

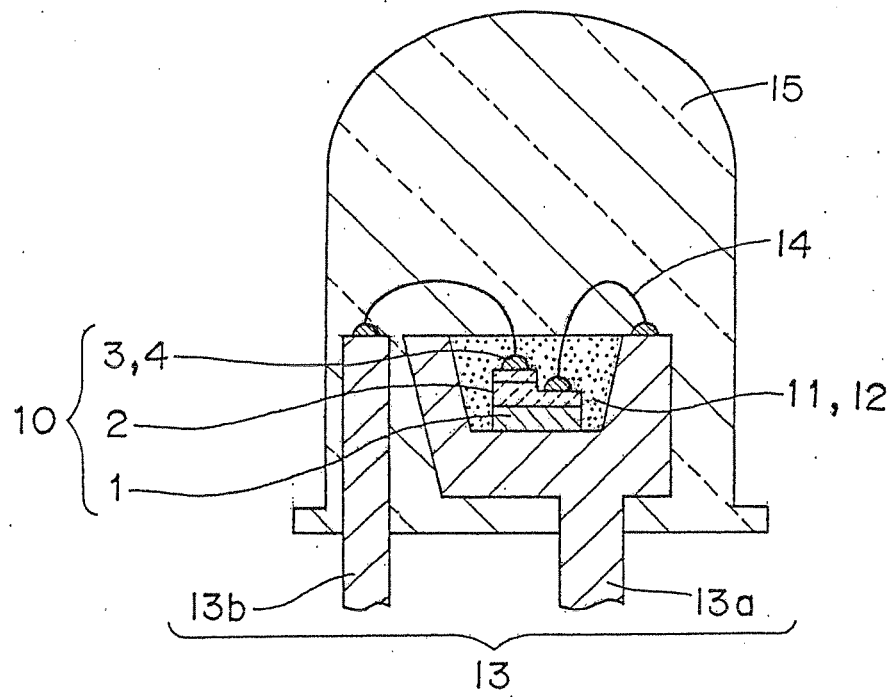
Fig. 1

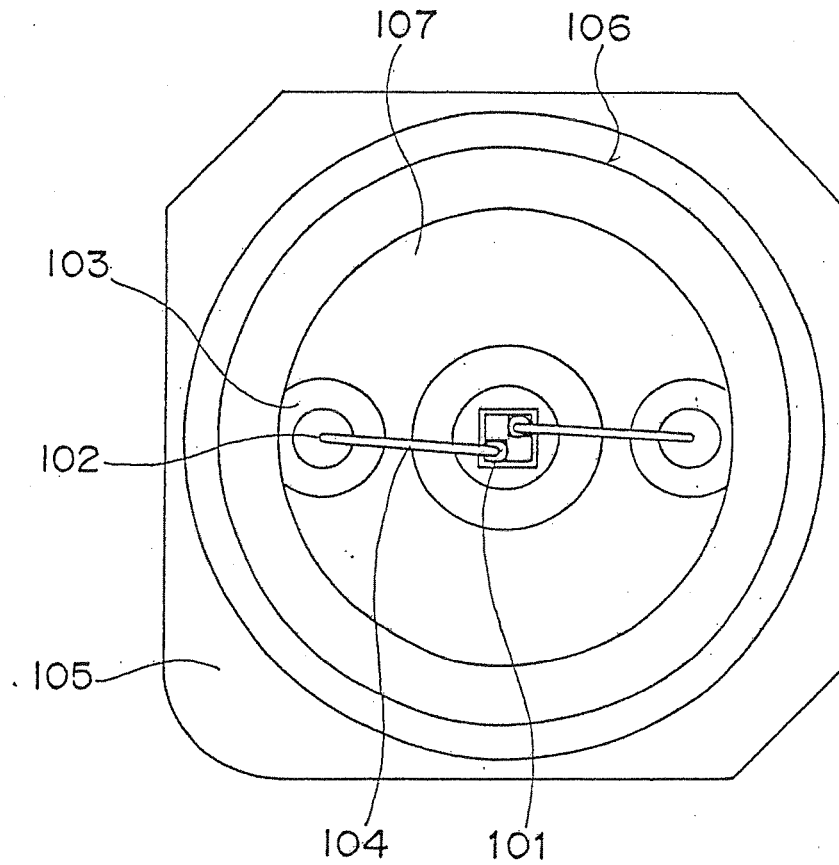
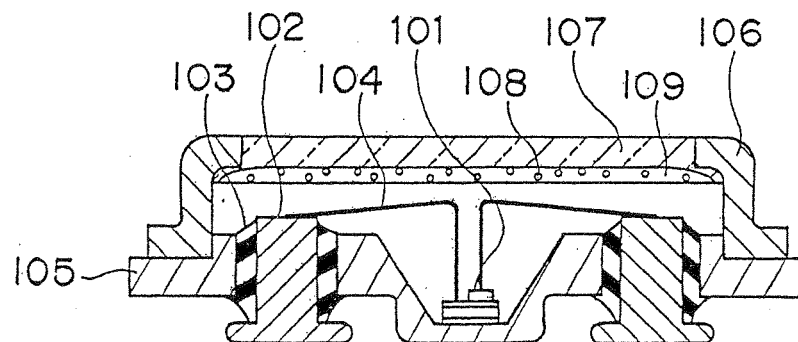
Fig.2A*Fig.2B*

Fig.3

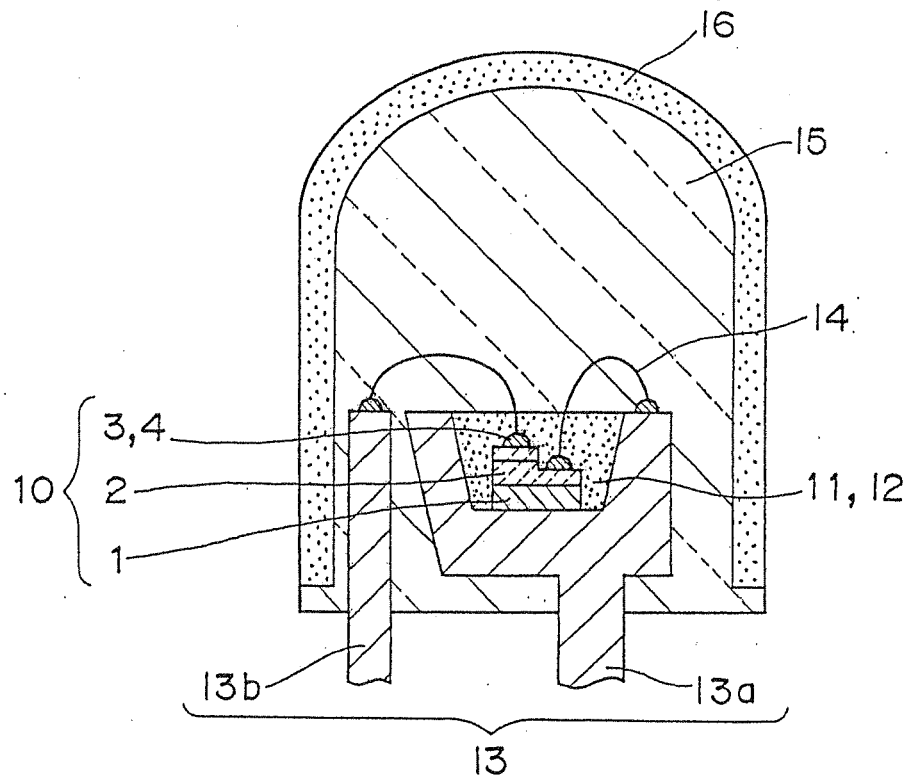


Fig.4

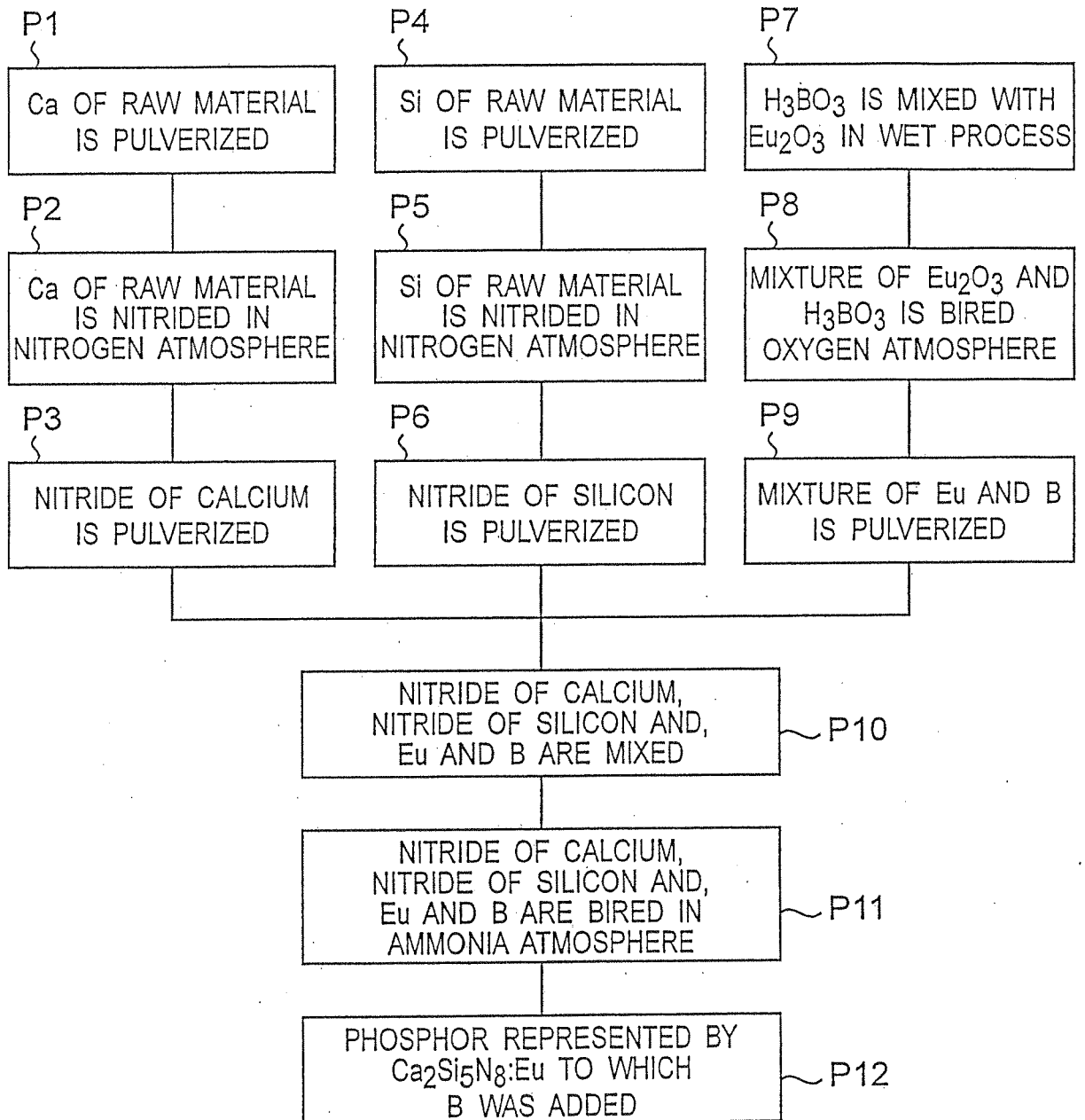
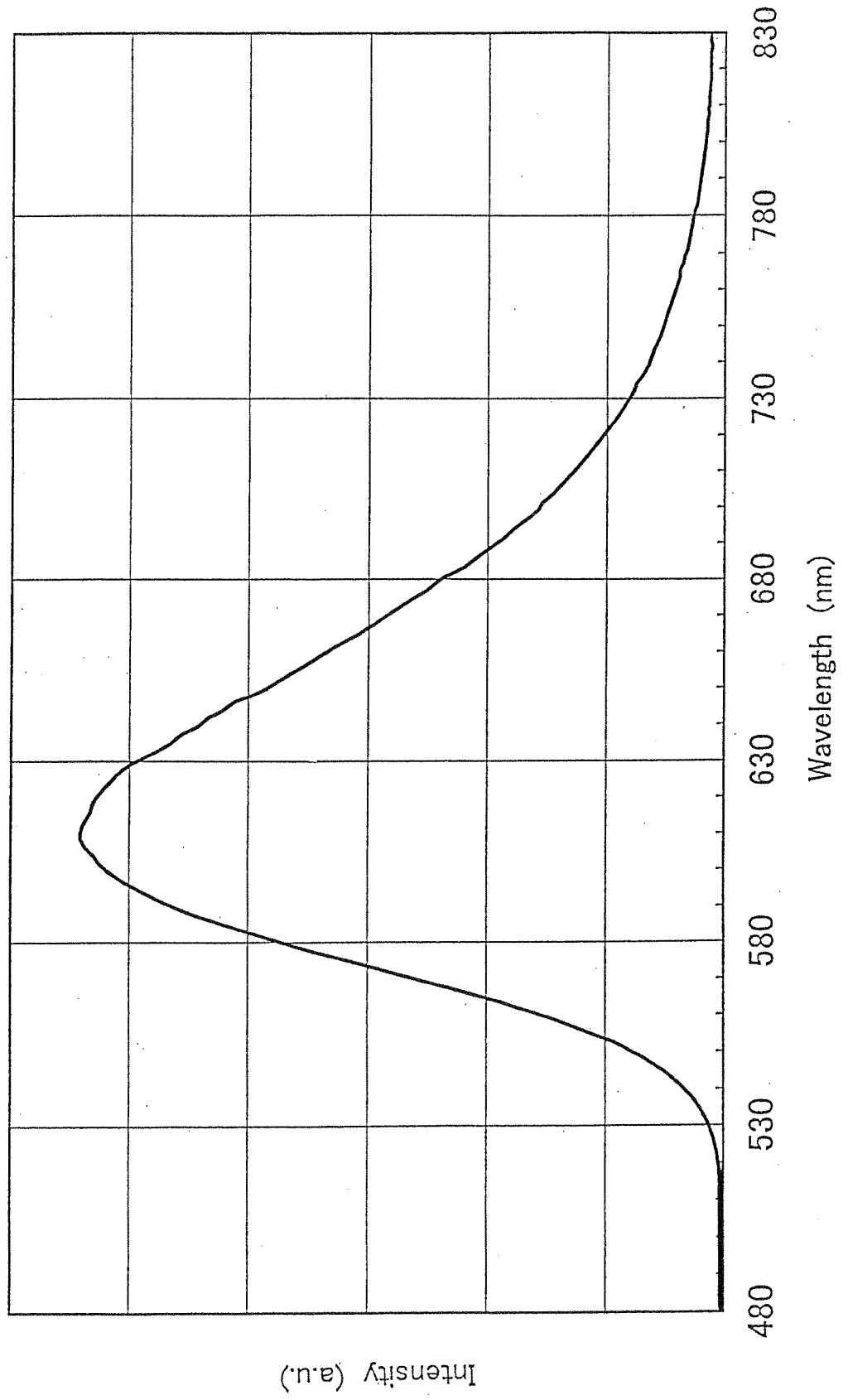
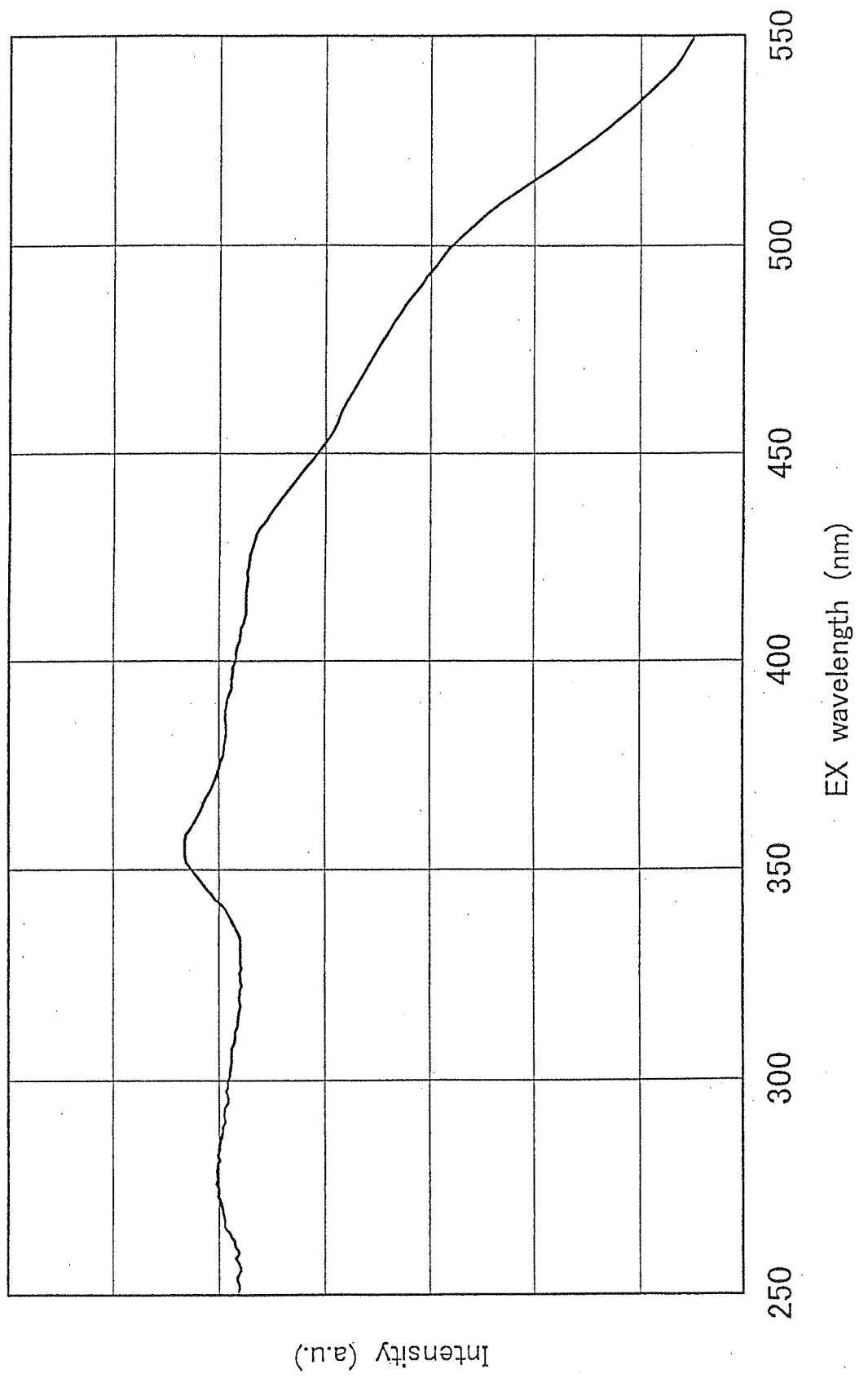


