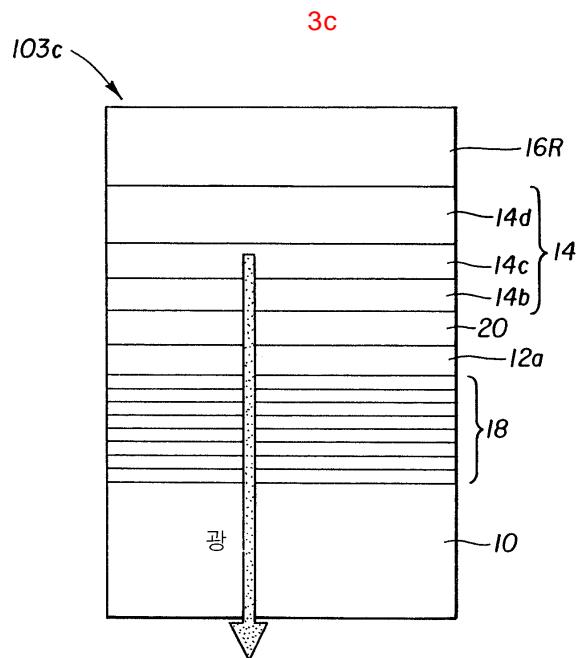
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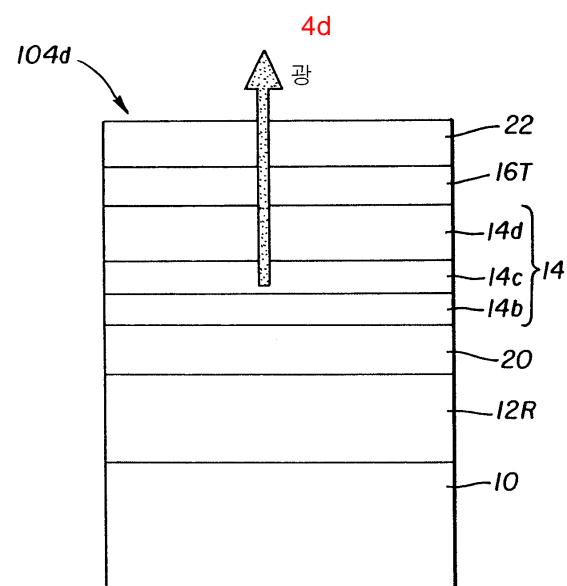
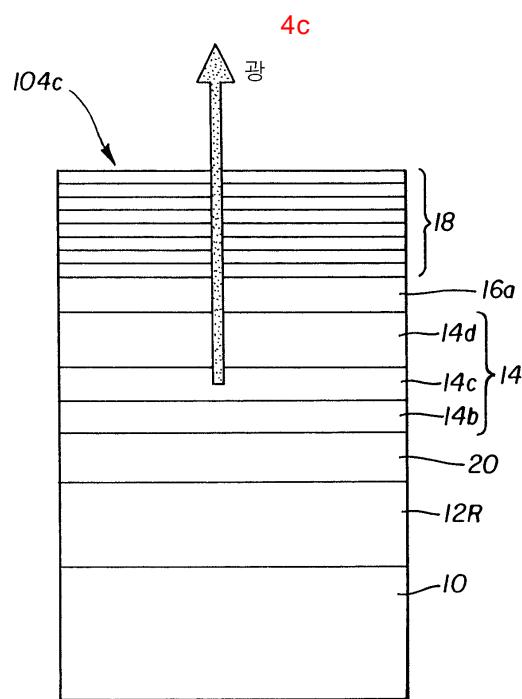
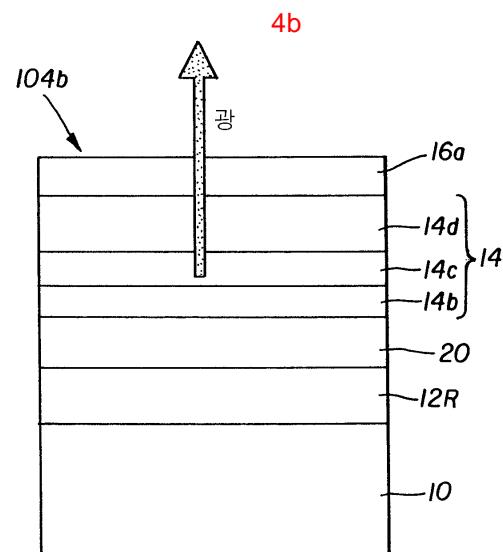
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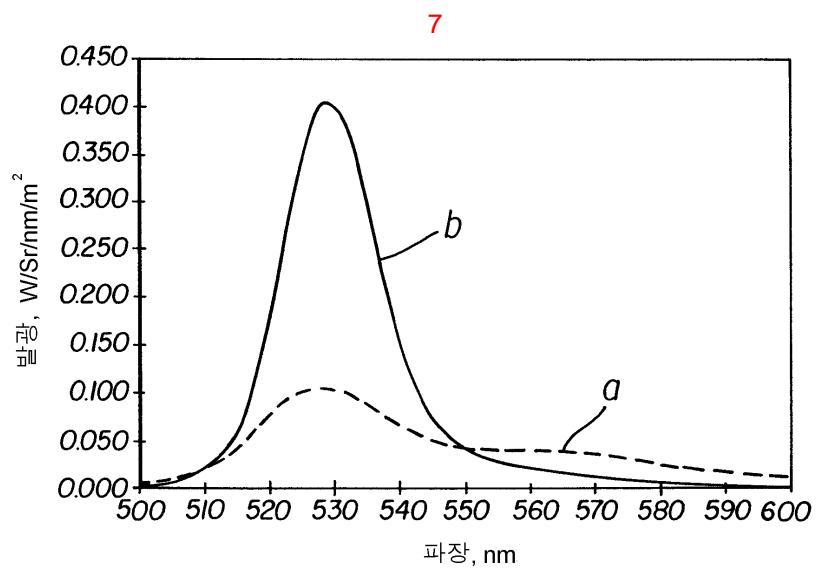
