

2). 가 (R), (G) (B) OLED , R- PCT/US9 G - B 5/15790).

가 F - G - B OLE D(TOLED) PCT/US97/02681 , TOLED 71% 가 (1%) Mg - Ag - ITO ITO TOLED 2 Mg - Ag - ITO OLED (SOLED) 가 가

PCT/US95/15790 가 가 SOLED 가 가 , PCT/US95/15790

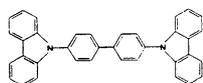
B.

가 가 OLED 3 hompson S.R.Forrest, () . (M.M. Baldo, D.F. O'Brien, M.E. T , Applied Physics Letters, 1999, 75, 4 - 6)

(C.H. Chen, J. Si, C.W. Tang, "Recent developments in molecular organic electroluminescent materials" *Macromolecular Symposia*, 1997, 125, 1 - 48; U. Brackmann, *Lambda Physik*, Gottingen, 1997), 100% (C.H. Chen, 1997, op. cit.)
 (M.A. Baldo, "Nature", 1998, 395, 151 - 154; M.A. Baldo, M.E. Thompson, S.R. Forrest, "Nature", 1999).

40 LL'L" M(, L, L' L" 2 , M) 3 Zr Sb)
 MLCT
 , L, L' L" , L, L' L" 2 17가 , M
 sp² 3 Ir Pt ,
 L X 2 , L sp²) L₂MX (,
 , M (Ir) M

Ir) 2 L₂M(μ - Cl)₂ML₂ (, L 2 , M)
 X XH . XH
 L₂MX , 2 - N - , H 가 .
 L, L X M
 L₂MX , OLED
 4,4' - N,N' - (CBP) (12 %) L=(2 -
), X= , M=Ir(BTlr) 12%
 , CBP :



L₂MX 가 L 가 , L₂MX가
 L = -6 .
 L X .
 L X L₂M L₂MX , Ir(ppy)₃ (ppy)₂
 Ir(acac) 510nm max (ppy , 15nm) . , X
 가 가 .

, X L₃M
X (L) HOMO 가 ()

가

2가

1

(D.L. Dexter, " , J. Chem. Phys., 1953, 21, 836 - 850),

(E. Wigner E.W. Wittner, Über die Struktur

der zweiatomigen Molekelspektren nach der Quantenmechanik, Zeitschrift für Physik, 1928, 51, 859 - 886

; M. Klessinger J. Michl, Excited states and photochemistry of organic molecules, VCH , , 19

95). (1) 가 2

(T. Forster, Zwischenmolekulare Energiewanderung and Fluoreszenz Annalen der Physik, 1948, 2, 55 - 75

; T. Forster, Fluoreszenz organischer Verbindungen, Vandenhoeck and Ruprecht, Göttingen, 1951), (

1) 가

가

(F Wilkinson, in Advances in Photochemistry(W.A. Noyes, G. Hammond J.N. Pitts, 241 - 268 , John Wiley & Sons, , 1964), 가

(T. Forster, " Transfer mechanisms of electronic excitation" , Discussions of the Faraday Society, 1959, 27, 7 - 17)가 , 77K 90K

(V.L. Ermolaev

E.B. Sveshnikova, " Inductive - resonance transfer of energy from aromatic molecules in the triplet state" , Doklady Akademii Nauk SSSR, 1963, 149, 1295 - 1298)가

52

가

1

(2 -) (Ir(ppy)₃; M.A. Baldo , Appl. Phys. Lett., 1999, 75, 4 - 6) [2 -

- 6 - [2 - (2,3,4,6 - - 1H,5H - [i,j] - 9 -)] - 4H -] -

] (" DCM2" ; C.W. Tang, S.V. VanSlyke C.H. Chen, " Electroluminescence of doped organic films" J. Appl. Phys., 1989, 65, 3610 - 3616) DCM2 (

V. Bulovic , " Bright, saturated, red - to - yellow organic light - emitting devices based on polarization - induced spectral shifts" Chem. Phys. Lett., 1998, 287, 455 - 460), =570nm =650nm

가

가 , 가

가

, OLED

" (HTL)

" (ETL)
가 ()

가

(Frenkel)
(photoemissive mechanism)

가

가 ()

, OLED

가

가

() ()

();
가 200
> 1400) 가

(,

() (EL)

3 75%

C.

가

OLED

가

OLED

OLED

가

OLED

가

(LU

MO)

(HOMO)

(" ")

1. LUMO HOMO

2.

3. (IP)

()

4. LUMO LUMO 가 50%

5. 가

, E H ,
(가 " ")
" " .)

- , ()
:

1. LUMO HOMO

2. .

3. LUMO (-) LUMO . ()

4. 가 50% ,

5. 가

(가 " ")
" " .)

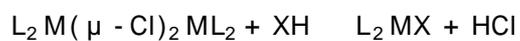
D. , OLED 가 , OLED SOLED , 3가

- OLED

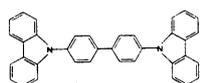
1996 12 23 US08/774,333 ()
OLED

, 40 M , M 3 2
Sb , , 2 ,
3 , 가 Ir Pt .
LL'L" M , L, L' L"
2 , M 가 40 .

$L_2M(\mu-Cl)_2ML_2 + XH \rightarrow L_2MX + HCl$
 , $L_2M(\mu-Cl)_2ML_2$ 2 L Ir M ;
 XH , 2- $N-$ X , XH
 XH , L_2MX 2 L, L X 가 M
 $L_2M(\mu-Cl)_2ML_2$, L X 2
 L_2MX L_2IrX , M 2
 L M .



$L_2M(\mu-Cl)_2ML_2$ 2 L Ir M ;
 XH , 2- $N-$ X , XH
 XH , L_2MX 2 L, L X 가 M
 $L_2M(\mu-Cl)_2ML_2$, L X 2
 L_2MX , OL
 $ED =$, $M=Ir(BTIr)$ (12 %) , $L=(2-$, X
 (CBP) : 12% , 4,4'-N,N'-

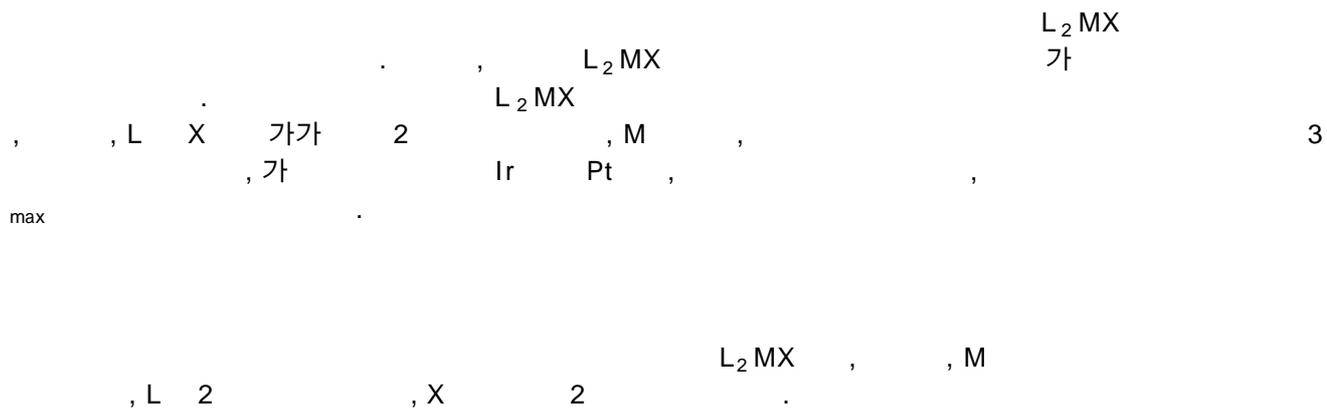


L_2MX , L , L_2MX 가
 $L =$ -6 .
 L_2M L_2MX L X
 $Ir(ppy)_3$ (ppy) $_2Ir(acac)$ 510nm max (ppy
 $)$, X 가 , 15nm
 L_3M HOMO 가 ()
 X (L) (X) ,
 () () .

1. PPIr $L_2 IrX$ acac X , O - O 4가 N - O
2. $L_3 M$
3. mer : mer - Ir(ppy)₃ mer - Ir(bq)₃ . PPY(ppy) BQ(bq) 7.8 -
4. mer - Ir(ppy)₃ (ppy)₂ Ir(acac)
5. (a) CBP " BTIr" 12 % (b) BTIr (2 -
- 6.
7. Ir(3 - MeOppy)₃
8. tpyIrsd
9. tpyIrsd(=tpyIrsd) NMR
10. thpyIrsd
11. thpyIrsd NMR
12. btIrsd
13. btIrsd NMR.
14. BQIr
15. BQIr NMR.
16. BQIrFA
17. THIr(=thpy; THPIr)
18. THPIr NMR
19. PPIr
20. PPIr NMR
21. BTHPIr(=BTPIr)
22. tpyIr

- 23. tpyIr .
- 24. C6 .
- 25. C6Ir .
- 26. PZIrP .
- 27. BONIr .
- 28. BONIr NMR.
- 29. BTIr .
- 30. BTIr NMR.
- 31. BOIr .
- 32. BOIr NMR.
- 33. BTIrQ .
- 34. BTIrQ NMR.
- 35. BTIrP .
- 36. BOIrP .
- 37. btlr .
- 38. mer - IRbq NMR.
- 39. L2MX L X
- 40. LL 'L" M

A.