Fig. 5
Emission spectrum (EX=460nm)



Excitation spectrum

Fig. 6



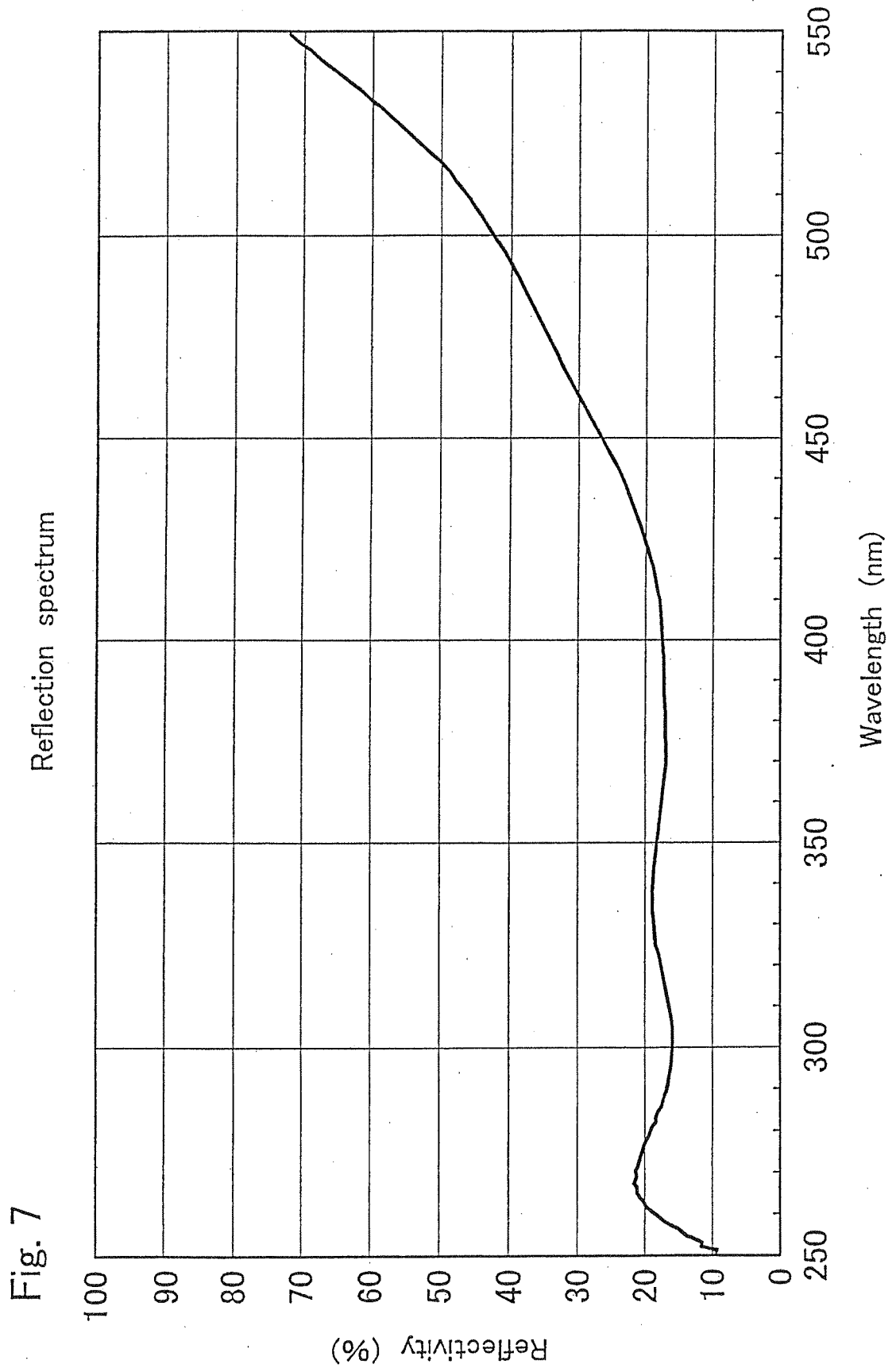
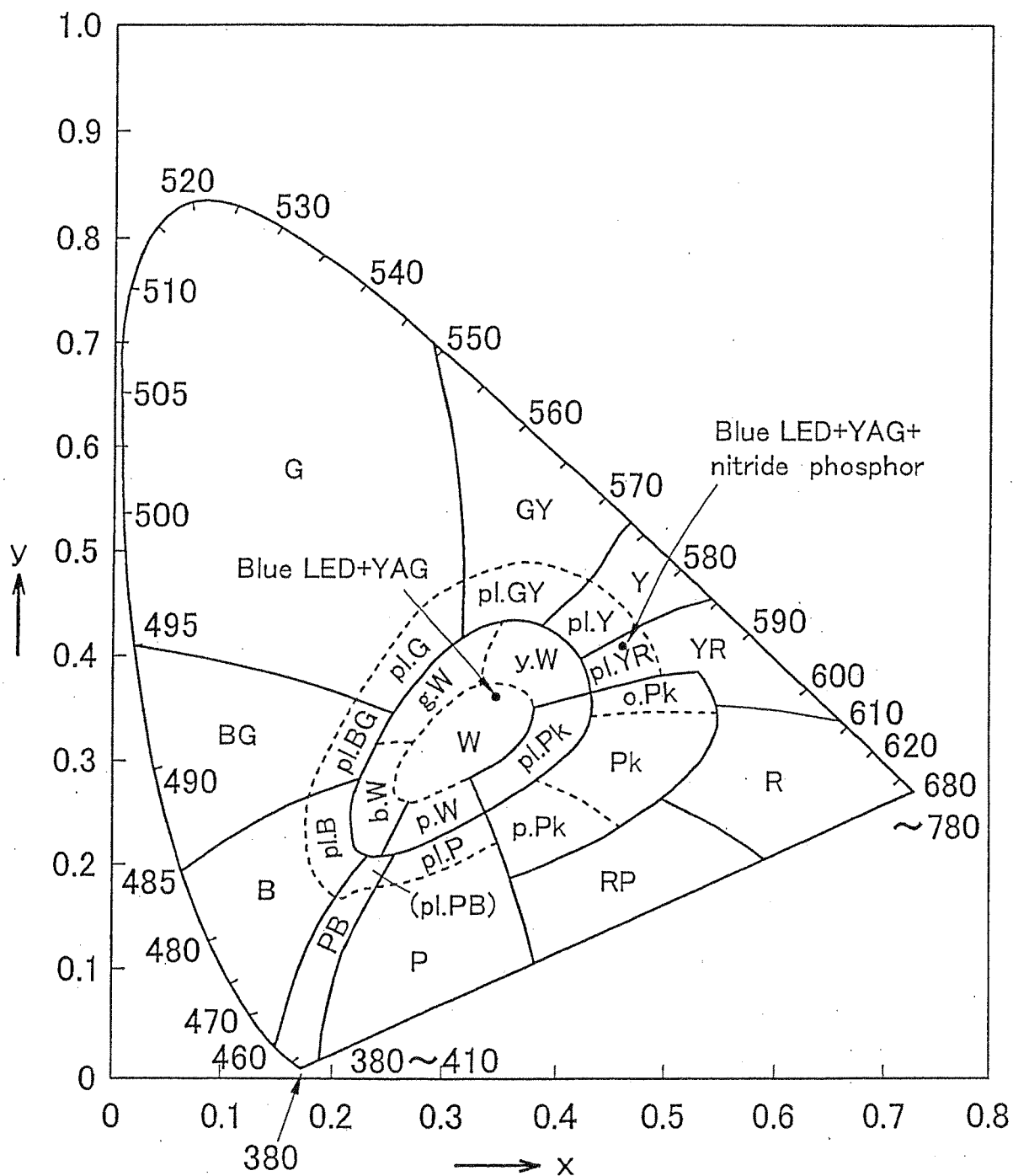


Fig. 8



G : Green GY : Yellow green
Y : Yellow YR : Yellow red
R : Red RP : Red purple
B : Blue BG : Blue green
W : White PB : Blue purple
P : Purple Pk : Pink

GY : Yellow green	pl.Y : pale yellow
YR : Yellow red	pl.G : pale green
RP : Red purple	pl.B : pale blue
BG : Blue green	pl.P : pale purple
PB : Blue purple	pl.Pk : pale pink
Pk : Pink	pl.PB : pale blue purple
	pl.GY : pale yellow green
	pl.BG : pale blue green
	pl.YR : pale yellow red

b.W : Bluish white
g.W : Greenish white
p.W : Purplish white
y.W : Yellowish white
o.Pk : Orange pink
p.Pk : Purplish pink

Fig. 9

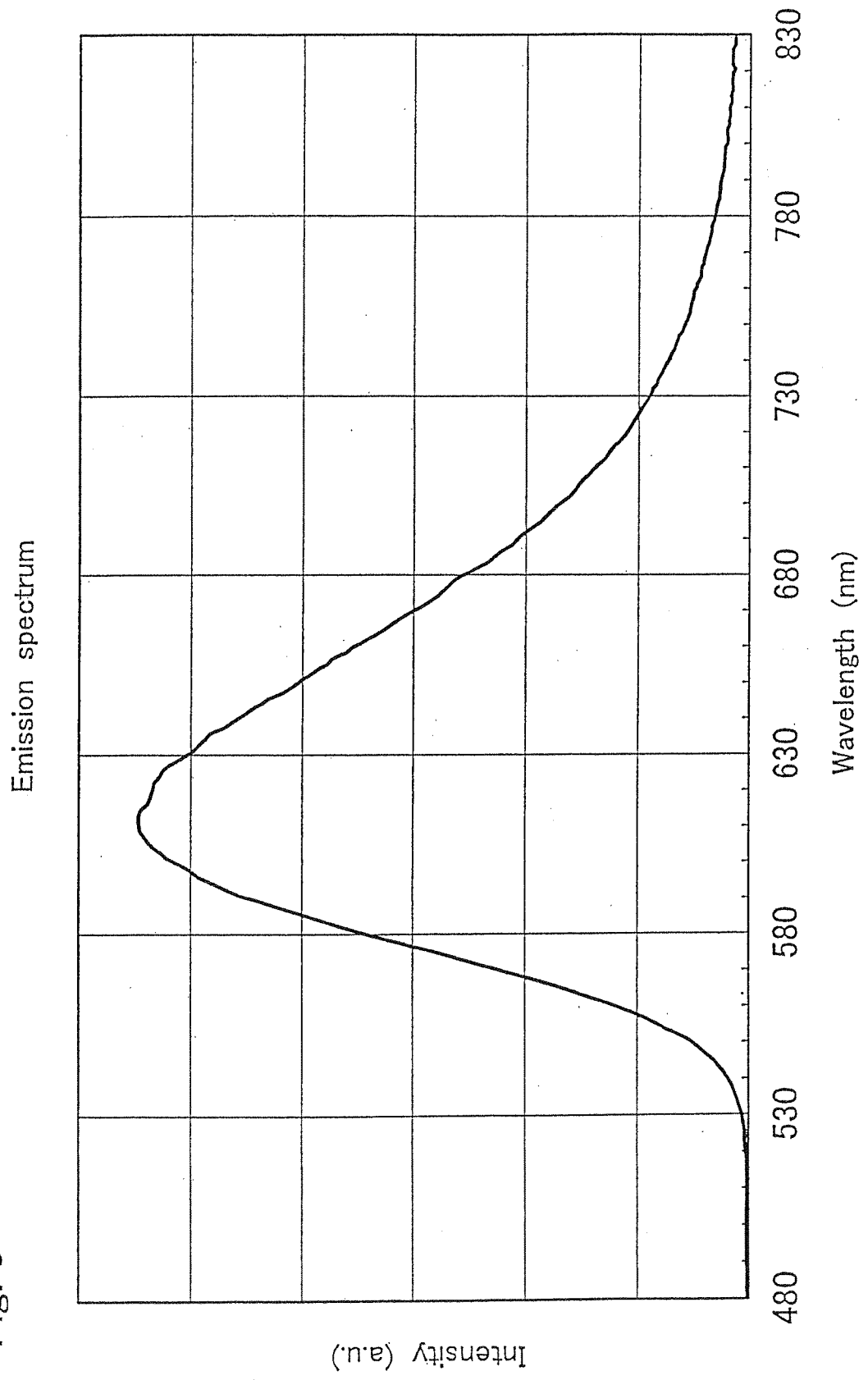
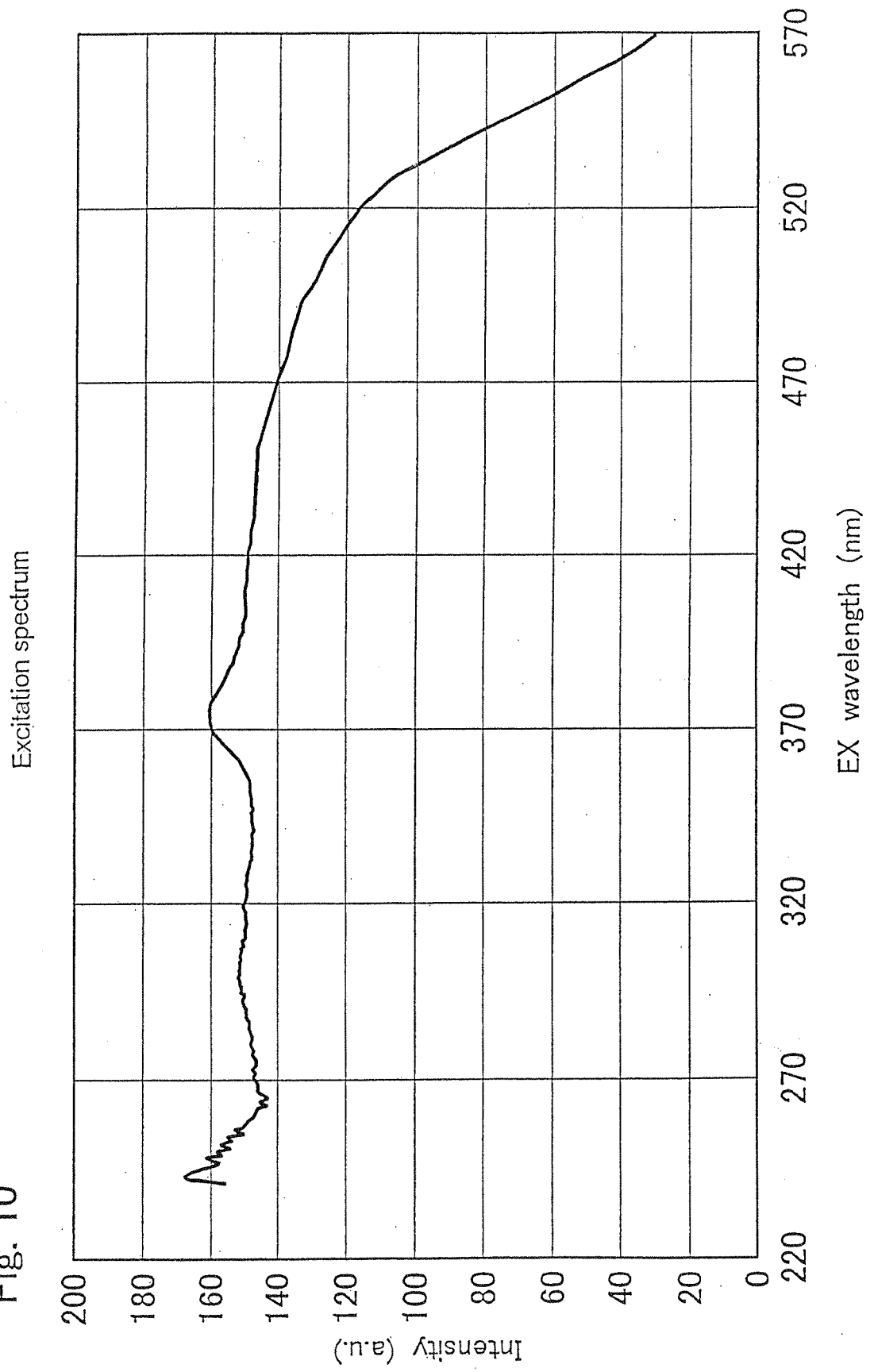
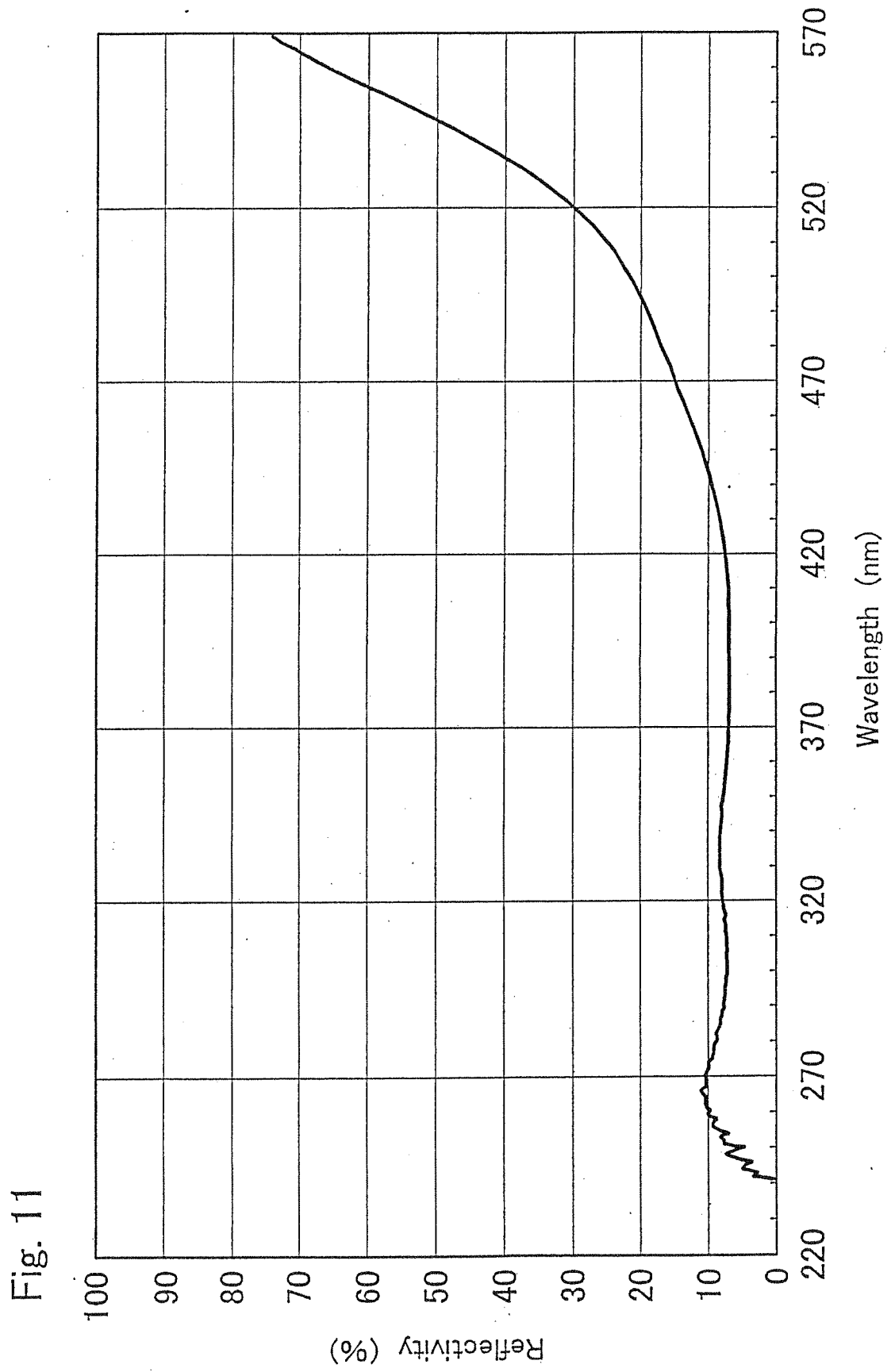