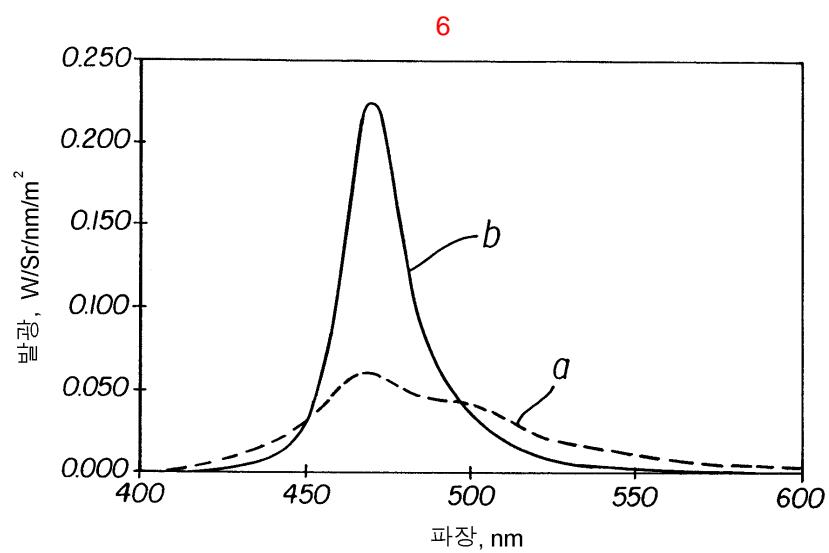
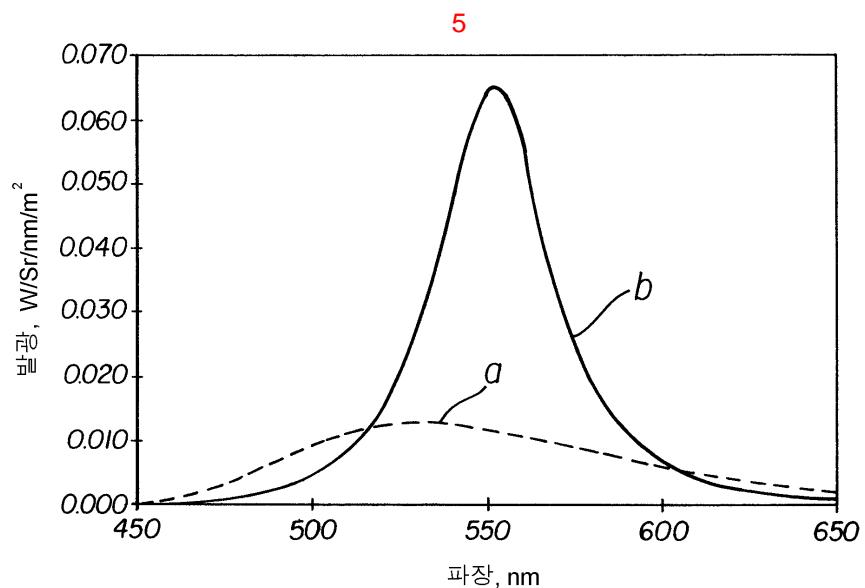
가 Al, Cu, , 50% Ag MgAg 가

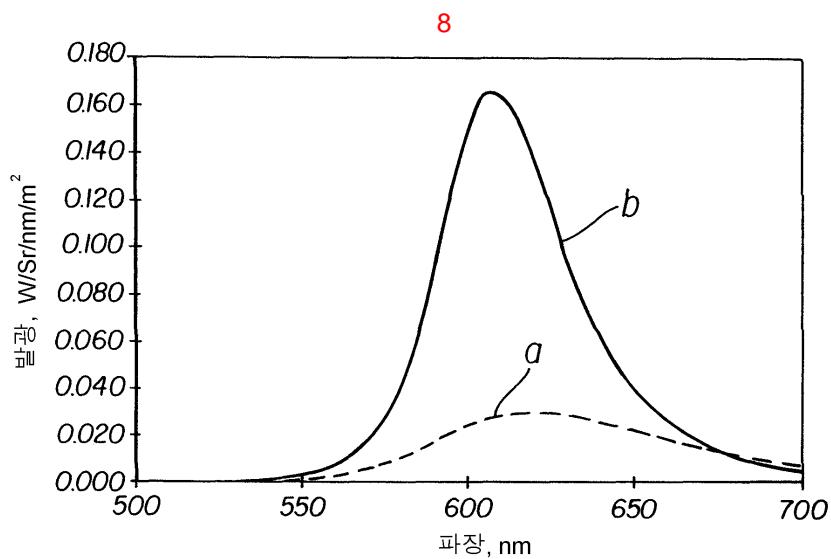












专利名称(译)	彩色OLED显示屏，改善了发光		
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申请(专利权)人(译)	柯达公司针		
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摘要(译)

本发明涉及一种彩色有机发光显示器，其中包括有机电致发光(EL)器件，金属上部电极层距金属底部电极层一定距离，半透明金属电极的材料和反射性金属是一种半透明的特殊材料;选择发光层在不透明金属电极层和电极的厚度之间的位置，以提高包括发光层的发光输出效率，其中发光层是不同的预定颜色的有机发光颜色显示器具有被分成不同颜色像素组的像素阵列，而不是它释放的相应的2;并且，阵列中的每个像素释放金属底部电极层：预定的彩色光，并且选择距金属底部电极层一定距离的金属上部电极层，以提高有机电致发光的发光输出效率显示包括在内。