L 2-(1-) , (2-) , (2-) , (2-) , (7,8-) , () , , , 3- -2- ,

X (" acac") , , , 8-

L X 가 39 , L X Comprehensive Coordination Chemistry, 2 , G. Wilkinson() , Pergamon Press, 20.1 (715) M. Calligaris L. Ra ndaccio 20.4 (793) R.S. Vagg .

L_2MX

L_2MX :

$L_2M(\mu - Cl)_2ML_2 + XH \rightarrow L_2MX + HCl$

, $L_2M(\mu - Cl)_2ML_2$ 2 L Ir M ;

XH 2 X , XH

L, L X가 M .

$L_2Ir(\mu - Cl)_2IrL_2$ $IrCl_3 \cdot nH_2O$ (S. Sprouse, K.A. King, P.J. Spellane, R.J. Watts, J. Am. Chem. Soc., 1984, 106, 6647 - 6653; : G.A. Carlson , Inorg. Chem., 1993, 32, 4483; B. Schmid , Inorg. Chem., 1993, 33, 9; F. Garces ; Inorg. Chem., 1988, 28, 3464; M.G. Colombo , Inorg. Chem., 1993, 32, 3088; A. Mamo , Inorg. Chem., 1997, 36, 5947; S. Serroni , J. Am. Chem. Soc., 1994, 116, 9086; A.P. Wilde , J. Phys. Chem., 1991, 95, 629; J. H. van Diemen , Inorg. Chem., 1992, 31, 3518; M.G. Colombo , Inorg. Chem., 1994, 33, 545)

$Ir(3 - MeOppy)_3 \cdot Ir(acac)_3$ 0.57g(1.17) 3- -2- 1.3g(7.02) 30m
 N_2 24 200 가 . 1M HCl 가 .
 CH_2Cl_2 0.35g
 (40%) . MS(EI): m/z() 745(M^+ , 100), 561(30), 372(35). 7 .

tpylrsd. (tpylrCl)₂ 0.07g(0.06) , 0.022g(0.16) $Na_2CO_3 \cdot O.O$
 2g(0.09) 1,2- 10ml 2ml . N_2 6
 TLC 가 . CH_2Cl_2 , .
 CH_2Cl_2
 0.07g(85%) . MS(EI): m/z() 663(M^+ , 75), 529(100), 332(35).
 8 , NMR 9 .

thpylrsd. (thpylCl)₂ 0.21g(0.19) (tpylrCl)₂
 : 0.21g(84%). MS(EI): m/z() 647(M^+ , 100), 513(30), 486(15), 434(20), 324(25).
 10 , NMR 11 .

btIrsd. (btIrCl)₂ 0.05g(0.039) (tpyIrCl)₂ .
: 0.05g(86%). MS(EI): m/z() 747(M⁺, 100), 613(100), 476(30), 374(25), 286(32).
12 , NMR 13

Ir(bq)₂ (acac), BQIr. (Ir(bq)₂Cl)₂ 0.091g(0.078), 0.021g
0.083g 2- 10ml N₂ 10
TLC : (91%).¹H NMR(360
MHz, -d₆), ppm: 8.93(d,2H), 8.47(d,2H), 7.78(m,4H), 7.15(d,2H), 6.87(d,2H), 6.21(d,2H), 5.70(
s,1H), 1.63(s,6H), MS, e/z: 648(M⁺, 80%), 549(100%). 14 , NMR
15

Ir(bq)₂ (Facac), BQIrFA. (Ir(bq)₂Cl)₂ 0.091g(0.078),
0.025g 0.083g 2- 10ml N₂ 10
TLC : (69%).
¹H NMR(360MHz, -d₆), ppm: 8.99(d,2H), 8.55(d,2H), 7.86(m,4H), 7.30(d,2H), 7.14(d,2H), 6.97(
d,2H), 6.13(d,2H), 5.75(s,1H) MS, e/z: 684(M⁺, 59%), 549(100%). 16

Ir(thpy)₂ (acac), THPIr. (Ir(thpy)₂Cl)₂ 0.082g(0.078), 0.025g
0.083g 2- 10ml N₂ 10
TLC : (80%).¹H NMR
(360MHz, -d₆), ppm: 8.34(d,2H), 7.79(m,2H), 7.58(d,2H), 7.21(d,2H), 7.15(d,2H), 6.07(d,2H), 5.
28(s,1H), 1.70(s,6H). MS, e/z: 612(M⁺, 89%), 513(100%). 17(" THIr") ,
NMR 18

Ir(ppy)₂ (acac), PPIr. (Ir(ppy)₂Cl)₂ 0.080g(0.078), 0.025g
0.083g 2- 10ml N₂ 10
TLC : (87%).¹H NMR(360
MHz, -d₆), ppm: 8.54(d,2H), 8.06(d,2H), 7.92(m,2H), 7.81(d,2H), 7.35(d,2H), 6.78(m,2H), 6.69(
m,2H), 6.20(d,2H), 5.12(s,1H), 1.62(s,6H). MS, e/z: 600(M⁺, 75%), 501(100%). 19
NMR 20

Ir(bthpy)₂ (acac), BTPIr. (Ir(bthpy)₂Cl)₂ 0.103g(0.078), 0.025g
0.083g 2- 10ml N₂ 10
TLC : (49%). MS, e/z
: 712(M⁺, 66%), 613(100%). 21

(Ir(ppy)₂Cl)₂: 2- 30ml IrCl₃ · xH₂O 1.506g(5.030) 2- (p-) 3.509g(
20.74) 25 , 1.
0M HCl 20ml 가 1.0M HCl 100ml 50ml ,
1.850g(65%)

(Ir(ppz)₂Cl)₂: 2- 30ml IrCl₃ · xH₂O 1.904g(3.027) 1- 1.725g(11.96
) 21 , 1.0M
HCl 20ml 가 1.0M HCl 100ml 50ml ,
1.133g(73%)

(Ir(C6)₂Cl)₂: 2 - 15ml IrCl₃ · x H₂O 0.075g(0.251) C6 [3 - (2 -
) - 7 - ()]() 0.350g(1.00) 22
 1.0M HCl 20ml 가 . 1.0M HCl 100m
 l 50ml . 0.0657g(28%)

Ir(ppy)₂acac(tpyIr): 1,2 - 60ml [Ir(ppy)₂Cl]₂ 1.705g(1,511), 2,4 - 3.013
 g(30.08) 1.802g(17.04) 40
 CH₂Cl₂ 50ml
 1.696g(89%) . 22 . x -
 23 . tpy(" ") . x -
 , 4663 , R 5.4% .

Ir(C6)₂acac(C6Ir): 2,4 - 2 Na₂CO₃ CDCl₃ [Ir(C6)₂Cl]₂ 가 . 2,
 50 48 가 . C6 24 , C6Ir
 4 - 25 .

Ir(ppz)₂ (PZIr): CH₂Cl₂ 15ml [Ir(ppz)₂Cl]₂ 0.0545g (0.0530) 0.0525g(
 0.426) 16
 10ml
 CH₂Cl₂
 0.0075g(12%) . 26

2 - (1 -) , (BZO - Naph). 2 - 11.06g(101) 1 - 15.
 867g(92.2) 가 가 240 N₂ 8 . 100
 , 가 . 10% Na₂CO₃
 . BP 140 /0.3mmHg. 4.8g(21%).

(2 - (1 -)) C², (N') (μ -) . ((Ir₂(BZONaph)₄Cl)₂).
 0.388g 2 - (1 -) 1.2g(4.88) , 2 - 30ml 2
 4 4 / . 0.66g.

(2 - (1 -)) , Ir(BZO - Naph)₂(acac), (BONIr). (Ir
 2 (BZO - Naph)₄Cl)₂ 0.66g(0.46) , 0.185g 0.2g 20ml
 . N₂ 60
 4 / / (1:1)
 . SP 250 /2x10⁻⁵ torr. 0.57g(80%).
 27 , NMR 28

(2 -) (BTIr): 2,4 - 9.8 (0,98g, 1.0ml) 2 -
 120ml 2 - 2.1 (2.7g) 가 가 . 1g
 가 , 가 .
 가 . 75% . 29 , NMR
 30 .

(2-) acac(BOIr): 2,4- 9.8 (0,98g, 1.0ml) 2- 120ml
 2- 2.4 (3.0g) 가 1g
 가 , (16) 가 .
 . 60% 31 , NMR 가
 32 .

(2-) (8-) (BTIrQ): 8- 4.7 (0,98g) 2-
 20ml 2- 가 , 0.14 (0.19g) 가 .
 700mg 가 , (23) 가 .
 가 . 57% 33 ,
 NMR 34 .