Fig. 10





12/97

Fig. 12A

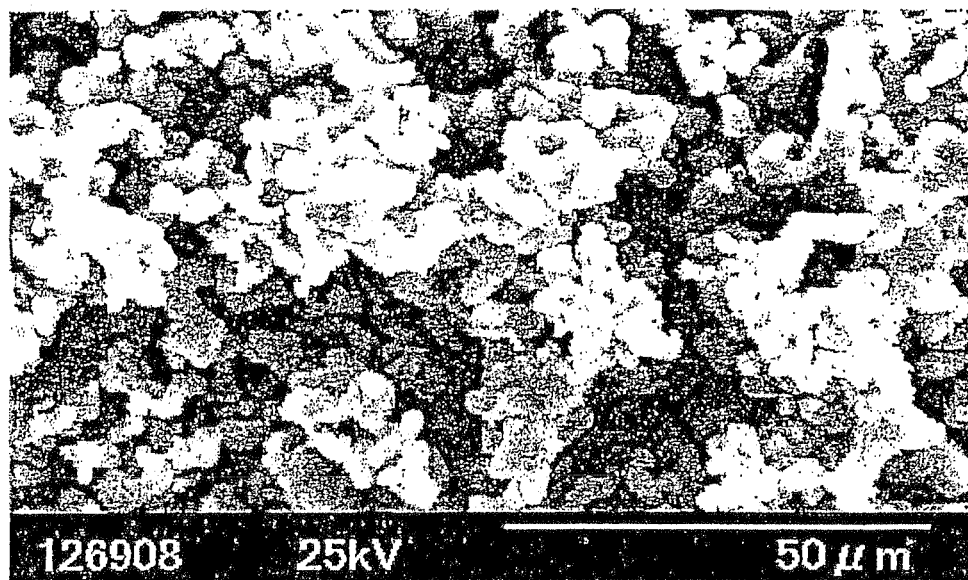


Fig. 12B

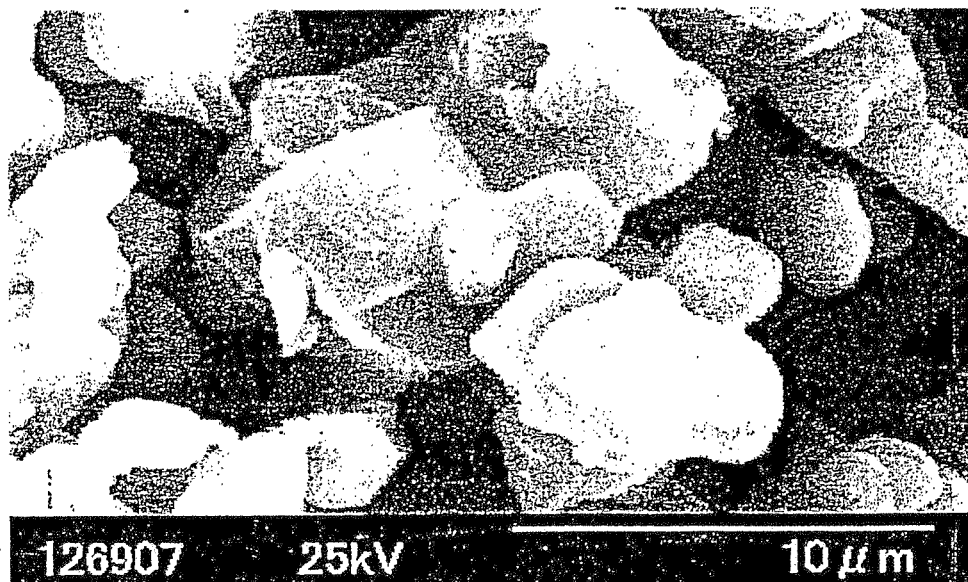
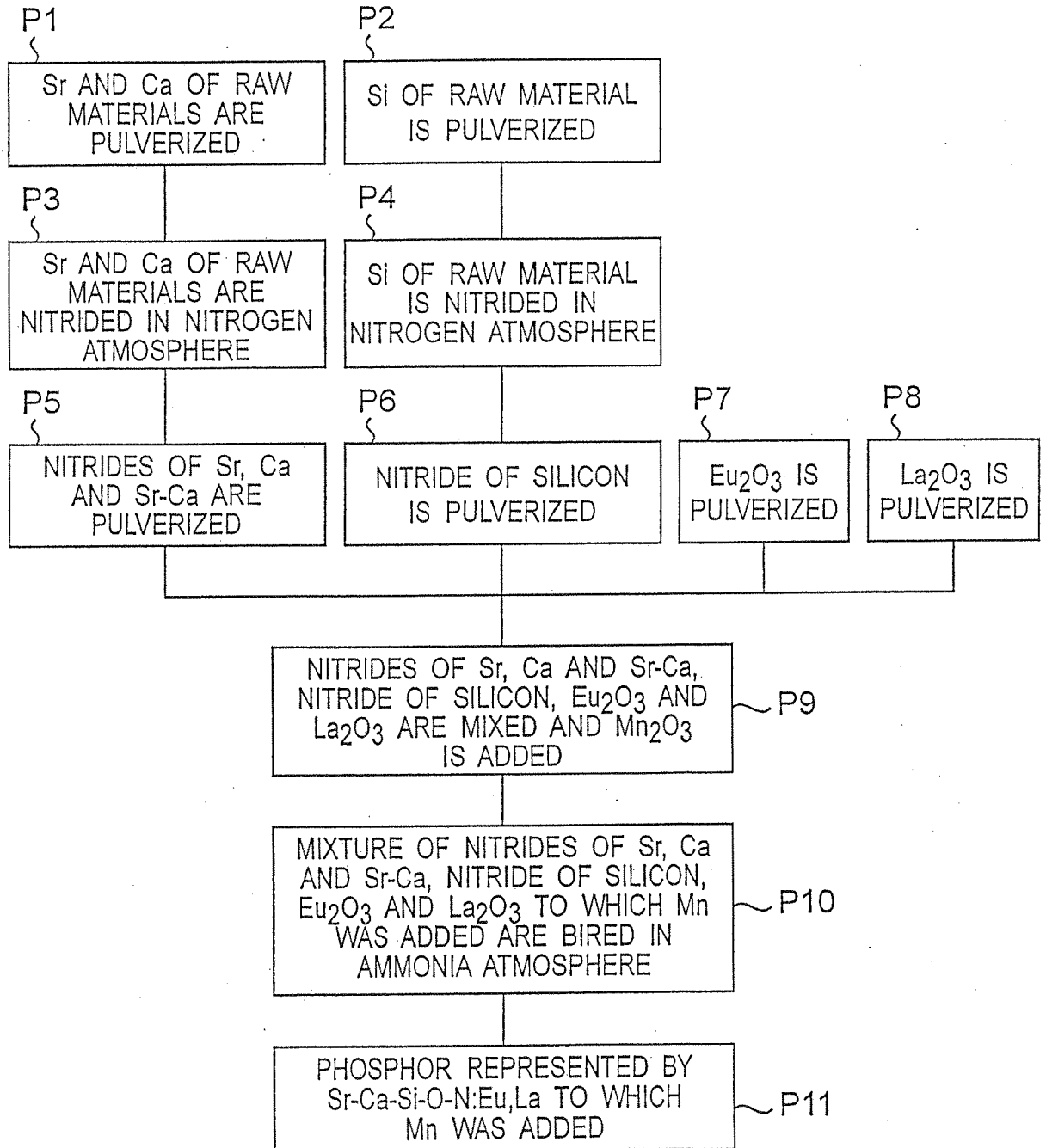
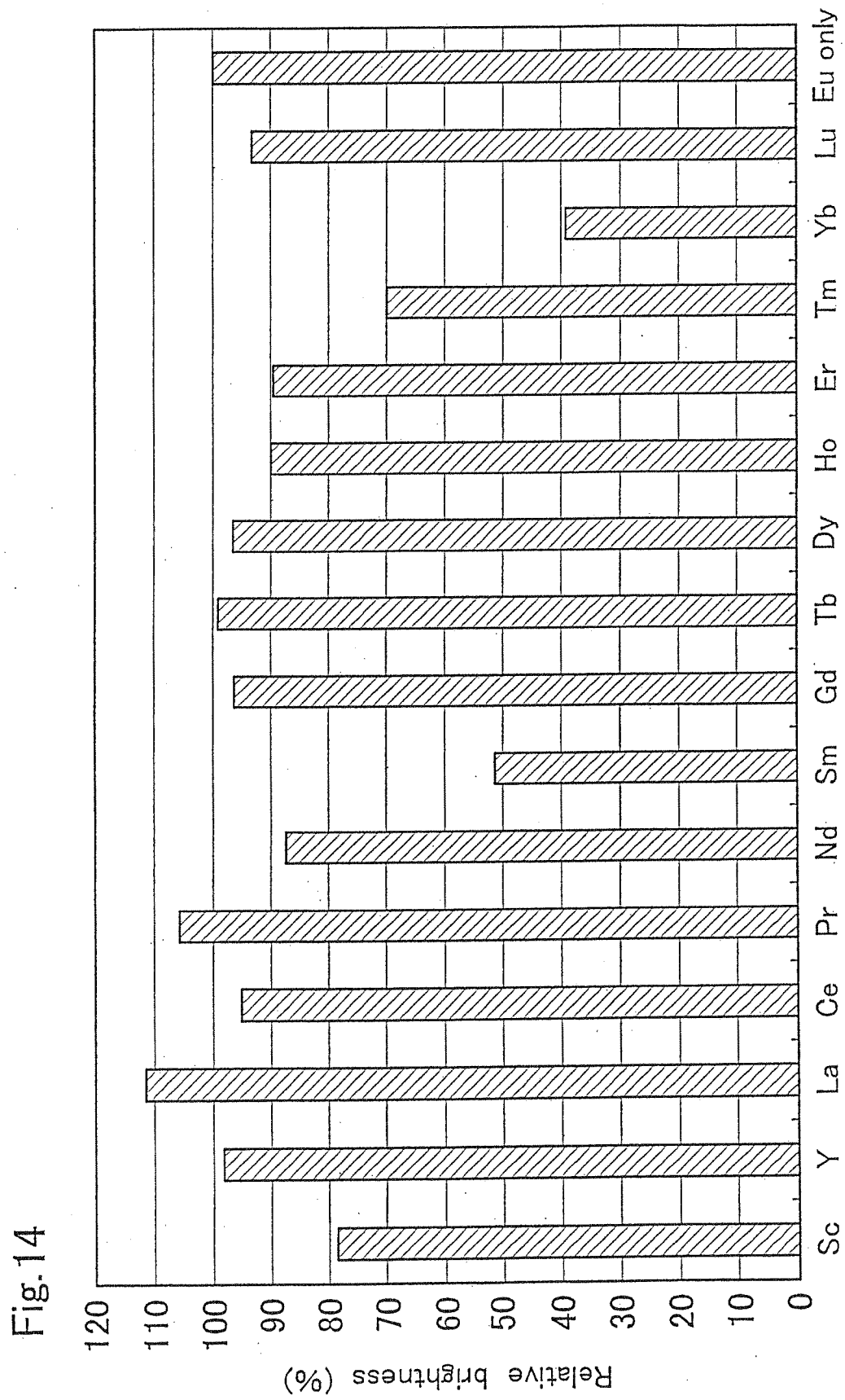


Fig. 13





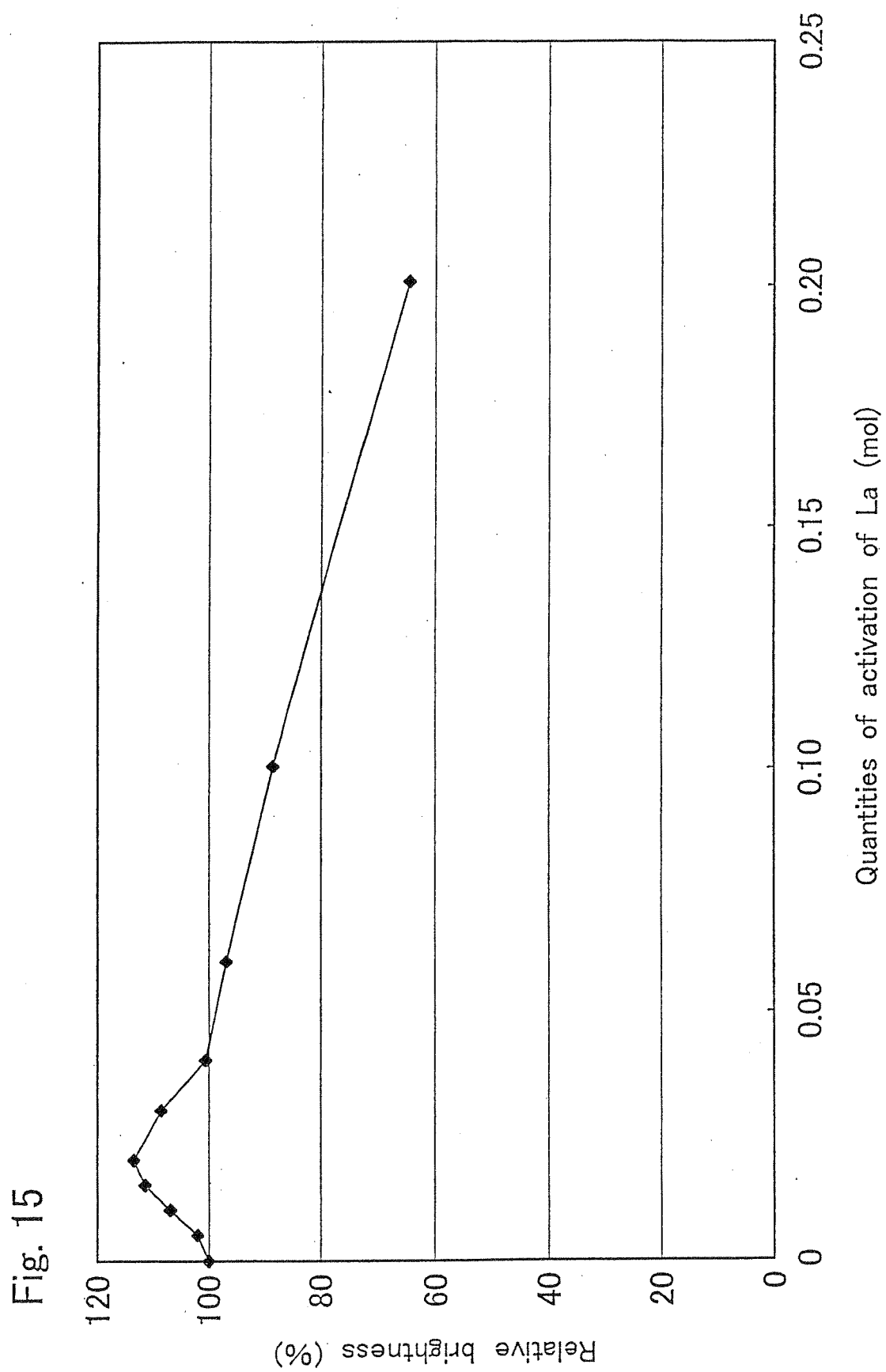


Fig. 16

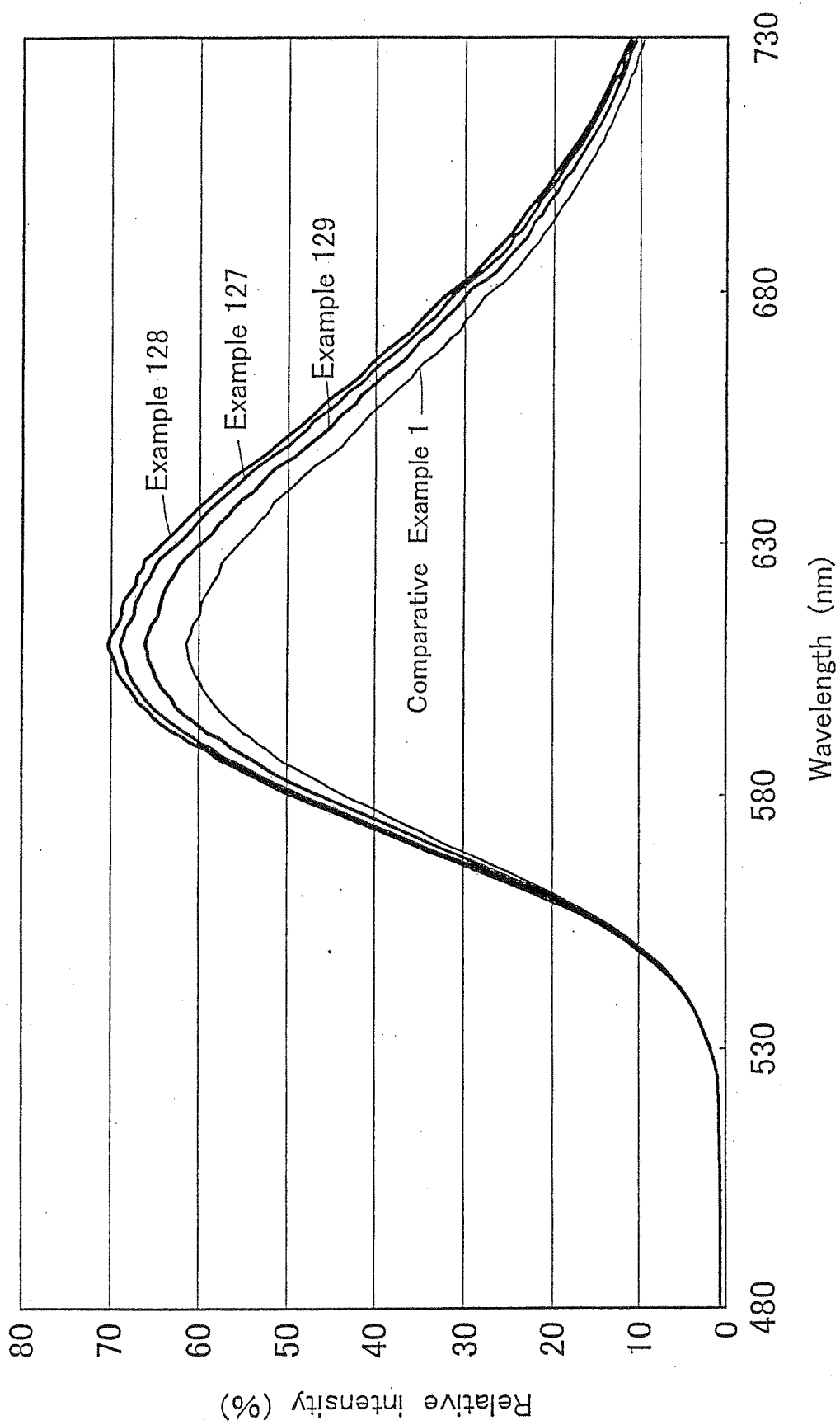


Fig. 17

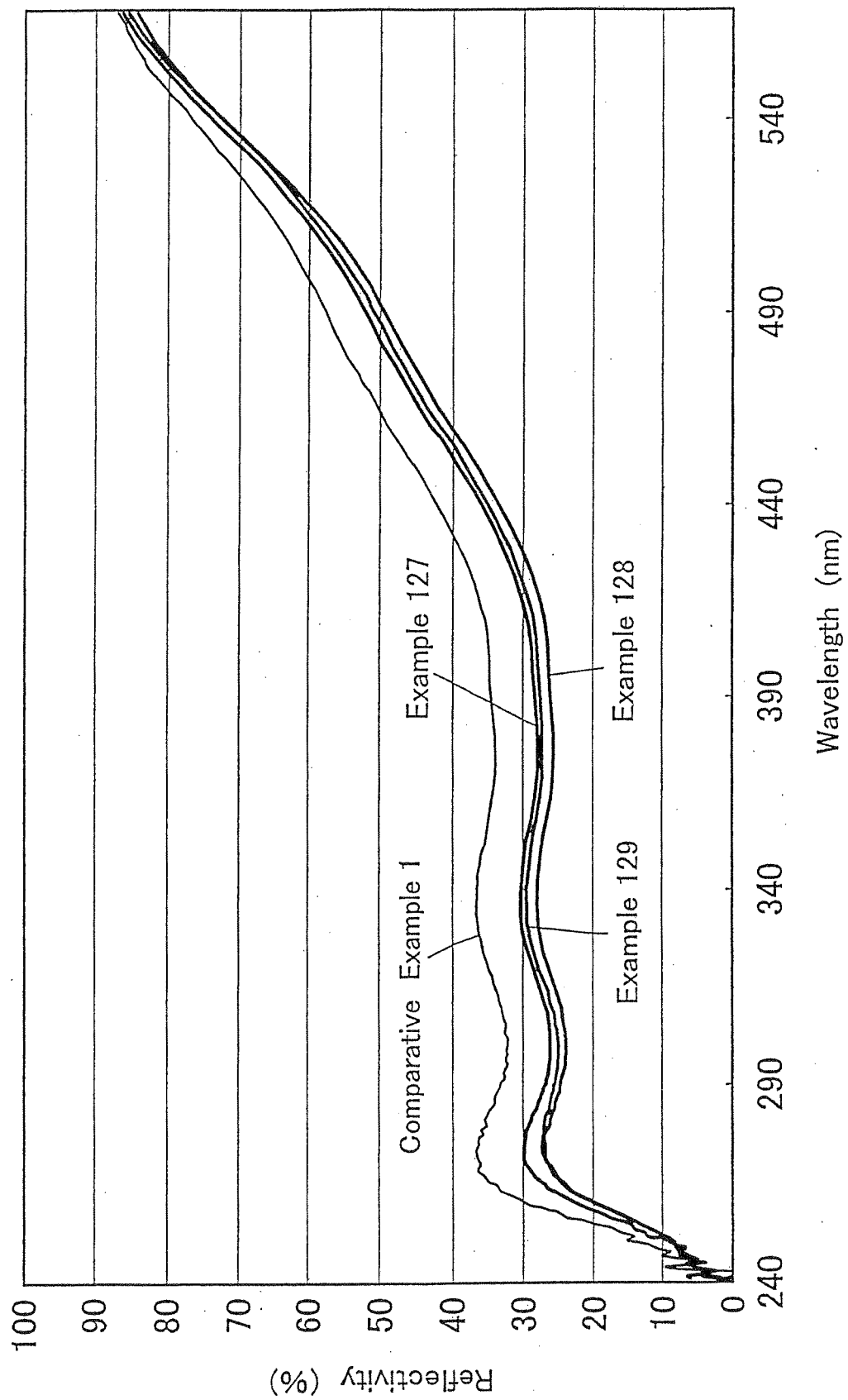


Fig. 18

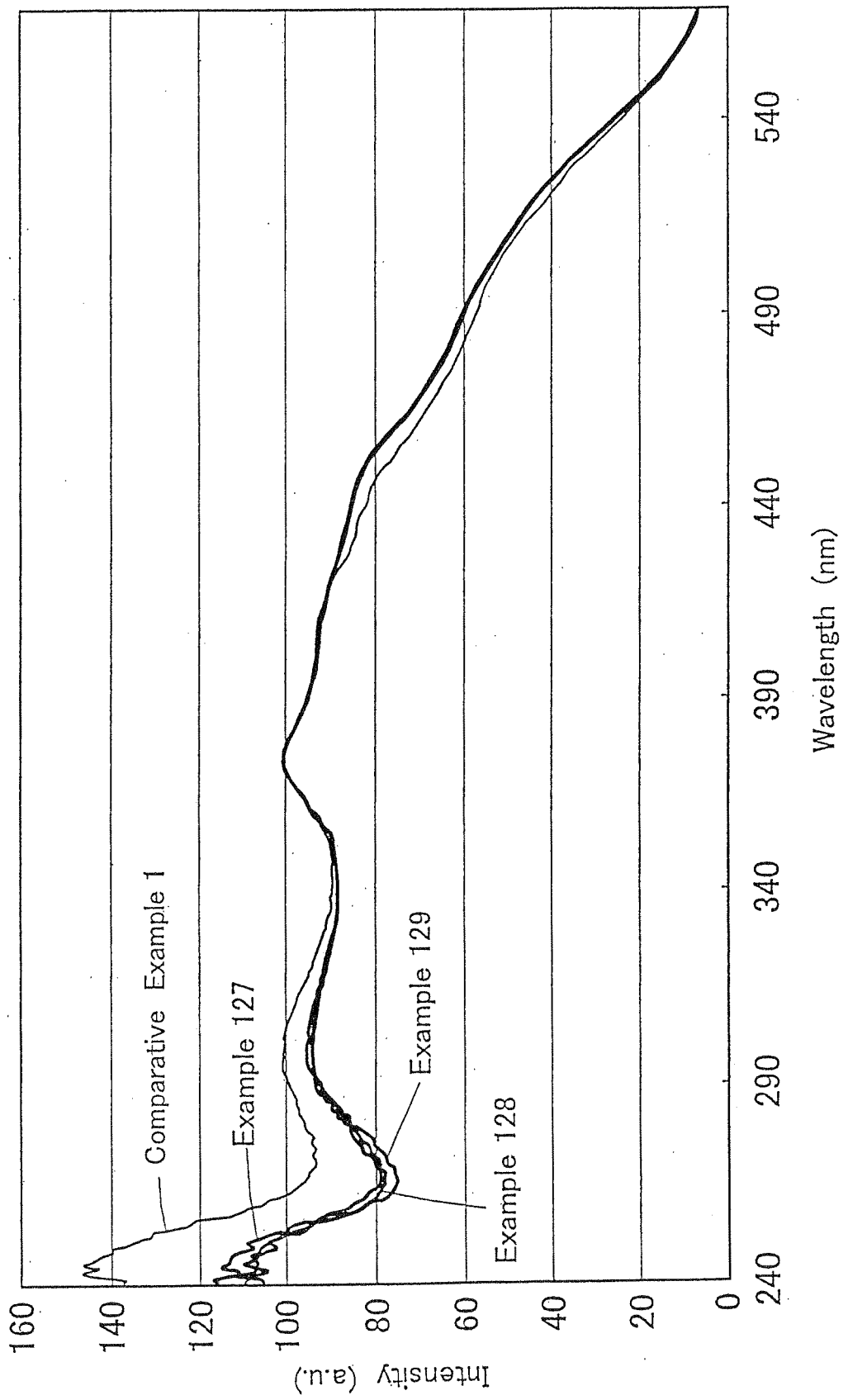


Fig. 19A

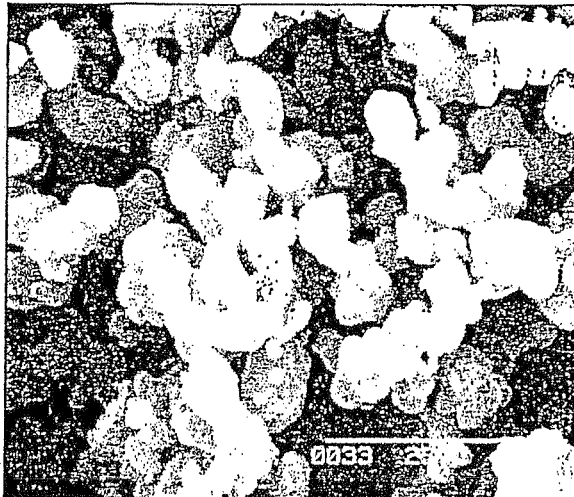


Fig. 19B

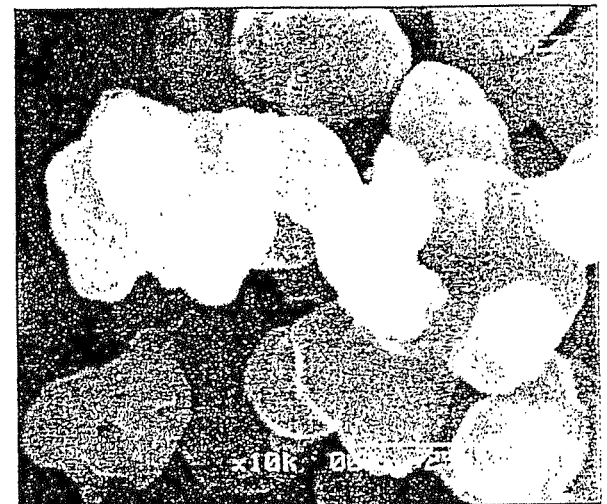
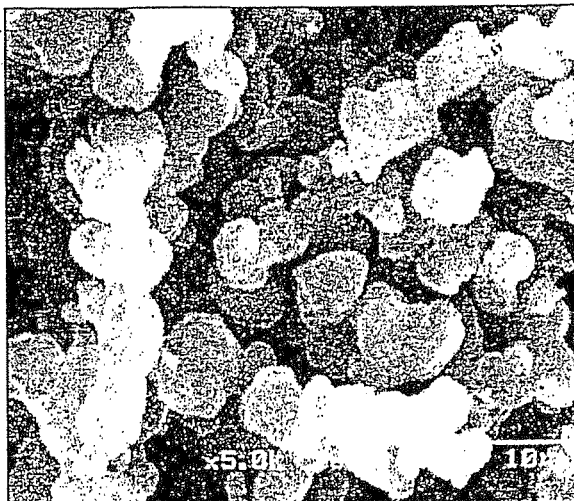
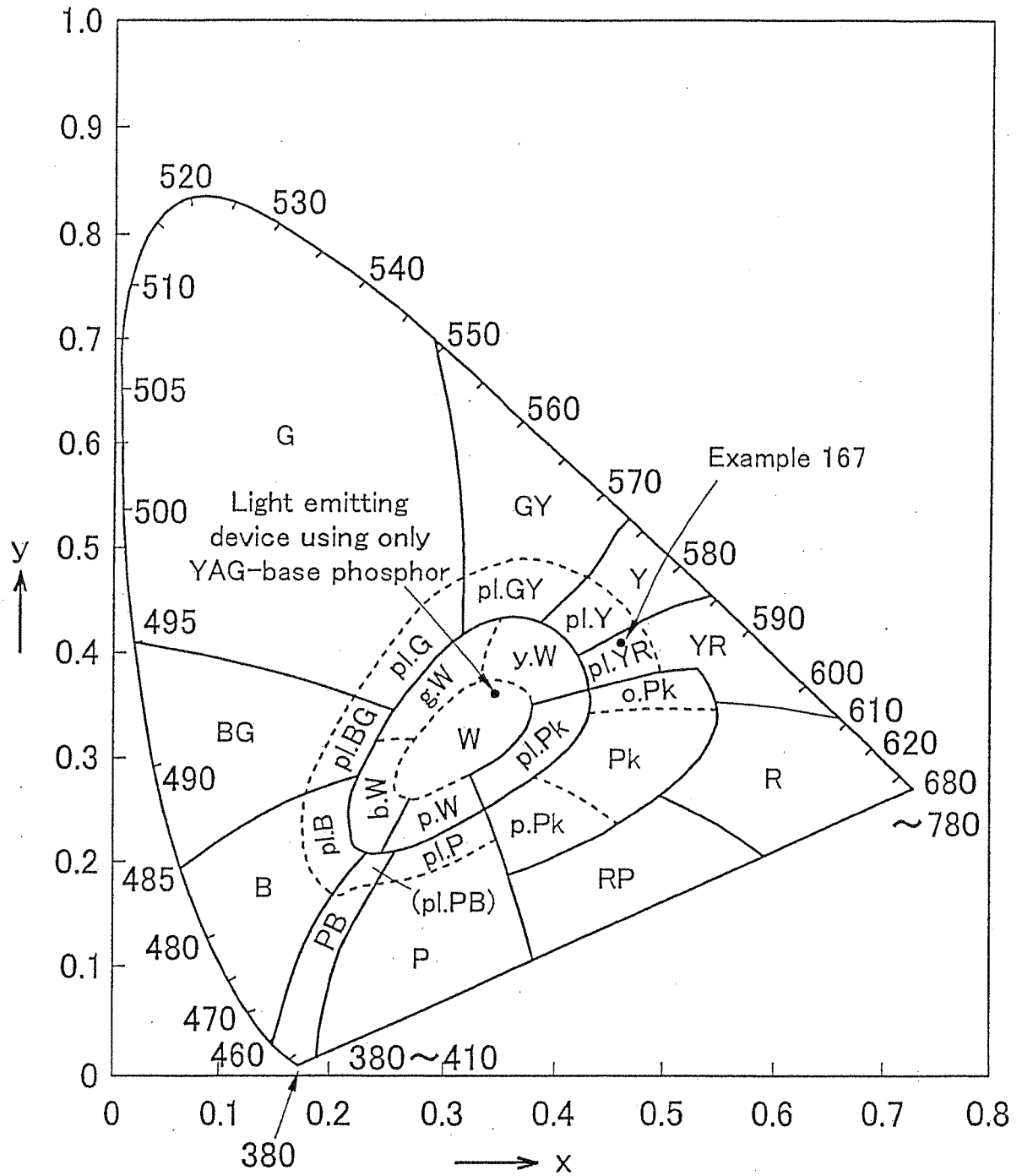


Fig. 20



G : Green
 Y : Yellow
 R : Red
 B : Blue
 W : White
 P : Purple

GY : Yellow green
 YR : Yellow red
 RP : Red purple
 BG : Blue green
 PB : Blue purple
 Pk : Pink

pl.Y : pale yellow
 pl.G : pale green
 pl.B : pale blue
 pl.P : pale purple
 pl.Pk : pale pink
 pl.PB : pale blue purple
 pl.GY : pale yellow green
 pl.BG : pale blue green
 pl.YR : pale yellow red

b.W : Bluish white
 g.W : Greenish white
 p.W : Purplish white
 y.W : Yellowish white
 o.Pk : Orange pink
 p.Pk : Purplish pink