(2-) (BTIrP): 2.14 (0.26g) 60ml 2-
 5 가 0.80 (1.0g) 가 . 8.
 가 . 가 , 900mg
 . 35 .

(2-) (BOIrP): 0.52 (0.064g) 20ml 2-
 - (17.5) 가 0.14 (0.18g) 가 .
 . , , . 36 .
 btIr L' 37 .

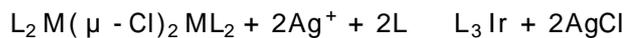
IrL₃ , 가 PtL₃
 Ir(acac)₃

3L + Ir(acac)₃ L₃Ir + acacH

30% , L=2- , 2- . Ir
 L₂M(μ-Cl)₂ML₂

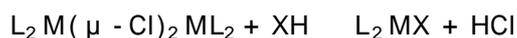
4L + IrCl₃ · H₂O L₂M(μ-Cl)₂ML₂ + 4HCl

가 10% Ir ,
 IrL_3 .



) . 가 (,

:



M= (" μsec ") 1 - 3
 Solid State Physics). (Charles Kittel, Introduction to (" MLCT") .

(M=Ir) , L MLCT (2) , X 2 L₂MX ,
 , L , Ir) . (, L₂IrX , L=2- X=acac, (, 8-) .

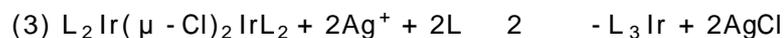
L₂IrX L₃Ir OLED L₃Ir
 . 2가 2 .
 L₃Ir 1() L Ir(acac)₃ L₃Ir 2+3() .
 3 L₃Ir Ir(acac)₃ 가 (Ag⁺) , L₃Ir
 가 . 2가 mer - Irppy mer - Irbq (3) ,
 L₃Ir 가 가



30%, L=2- , , 2- .

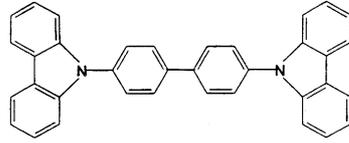


> 90%, L . (1) 가



[.] 가

가 4,4' - N,N' - (CBP) ,



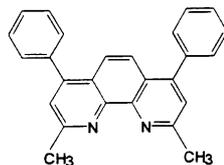
가 ITO() . 12% , (" HTL")
 0) NPD . NPD , HTL 30nm(30
 12 % CBP ; , (2-) (" BTIr")
 BCP") , 30nm(300) (")
 nm Alq₃ , 20nm(200) . 20
 100nm . 5X10⁻⁵ Torr Mg - Ag .

MgAg Alq 가 , ITO NPD NPD ,
 CBP , Alq BCP , BTIr , EML ,
 , 가 , BTIr

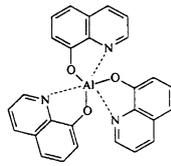
5 , 0.01mA/cm² 12% .

ITO . ITO 10¹⁹ /cm³ . ITO . BCP . Alq₃:
 , TPD, .

BCP 2,9 - -4,7 - -1,10 - , 10nm(100) . BCP



/ Alq³ :



Ir L 가 , L₂MX(, M=Ir)
 Ir L 가
 (, L L₂MX(M=Ir)).

L₂IrX(, L - X=acac) - 6[" C6Ir"]
 C6Ir

5 가 6 () Ir 5
 가 , 가 sp² L , N

X L

OLED

가

()

) 6 200 - 300mV HOMO 가 Ir (MLCT

Ir() Ir(X) L₂Ir

IrL₃ L MLCT (, IrL₃) L₂IrX , Ir(ppy)₃ (ppy)₂Ir(acac)(=PPIr) 510nm max , Ir(BQ)₃ Ir(thpy)₃ L₂Ir(acac) , 2가 , X

Ir_{sd} BTIrpic -L 3가 (15nm) Acac L₂IrX acac BTIr, BT MLCT MLCT

" L₂Ir" 가 X 가 , X BTIRQ Q , 650nm (, IrQ₃ Pt Q₂) 650nm 0.01 < " IrX" . L₂IrQ " X" 가 . X " L" " X"

X ac X L₂IrX 가 L₂IrX - acac - ac 가 acac BQIrFA BQIr acac BQIrFA BQIr 가 2

CBP OLED OLED 가

OLED OLED , , , , OLED , , , ,

: " High Reliability, High Efficiency, Intefratable Organic Light Emitting Devieces and Methods of Producing Same," 08/774,119 (1996 12 23); " Novel Materials for Multicolor Light Emitting Diodes" , 08/850,264 (1997 5 2); " Electron Transporting and Light Emitting Layers Based on Organic Free Radicals" , 08/774,120 (1996 12 23)(1998 9 22 US5,811,833); " Multicolor Display Devices" , 08/772,333 (1996 12 23); " Red - Emitting Organic Light Emitting Devices(OLED)" , 08/774,087 (1996 12 23); " Driving Circuit For Stacked Organic Light Emitting Devices" , 08/792,050 (1997 2 3)(1998 5 26 US5,757,139); " High Efficiency Organic Light Emitting Device Structures" , 08/772,332 (1996 12 23)(1998 11 10 US5,834,893); " Vacuum Deposited, Non - Polymeric Felxible Organic Light Emitting Devices" , 08/789,319 (1997 1 23)(1998 12 1 US5,884,363); " Displays Having Mesa Pixel Configuration" , 08/794,595 (1997 2 3); " Stacked Organic Light Emitting Devices" , 08/792,046 (1997 2 3)(1999 6 29 US5,917,280); " High Contrast Transparent Organic Light Emitting Devices" , 08/792,046 (1997 2 3); " High Contrast Transparent Organic Light Emitting Device Display" , 08/821,380 (1997 3 20); " Organic Light Emitting Devices Containing A Metal Complex of 5 - Hydroxy - Quinoxaline as A Host Material" , 08/838,099 (1997 4 15)(1999 1 19 US5,861,219); " Light Emitting Devices Having High Brightness" , 08/844,353 (1997 4 18); " Organic Semiconductor Laser" , 08/859,468 (1997 5 19); " Saturated Full Color Stacked Organic Light Emitting Devices" , 08/858,994 (1997 5 20)(1999 8 3 US5,932,895); " Plasma Treatment of Conductive Layers" , PCT/US97/10252 (1997 6 12); " Novel Materials for Multicolor Light Emitting Diodes" , 08/814,976 (1997 3 11); " Novel Materials for Multicolor Light Emitting Diodes" , 08/771,815 (1996 12 23); " Patterning of Thin Films for the Fabrication of Organic Multi - color Displays" , PCT/US97/10289 (1997 6 12); " Double Heterostructure Infrared and Vertical Cavity Surface Emitting Organic Lasers" , PCT/US98/09480 (1998 5 8); 1999 2 23 US5,874,803 ; 1998 1 13 US5,707,745 ; 1997 12 30 US5,703,436 ; 1998 5 26 US5,757,026 ,

(57)

1.

L_2MX

(, L X 가가 2 ,

M)

max

2.

L_2MX

(, L X 가가 2 ,

M)

3.

1 , L 2 - (1 -) , (2 -) , (2 -) , (2 -) , (7 ,
8 -) , () , , , 3 - - 2 - , ,

X (" acac") , , , 8 -

4.

1 , M

5.

1 , M ,

L 2 - (1 -) , (2 -) , (2 -) , (2 -) , (7,8 -) ,
, () , , , 3 - - 2 - , ,

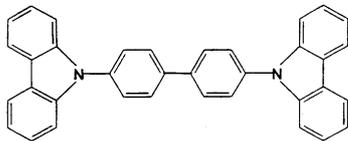
X (" acac") , , , 8 -

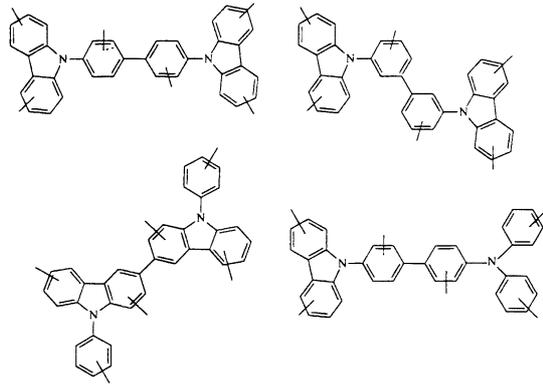
6.

1 , L , L₂MX .

7.

2 ,





(,)

8.

2 , L_2M

(, L sp^2 M 17가 2 ,

M ,

2 L)

9.

1 , , .

10.

1 , X .

11.

1 , X L_2MX L_3M max 가 15nm가 .

12.

1 , L_2MX $L_2M(\mu - Cl)_2ML_2$.

20.

15 , L L' 가 , sp³ M 1가 2 .

21.

19 , Ir(3 - MeOppy) ₃ , tpyIrsd, thphirsd, byirsd, BQIr, BQIrFA, THPIr, PPIr, BTPIr, tpyIr, C61 Ir, PZIr, BONIr, BTIr, BOIr, BTIrQ, BTIrP BOIrP .

22.

15 , L₂M

(, L sp² M 1가 2 ,

M ,

2 L)

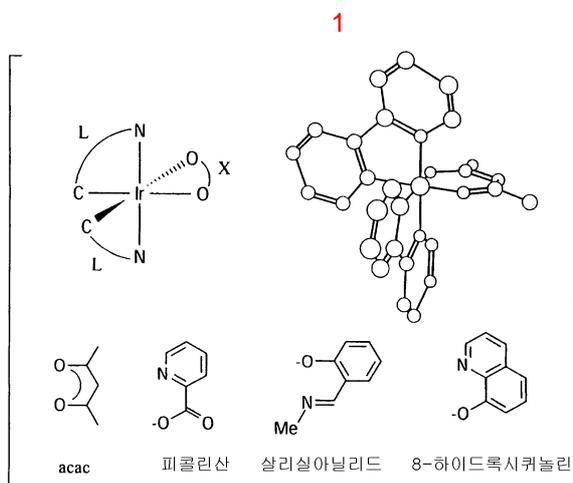
23.

L₂M(μ - Cl)₂ML₂
2)

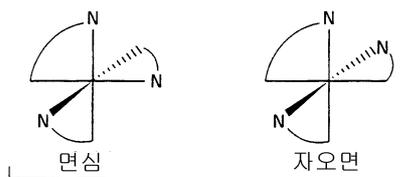
XH

, 19

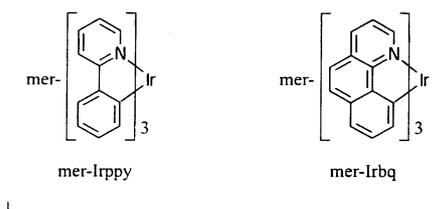
L₂MX(, L X 1가 .



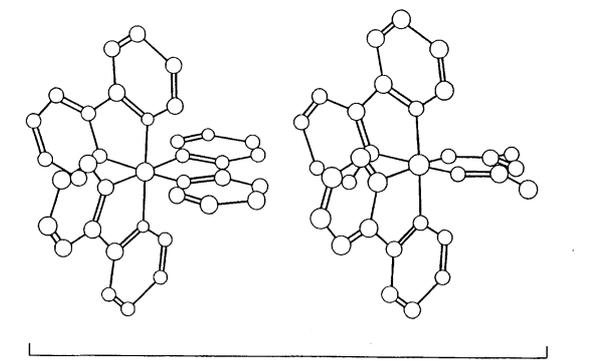
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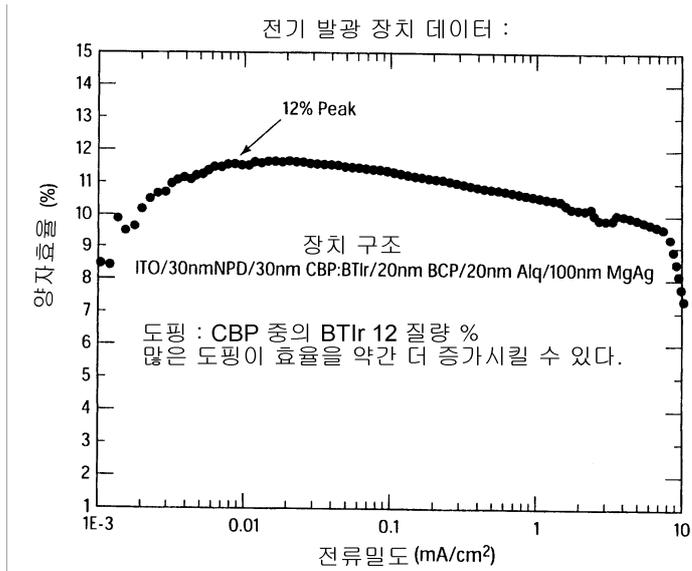
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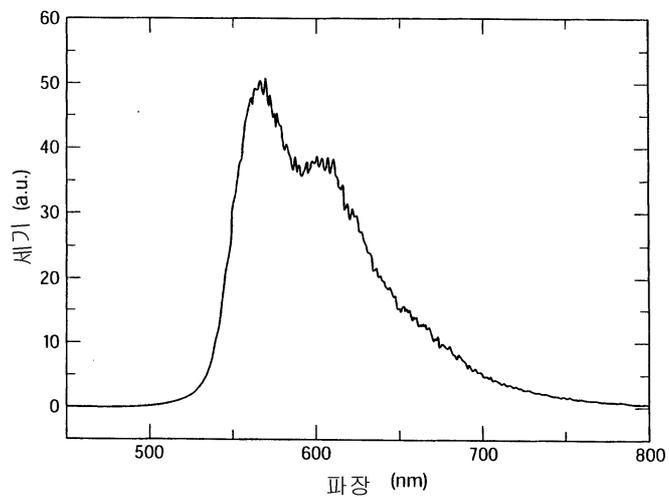
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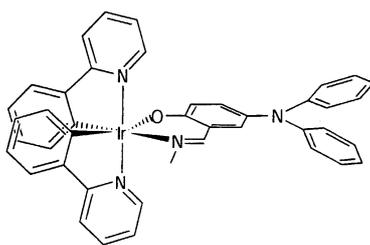
5A



5B

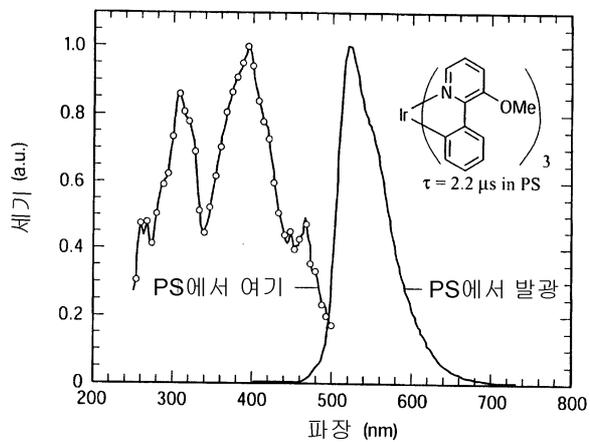


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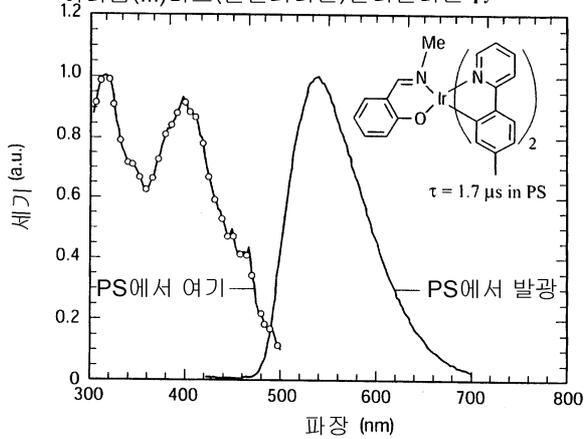
7

이리듐(III)트리스(3-메톡실-2-페닐피리딘)Ir(3-MeOppy)₃

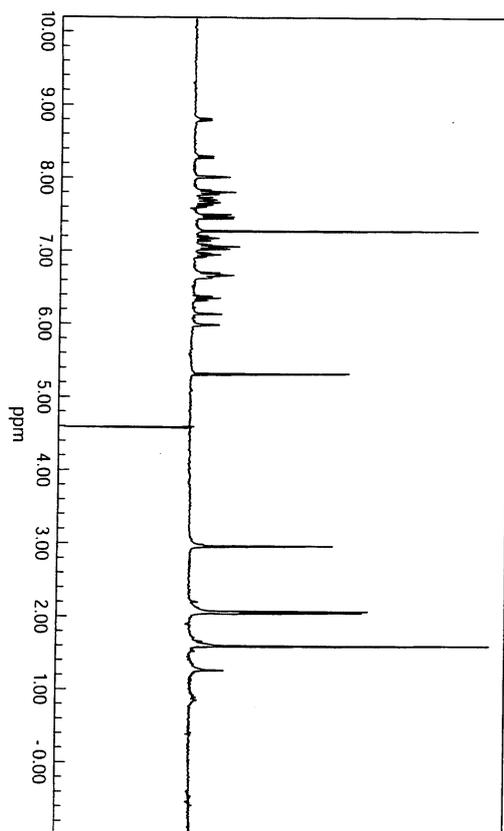


8

이리듐(III)비스(톨릴피리딘)살리실리덴 (tpylrsd)