Fig. 21

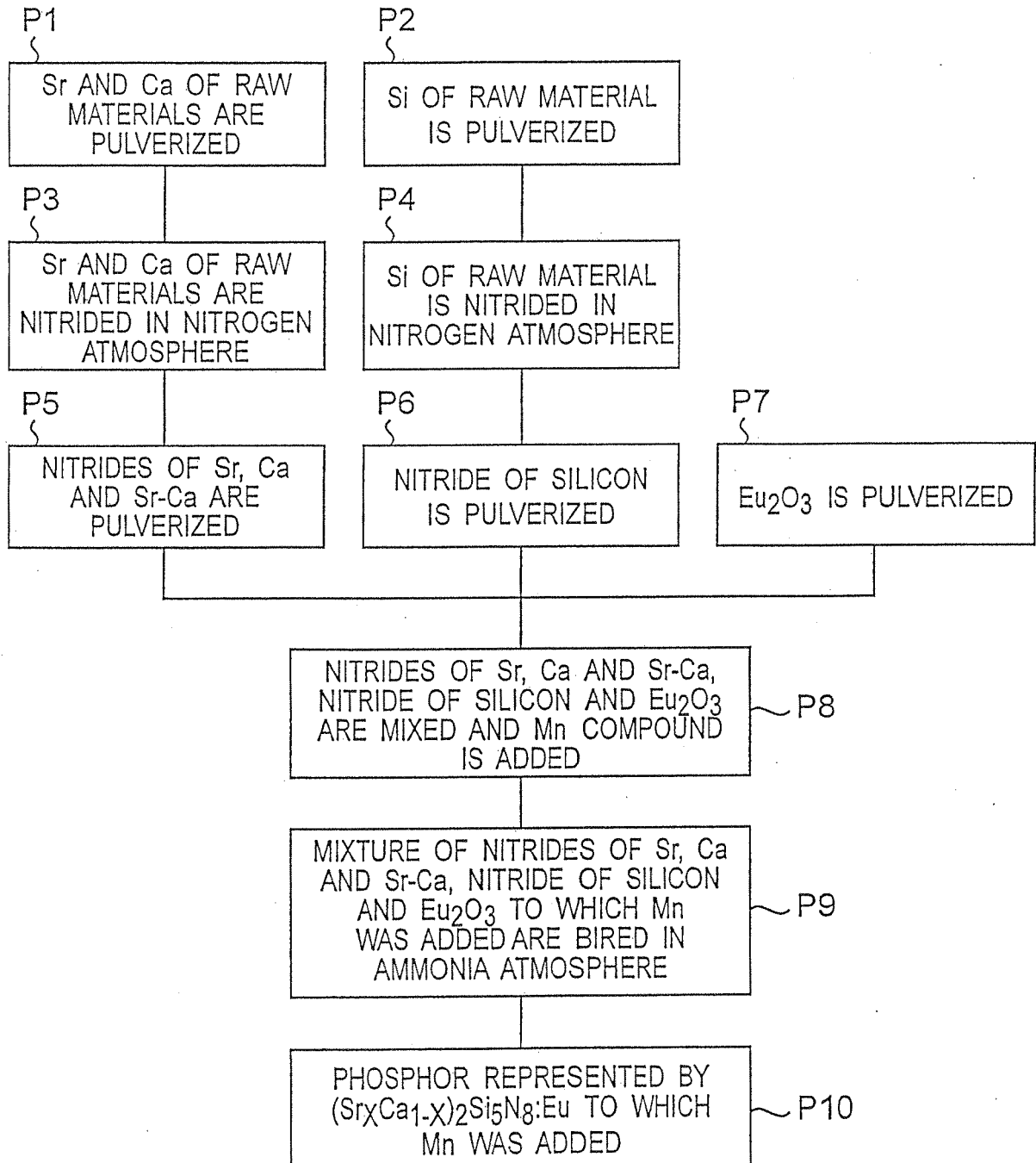


Fig. 22

Emission spectrum (EX=460nm)

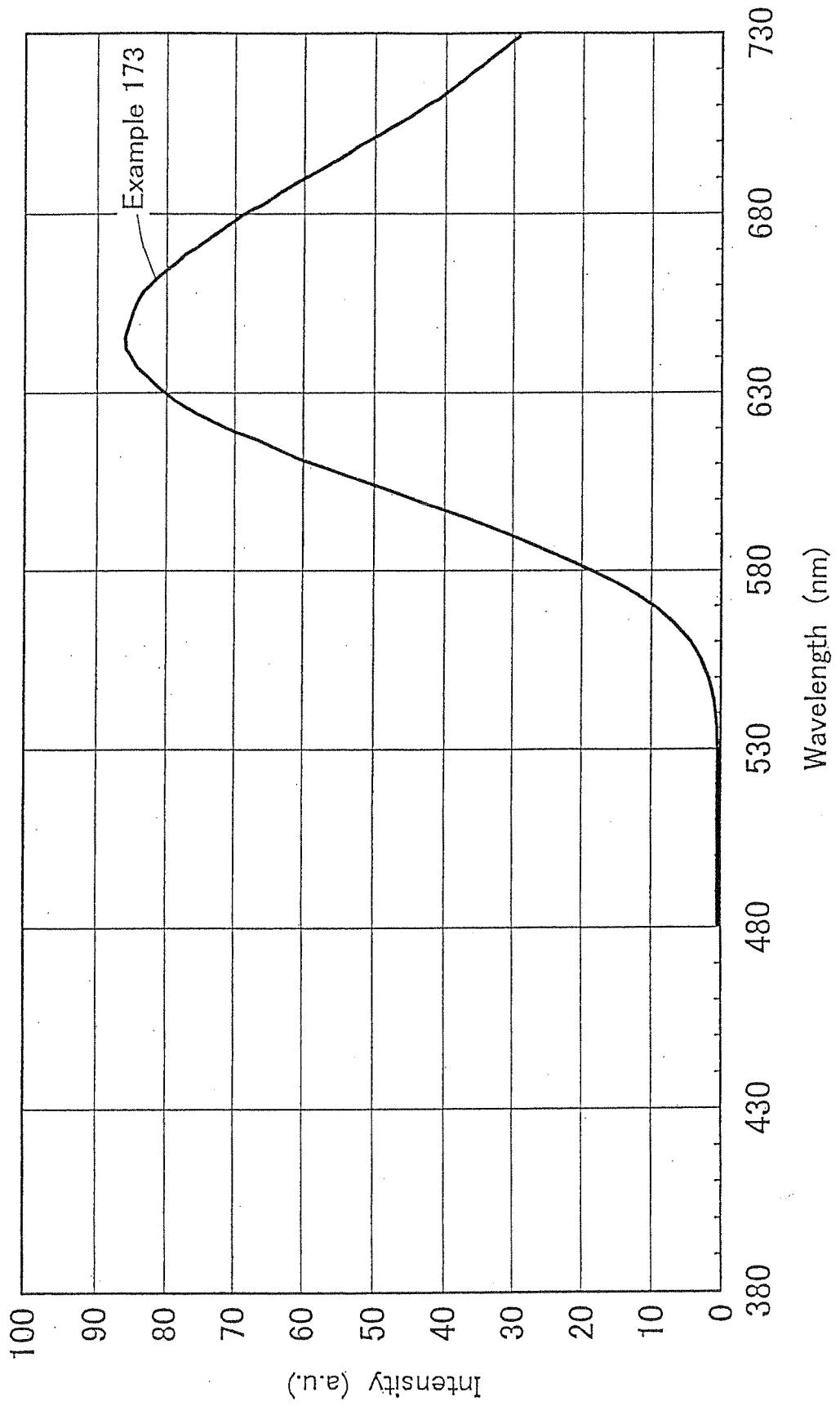


Fig. 23

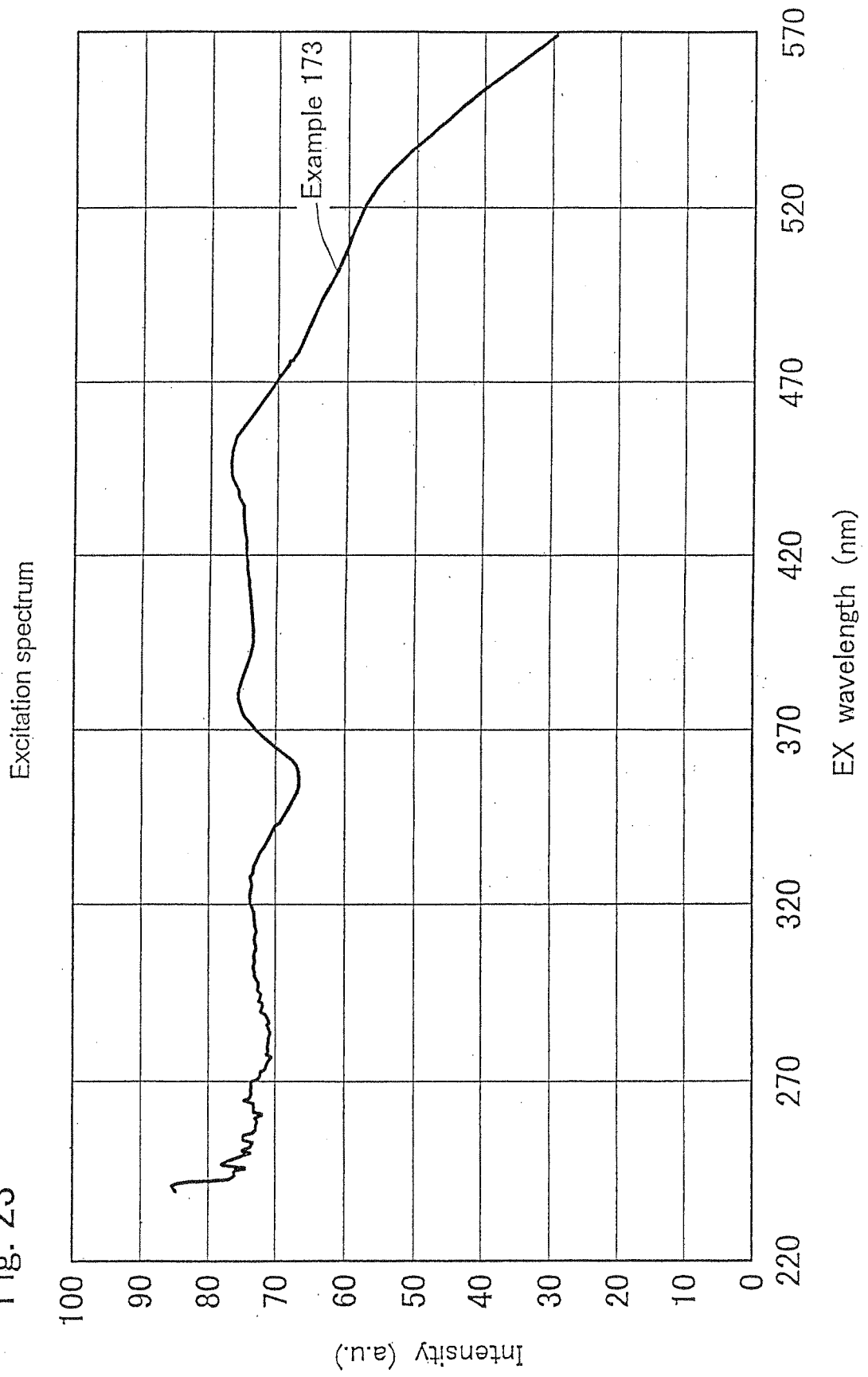


Fig. 24

Reflection spectrum (Std=CaHPO4)

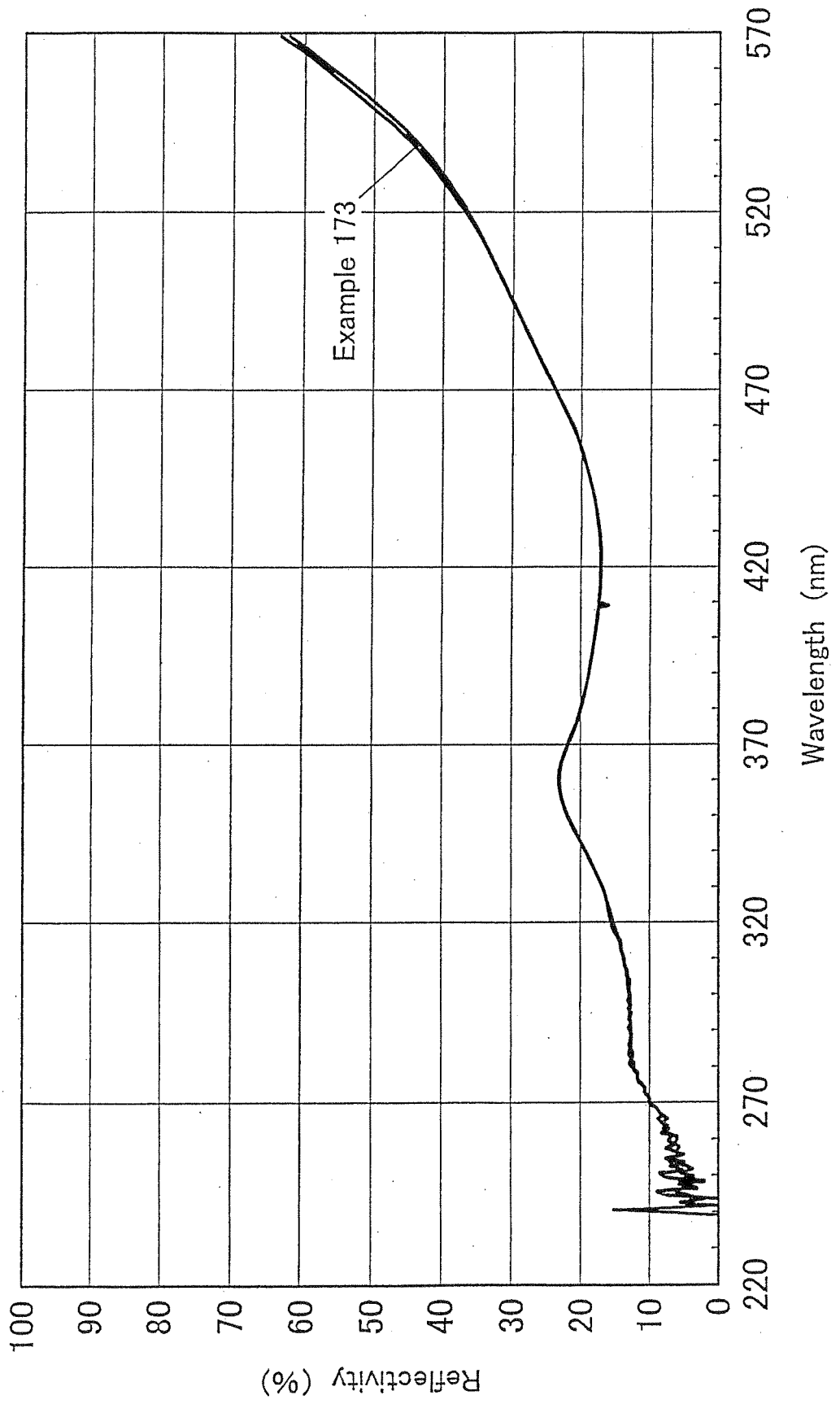


Fig. 25

Emission spectrum (EX=460nm)

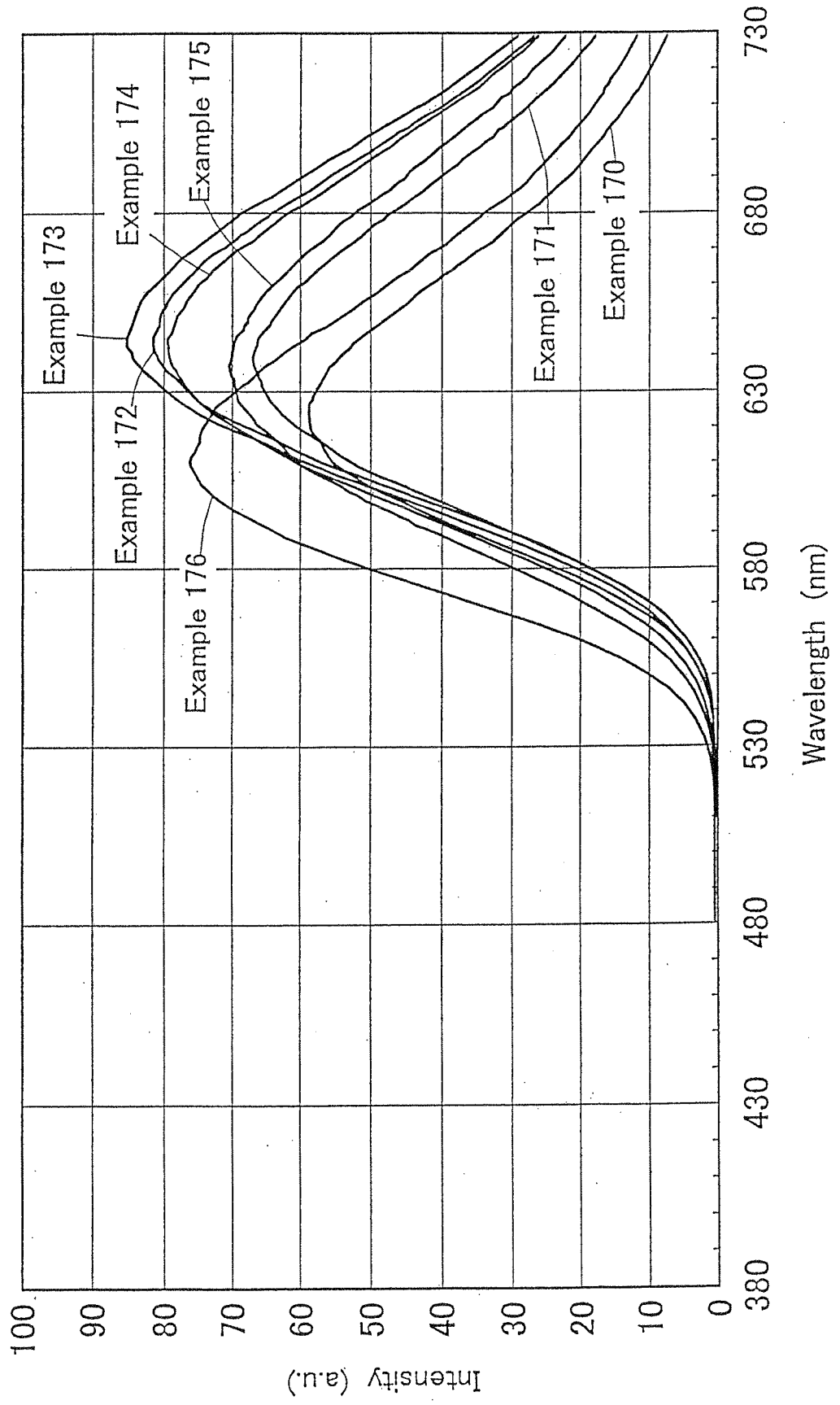


Fig. 26

Emission spectrum (EX=460nm)