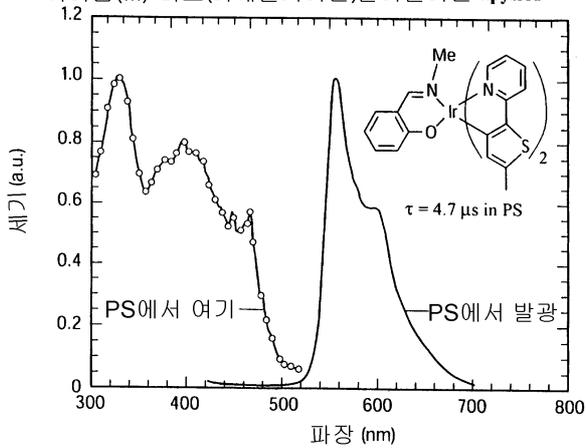


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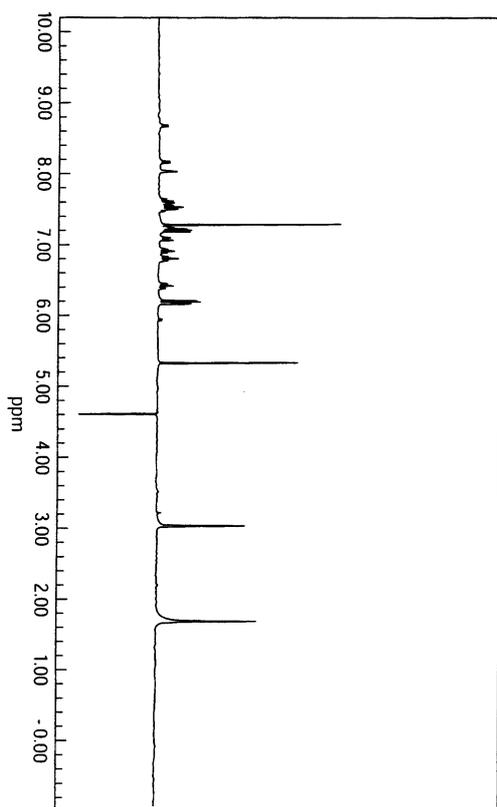


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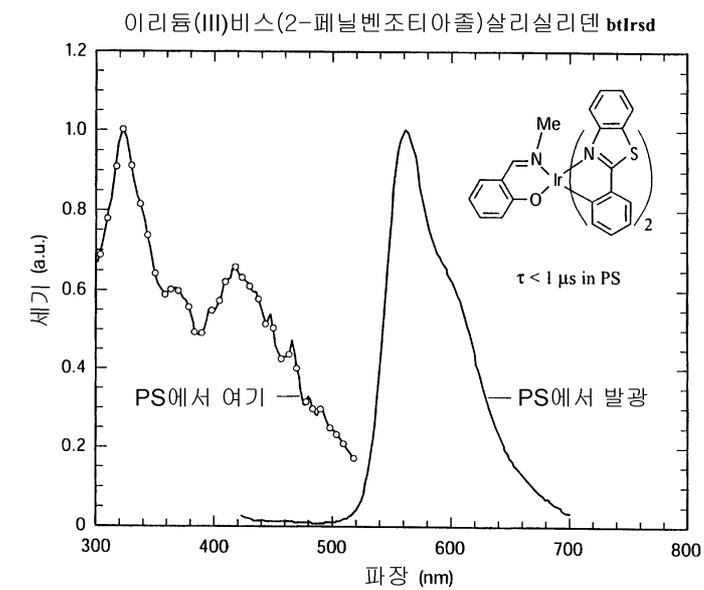
이리듐(III) 비스(티에닐피리딘)살리실리덴 **thpyIrsd**



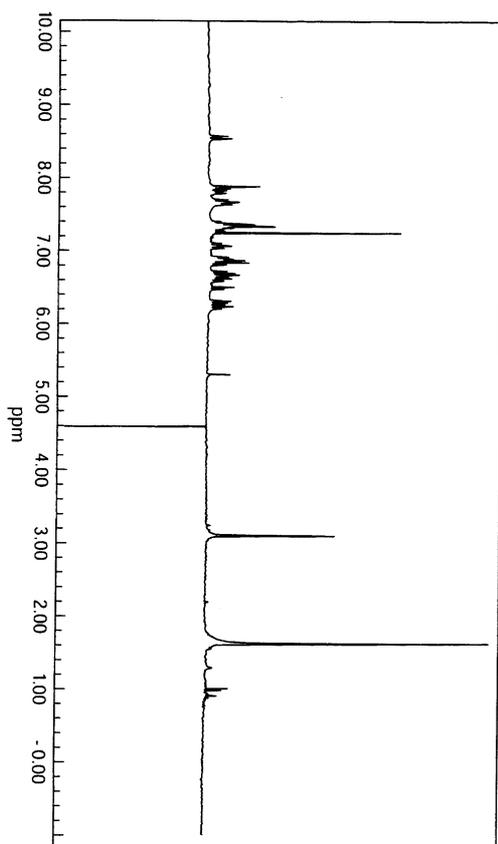
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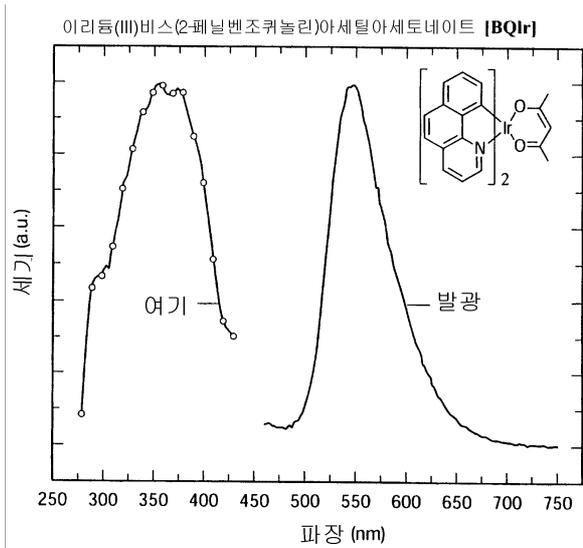
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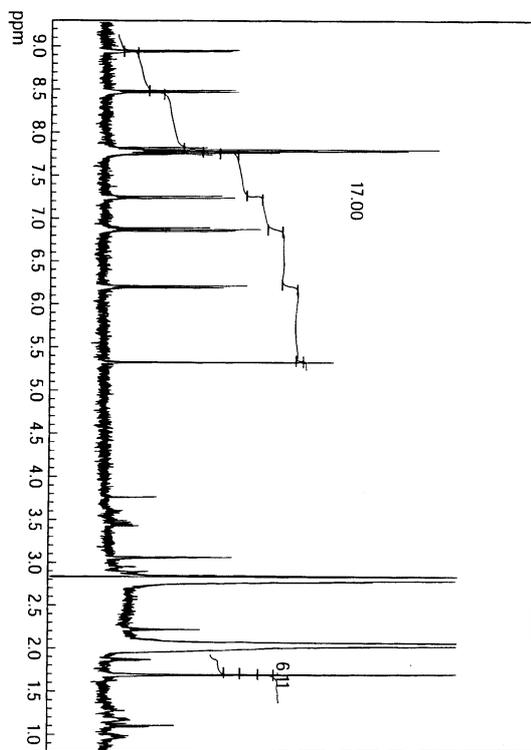
13



14

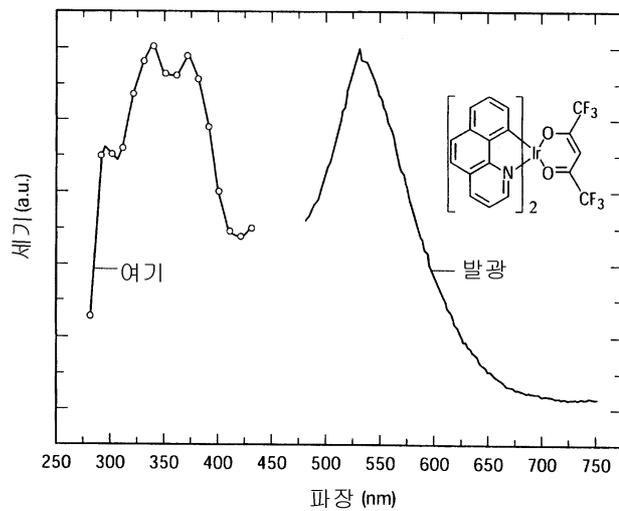


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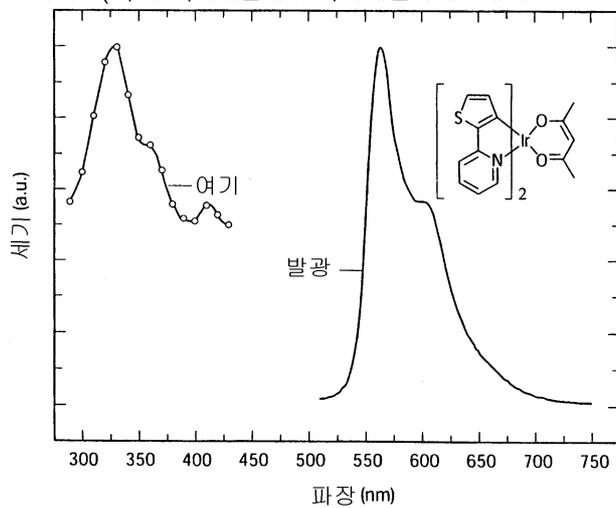
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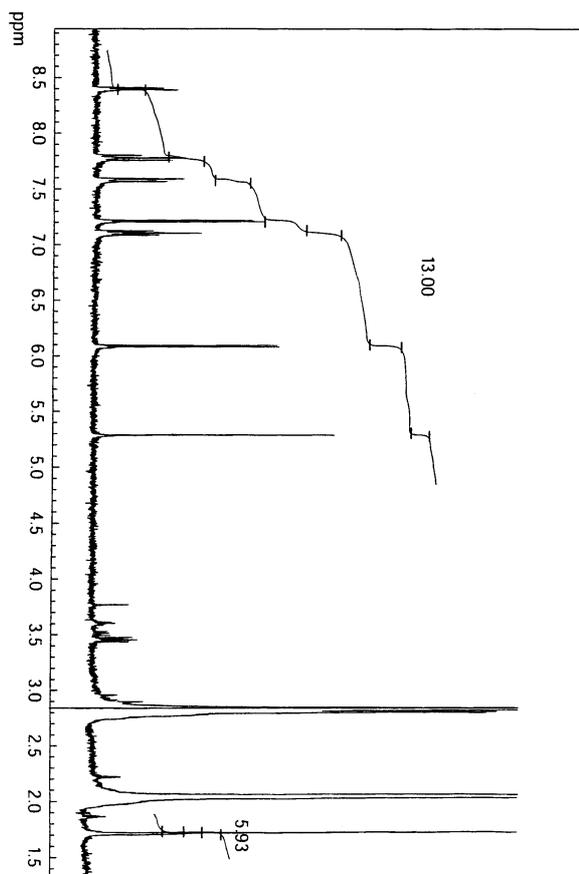
이리듐(III) 비스(7,8-벤조퀴놀린)헥사플루오로아세틸아세토네이트 [BQIrFA]



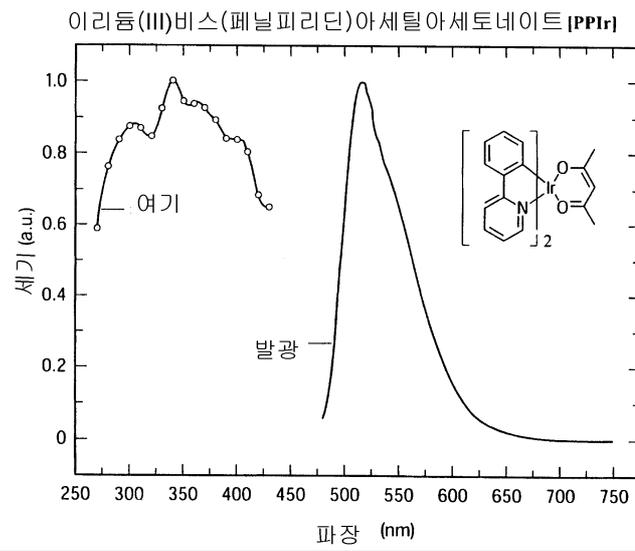
17

이리듐(III)비스(티에닐페리딘)아세틸아세토네이트 [THIr]

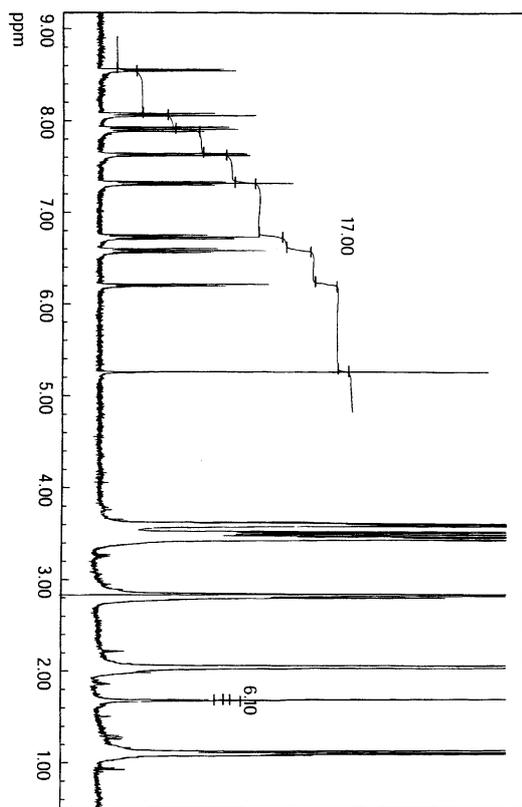




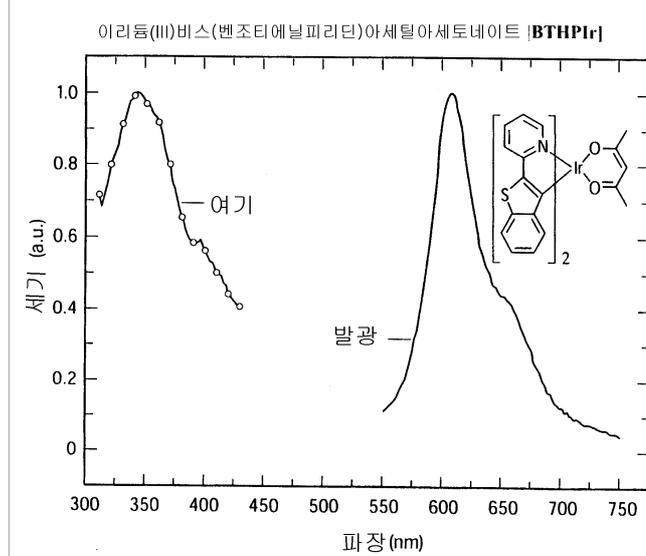
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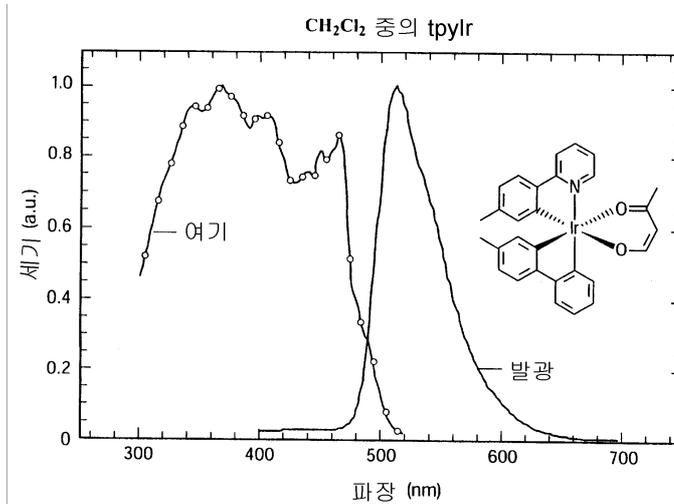
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21

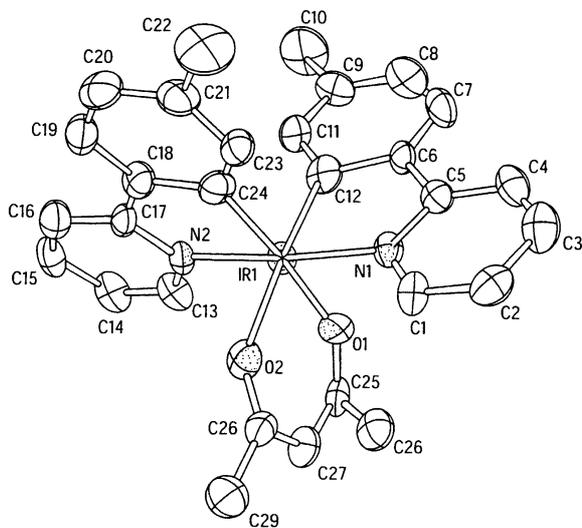


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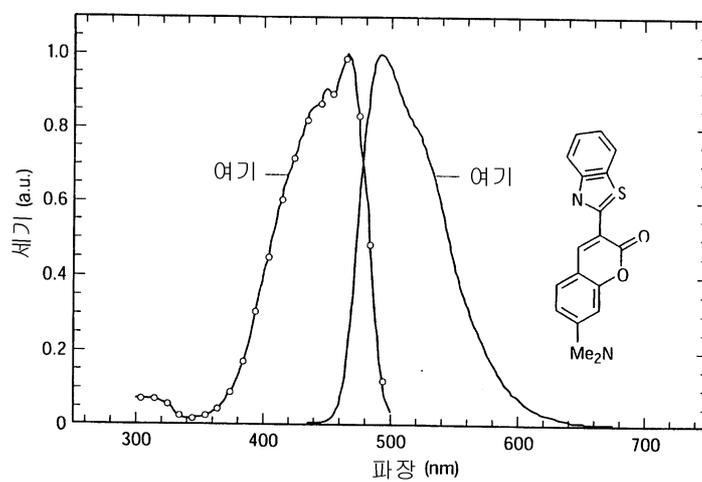