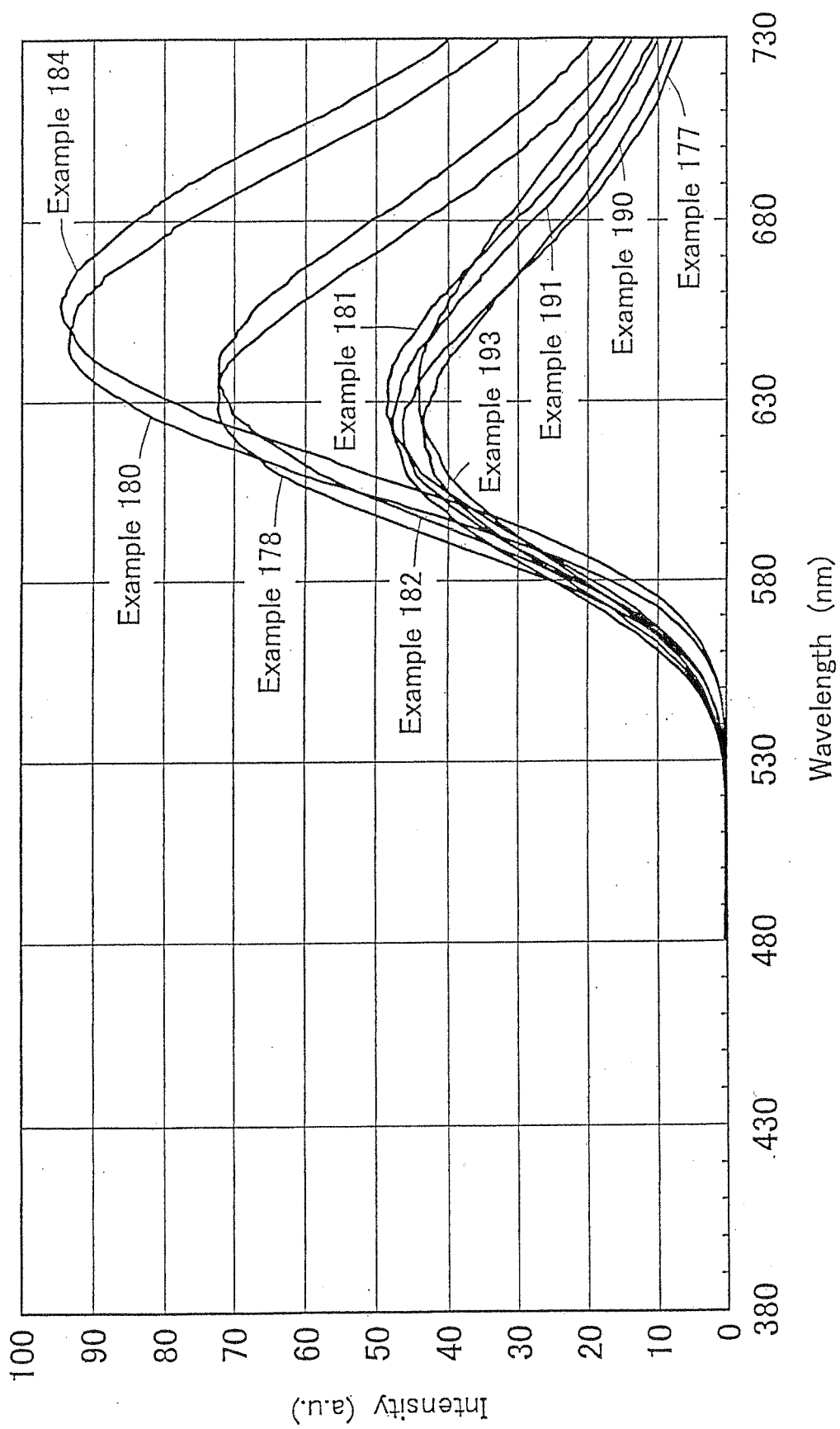


Fig. 27A

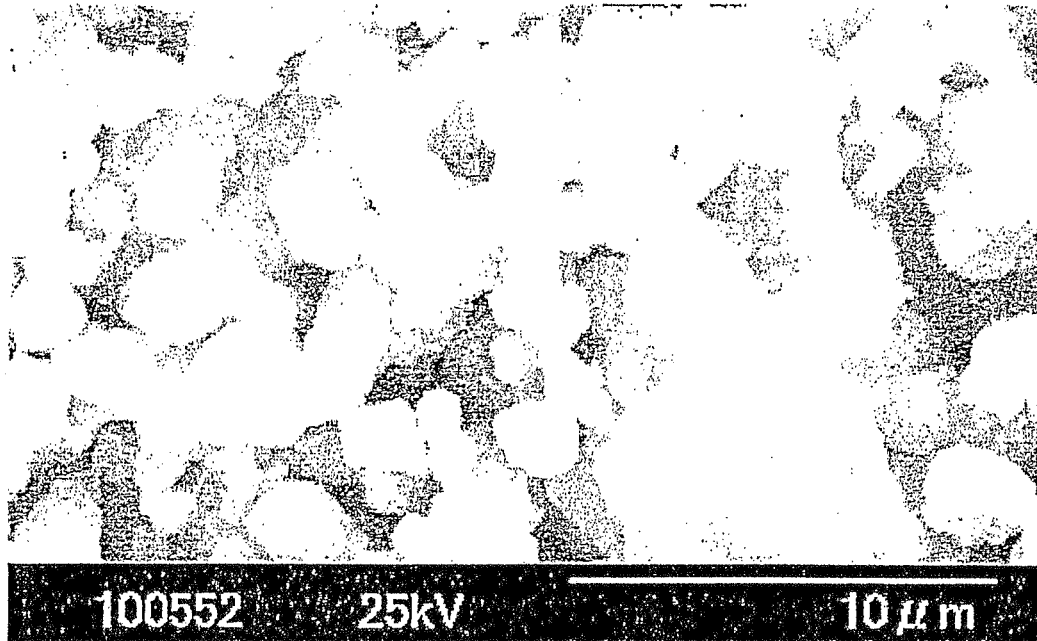


Fig. 27B

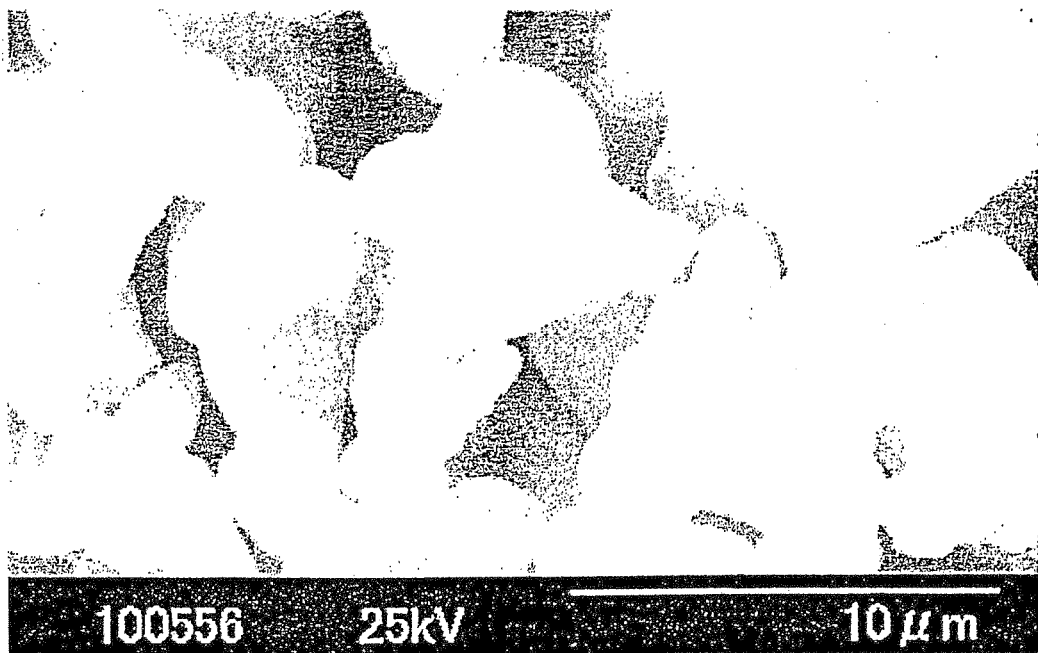


Fig. 28

Whole beam is equalized and compared

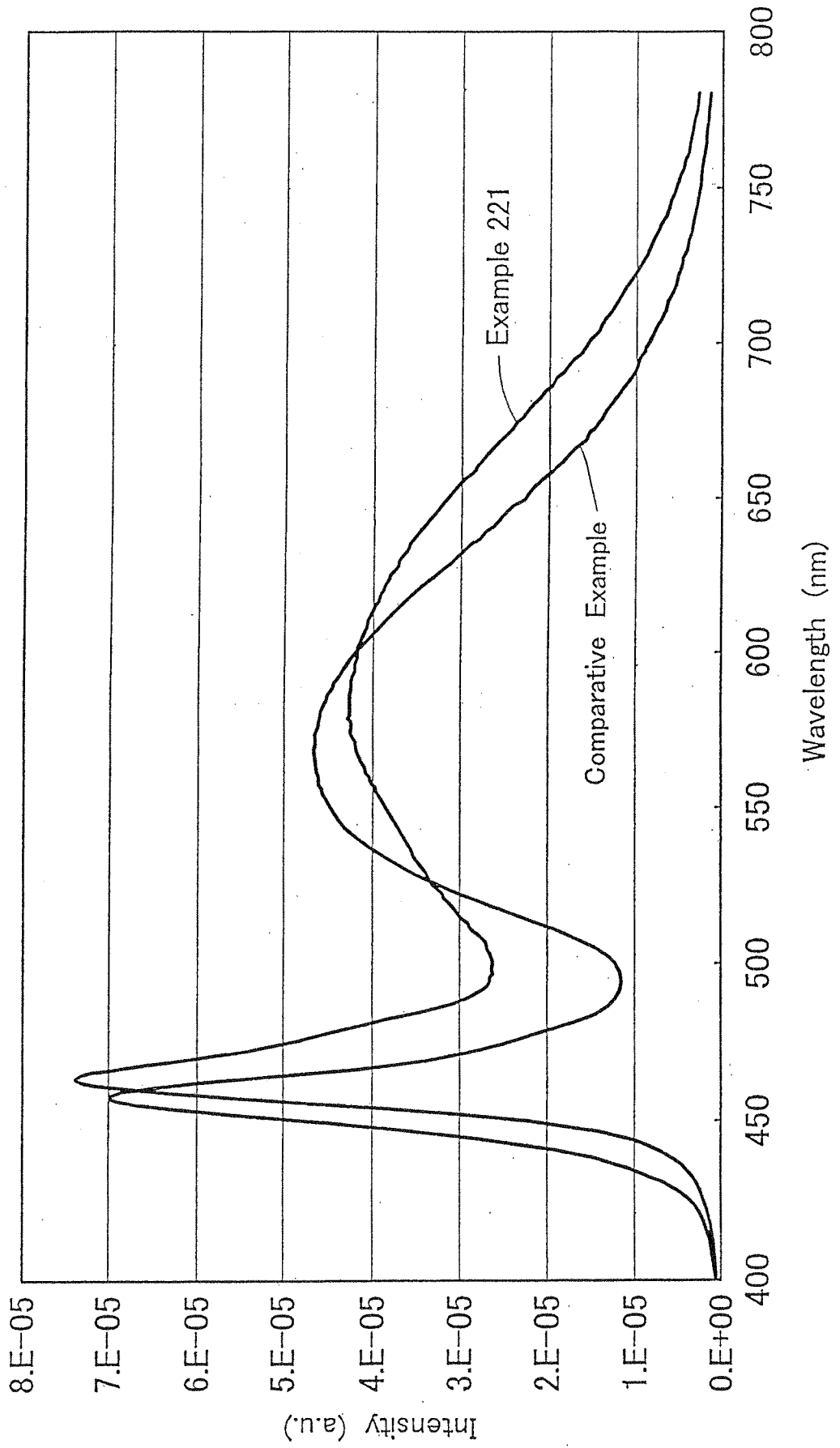


Fig. 29

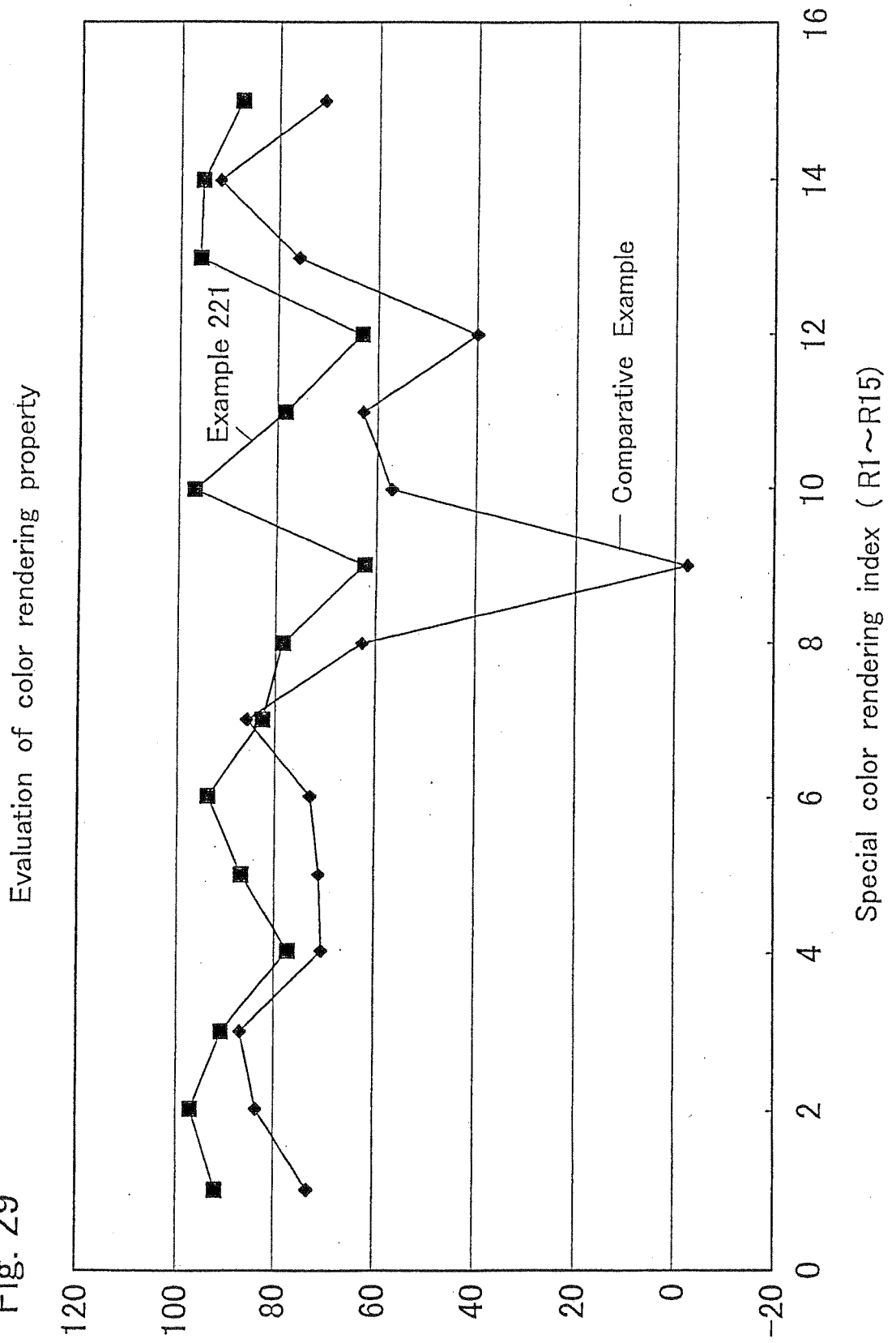


Fig. 30

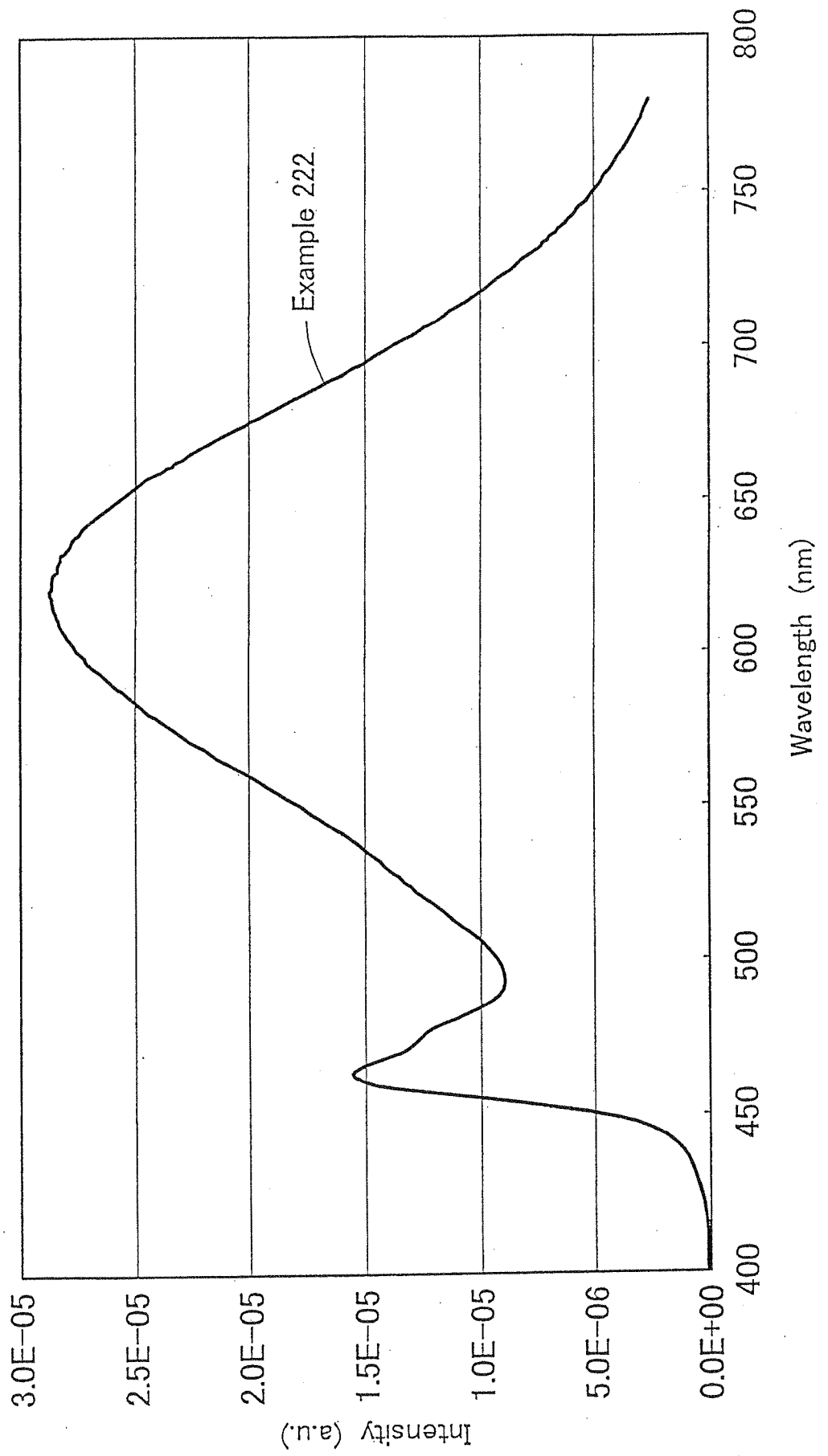


Fig. 31

Evaluation of color rendering property

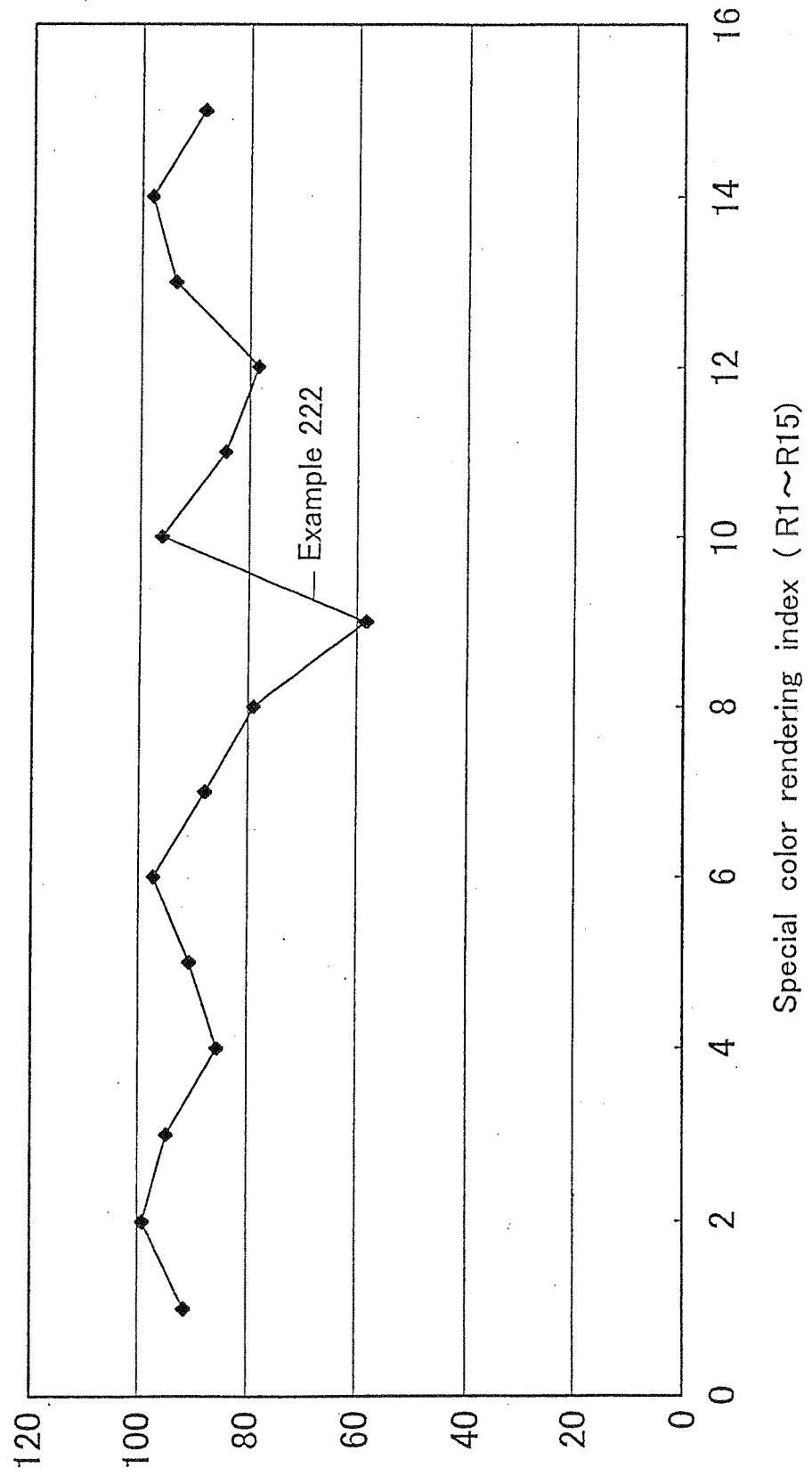
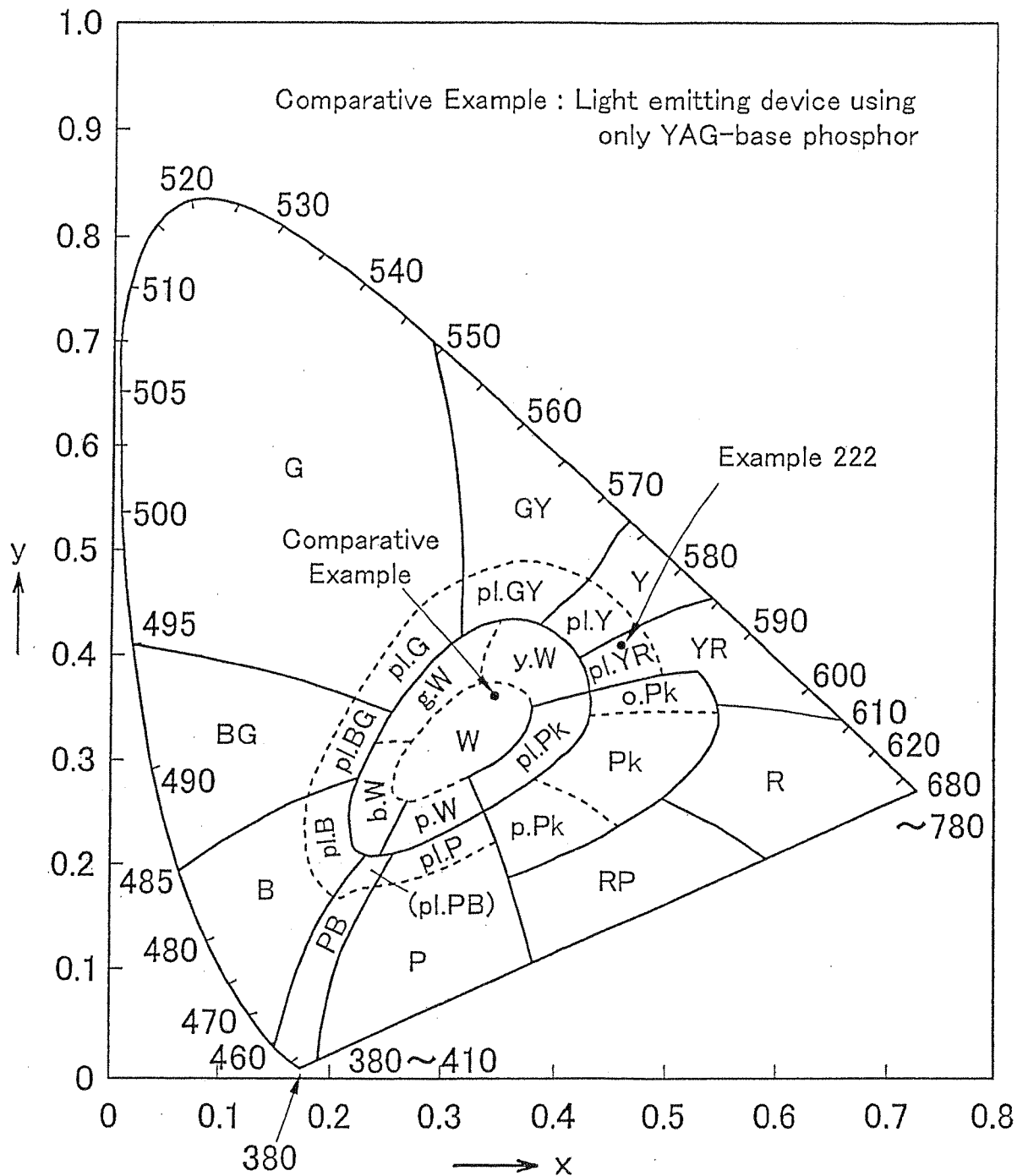
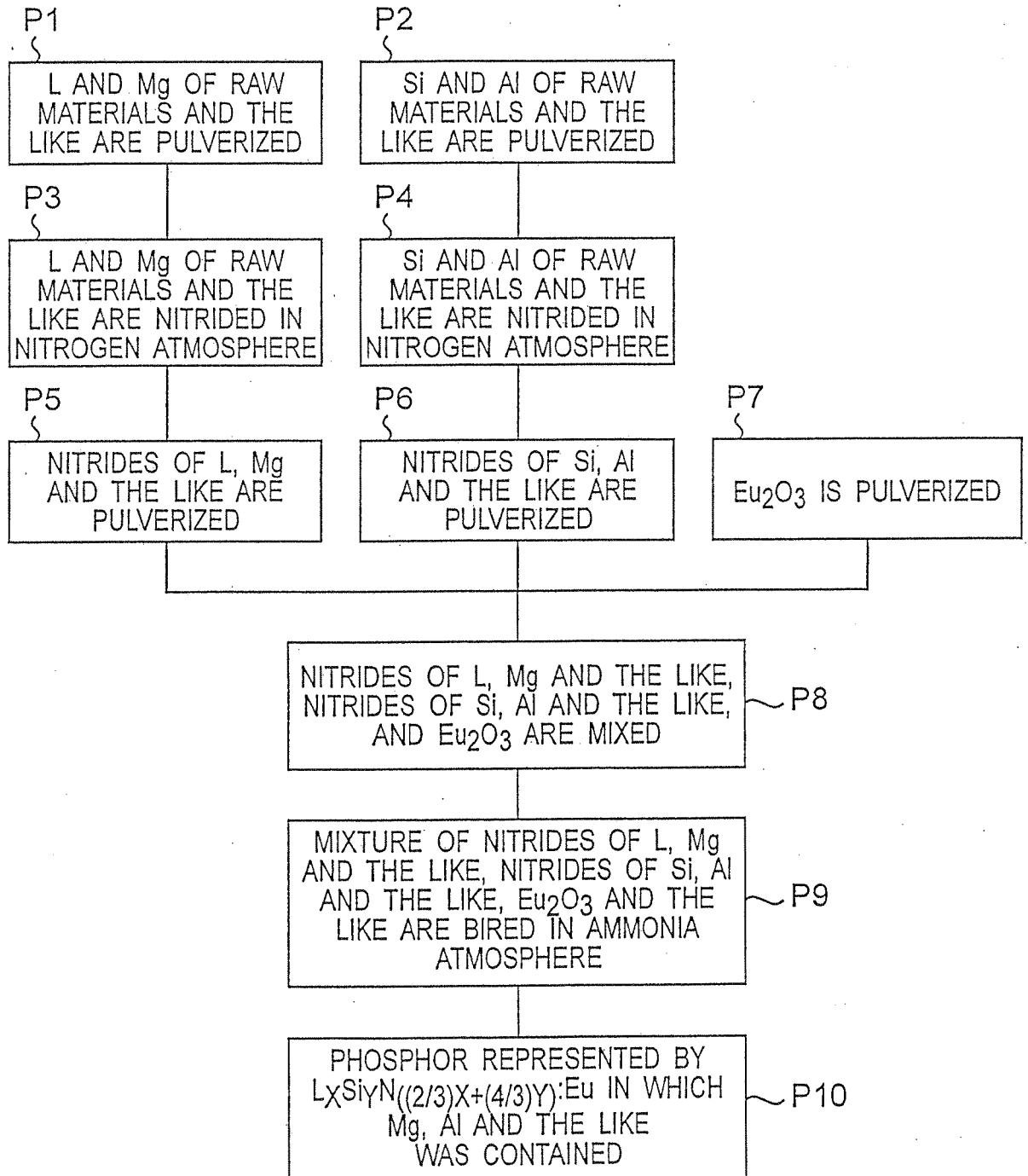


Fig. 32