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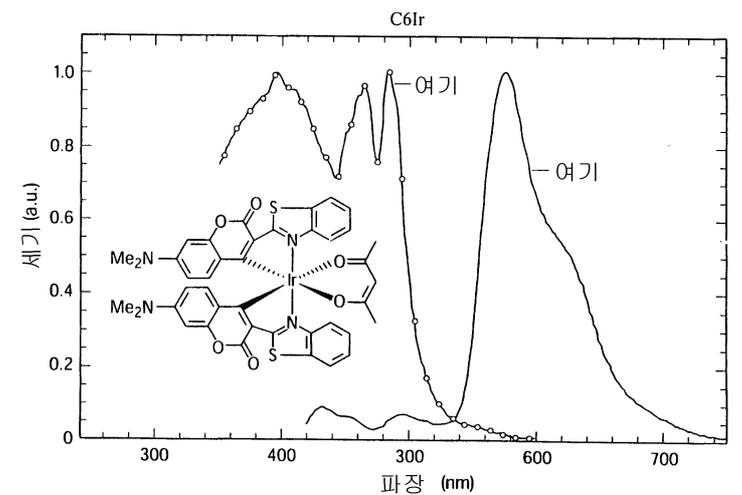
tpyr의 결정 구조



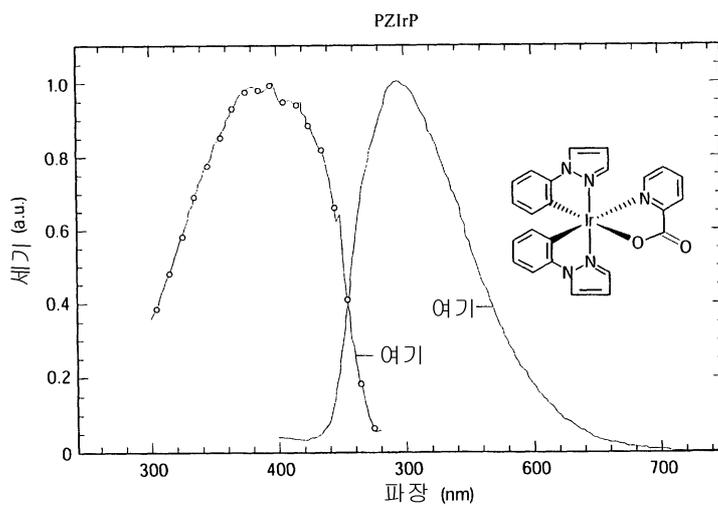
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25

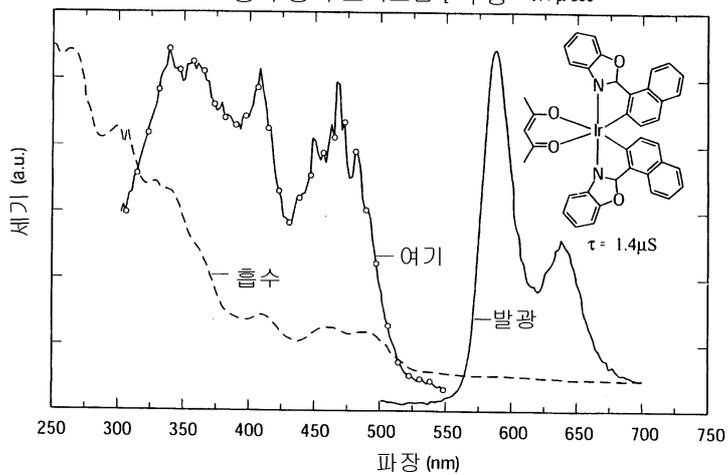


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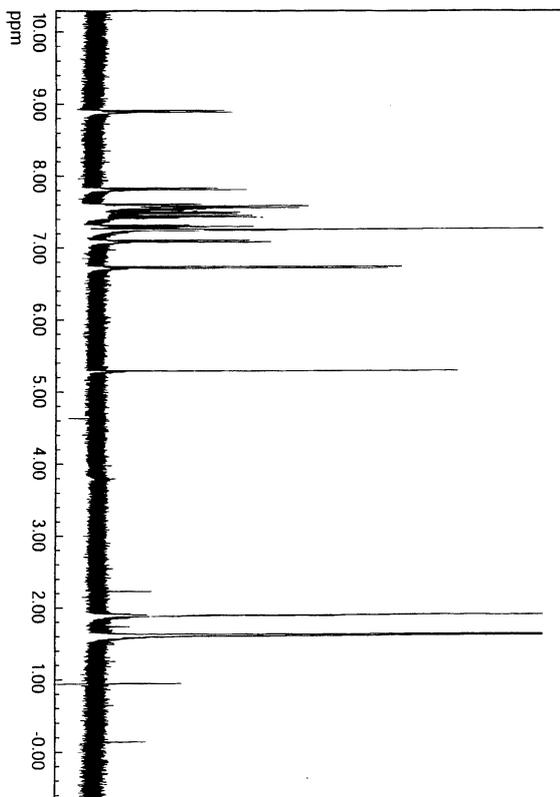


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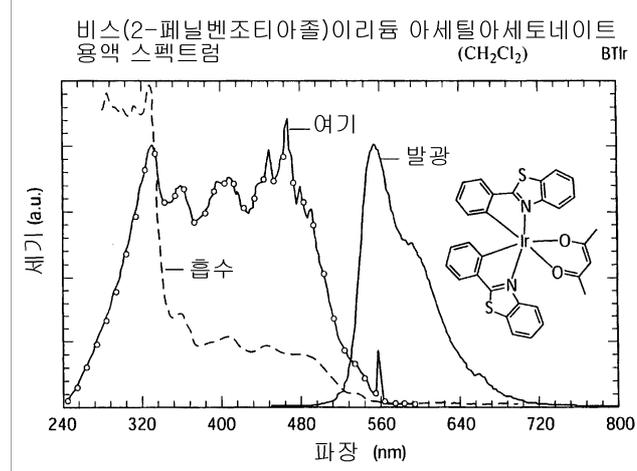
비스(2-(1-나프틸)벤조사졸)아세틸아세토네이트 **BONi⁺**
 CH₂Cl₂ 중의 용액 스펙트럼 [수명 = 1.4 μ sec



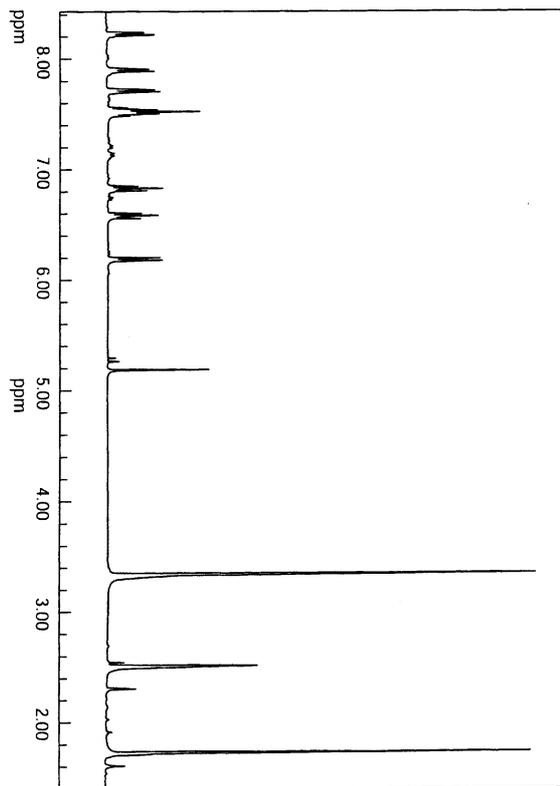
28



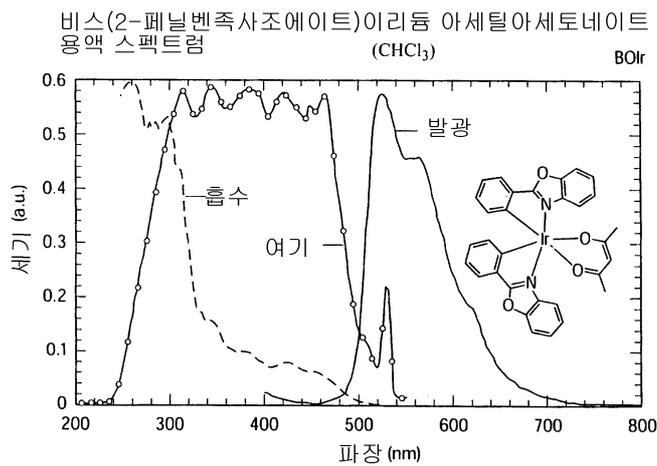
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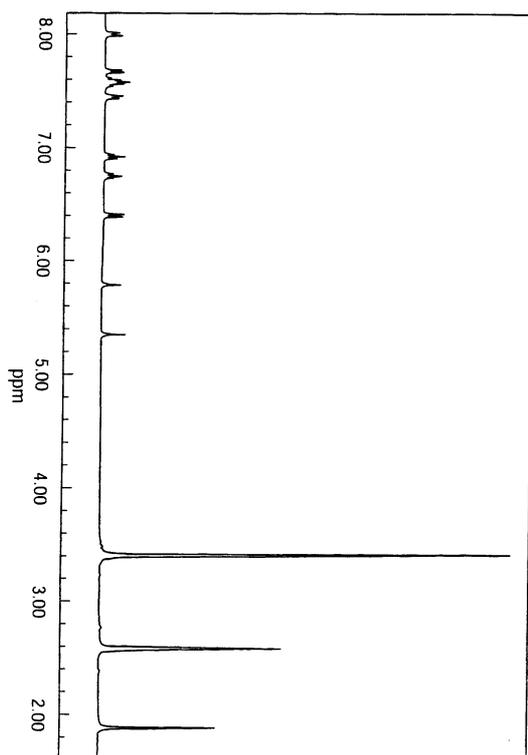
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31

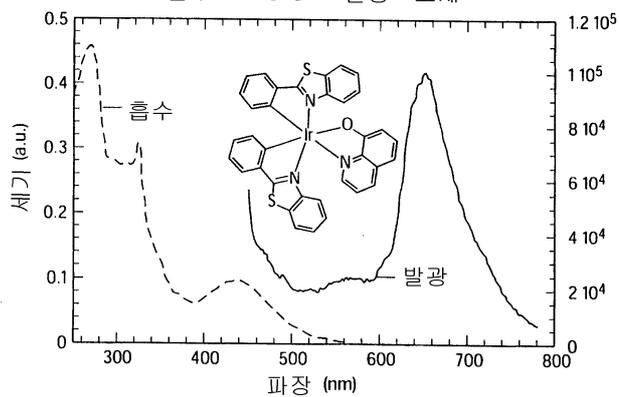


32

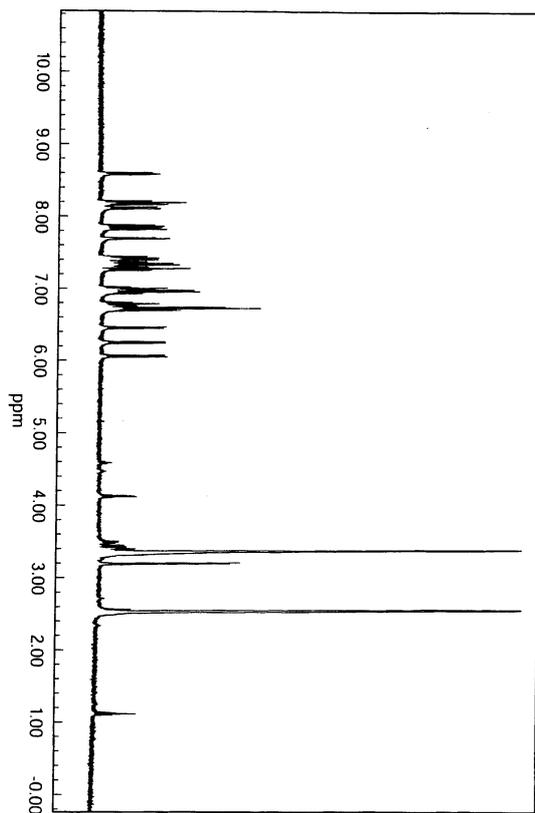


33

비스(2-페닐벤조티아졸)이리듐 8-히드록시퀴놀레이트
 흡수 : CH_2Cl_2 발광 : 고체 BTrQ

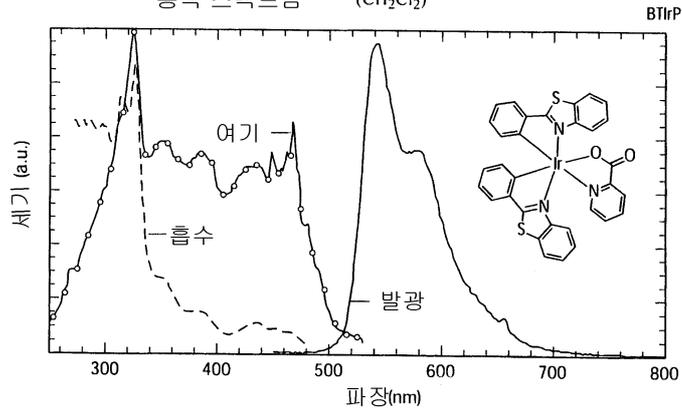


34



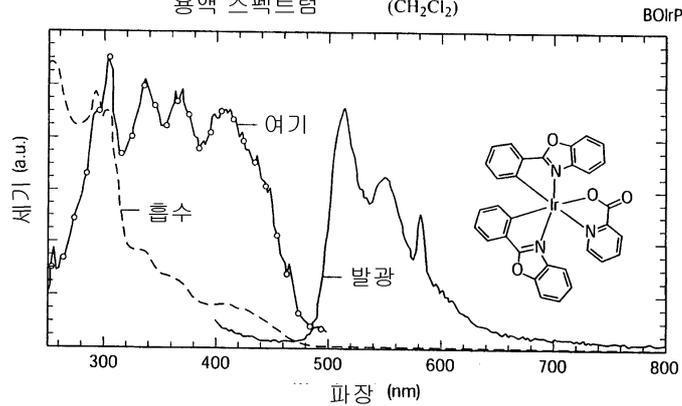
35

비스(2-페닐벤조티아졸)이리듐 피콜리네이트
용액 스펙트럼 (CH₂Cl₂)

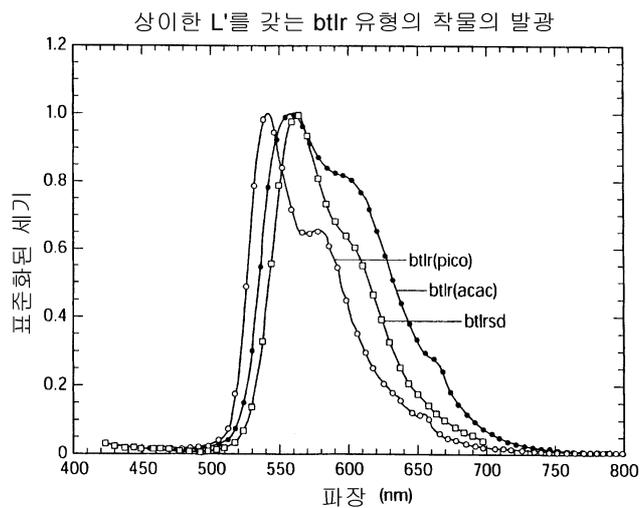


36

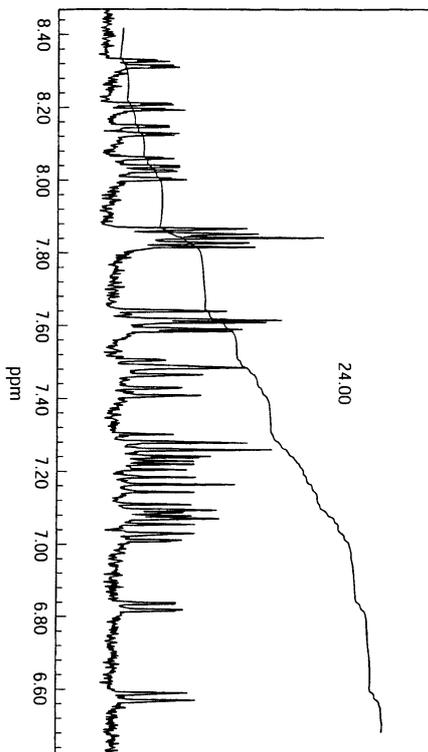
비스(2-페닐벤조사졸)이리듐 피콜리네이트
용액 스펙트럼 (CH₂Cl₂)



37

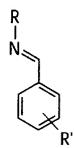


38

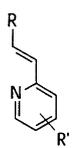


39

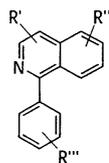
기타 L 리간드



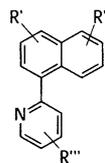
페닐아민



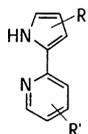
비닐피리딘



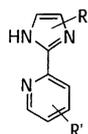
아릴퀴놀린



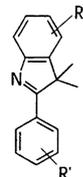
피리딜나프탈렌



피리딜피롤



피리딜이미다졸

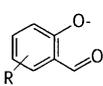


페닐인돌

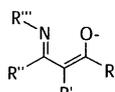
기타 X 리간드



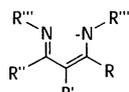
아미노산

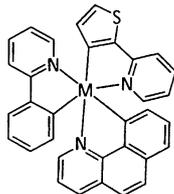


살리실알데히드

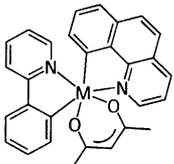


이미노아세토네이트

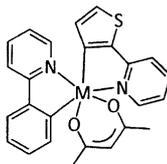


LL'L'M

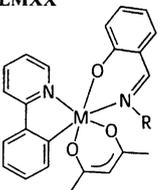
M(ppy)(bq)(thpy)

LL'MX

M(ppy)(bq)(acac)



M(ppy)(thpy)(acac)

LMXX'

M(ppy)(sd)(acac)