G : Green	GY : Yellow green	pl.Y : pale yellow	b.W : Bluish white
Y : Yellow	YR : Yellow red	pl.G : pale green	g.W : Greenish white
R : Red	RP : Red purple	pl.B : pale blue	p.W : Purplish white
B : Blue	BG : Blue green	pl.P : pale purple	y.W : Yellowish white
W : White	PB : Blue purple	pl.Pk : pale pink	o.Pk : Orange pink
P : Purple	Pk : Pink	pl.PB : pale blue purple	p.Pk : Purplish pink
		pl.GY : pale yellow green	
		pl.BG : pale blue green	
		pl.YR : pale yellow red	

Fig.33



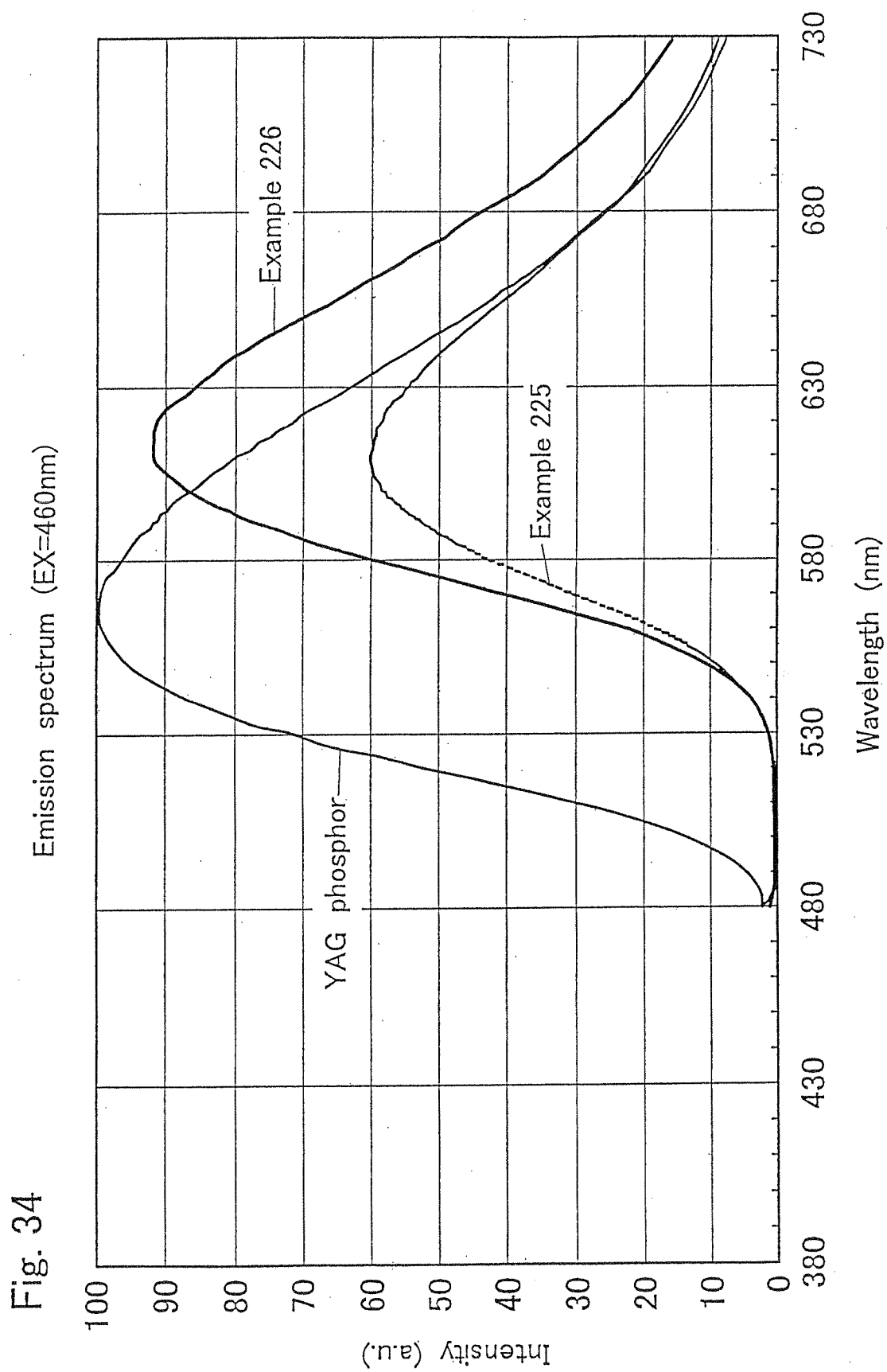
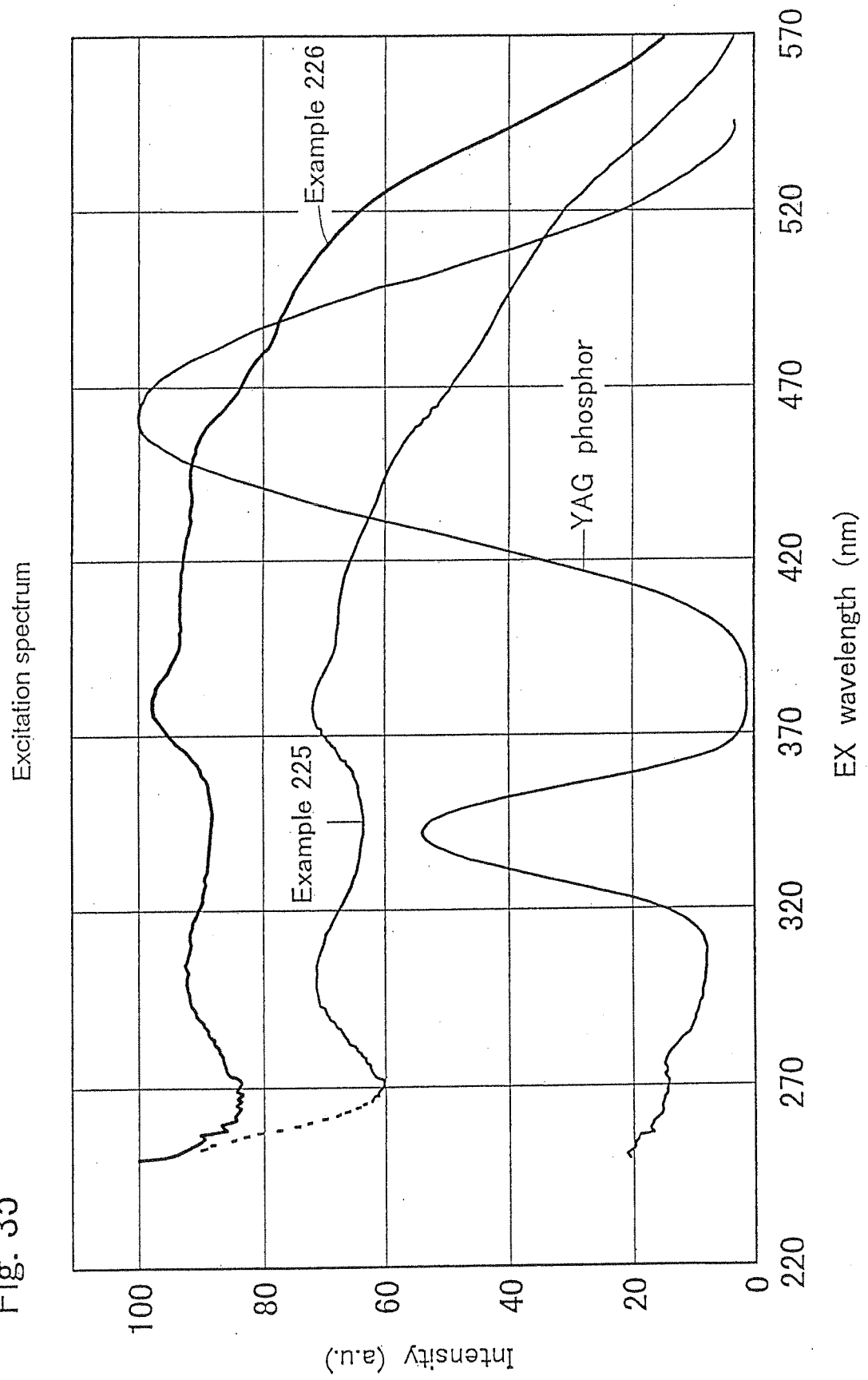


Fig. 35



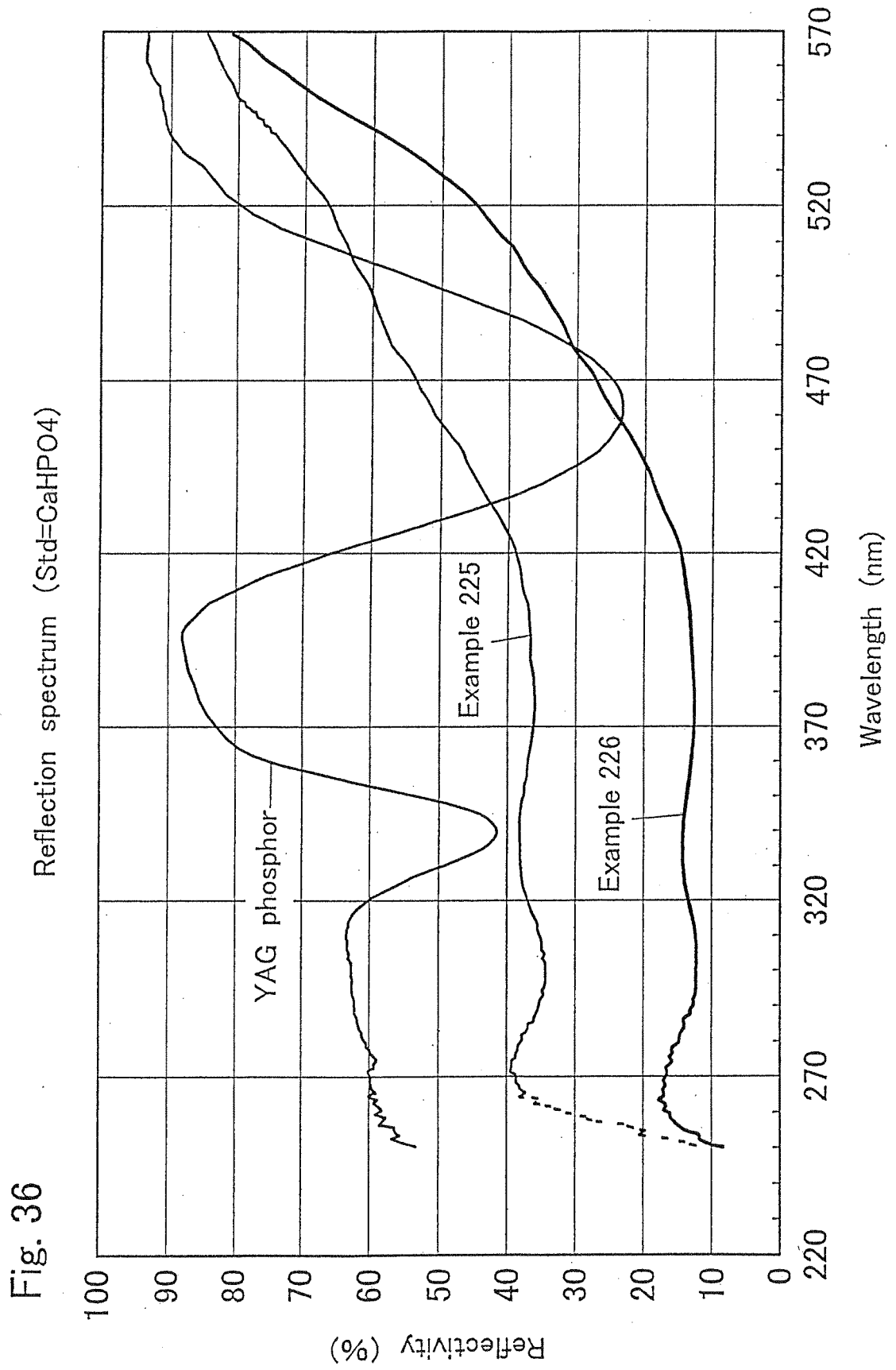
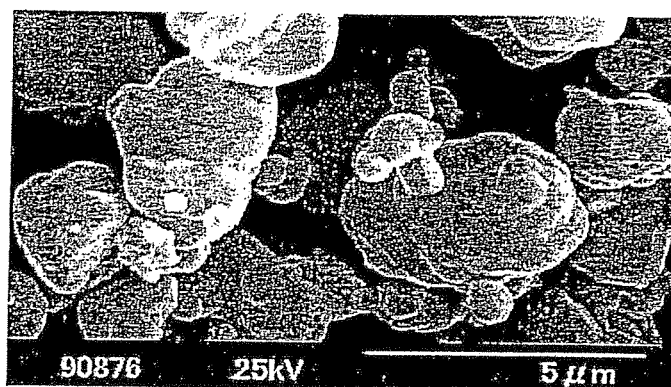


Fig. 37

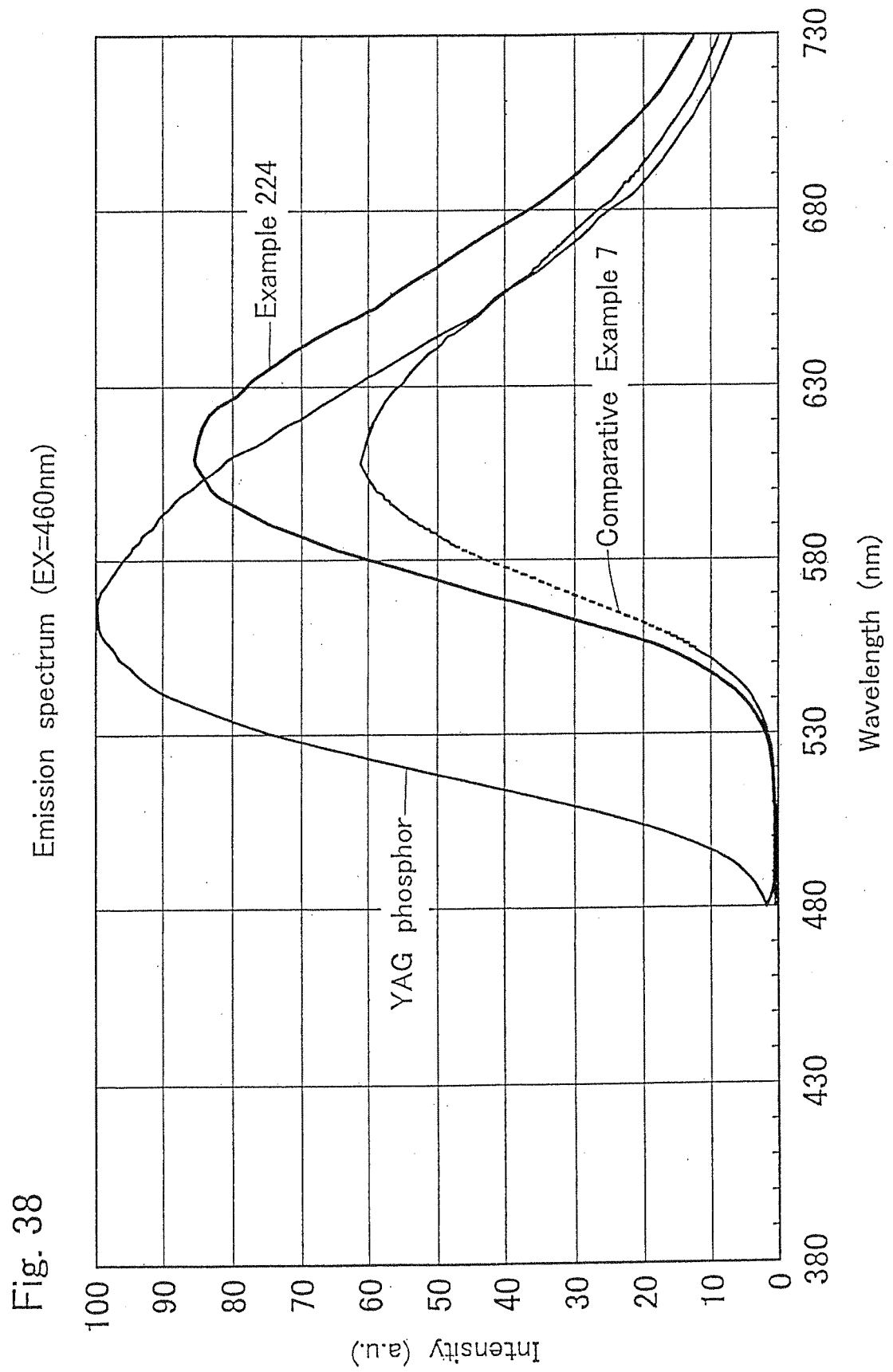


Fig. 39

Emission spectrum (EX=460nm)

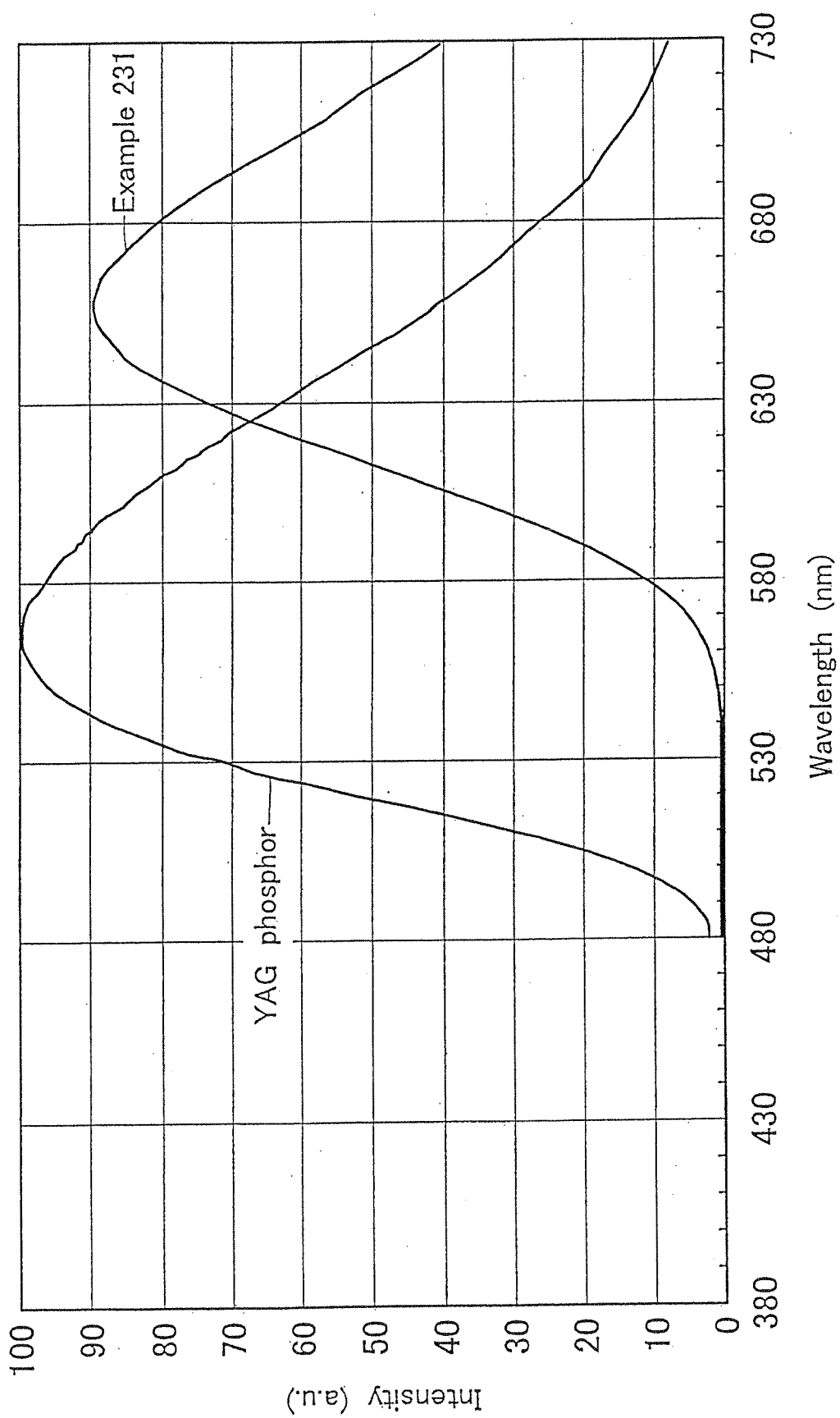


Fig. 40

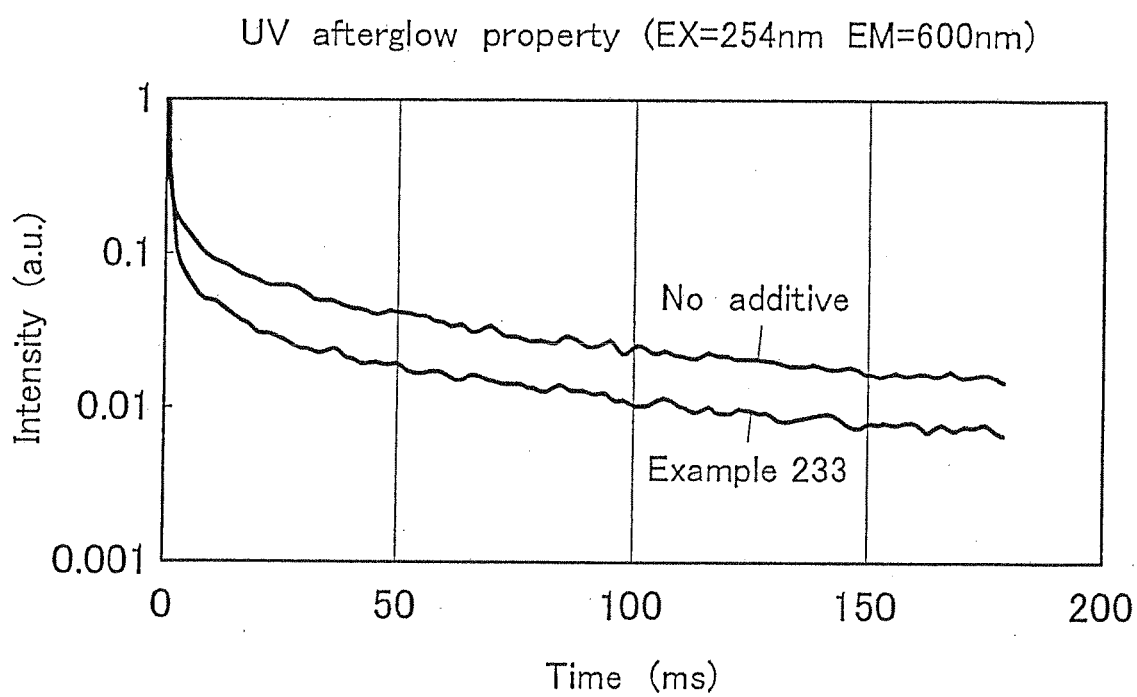


Fig. 41

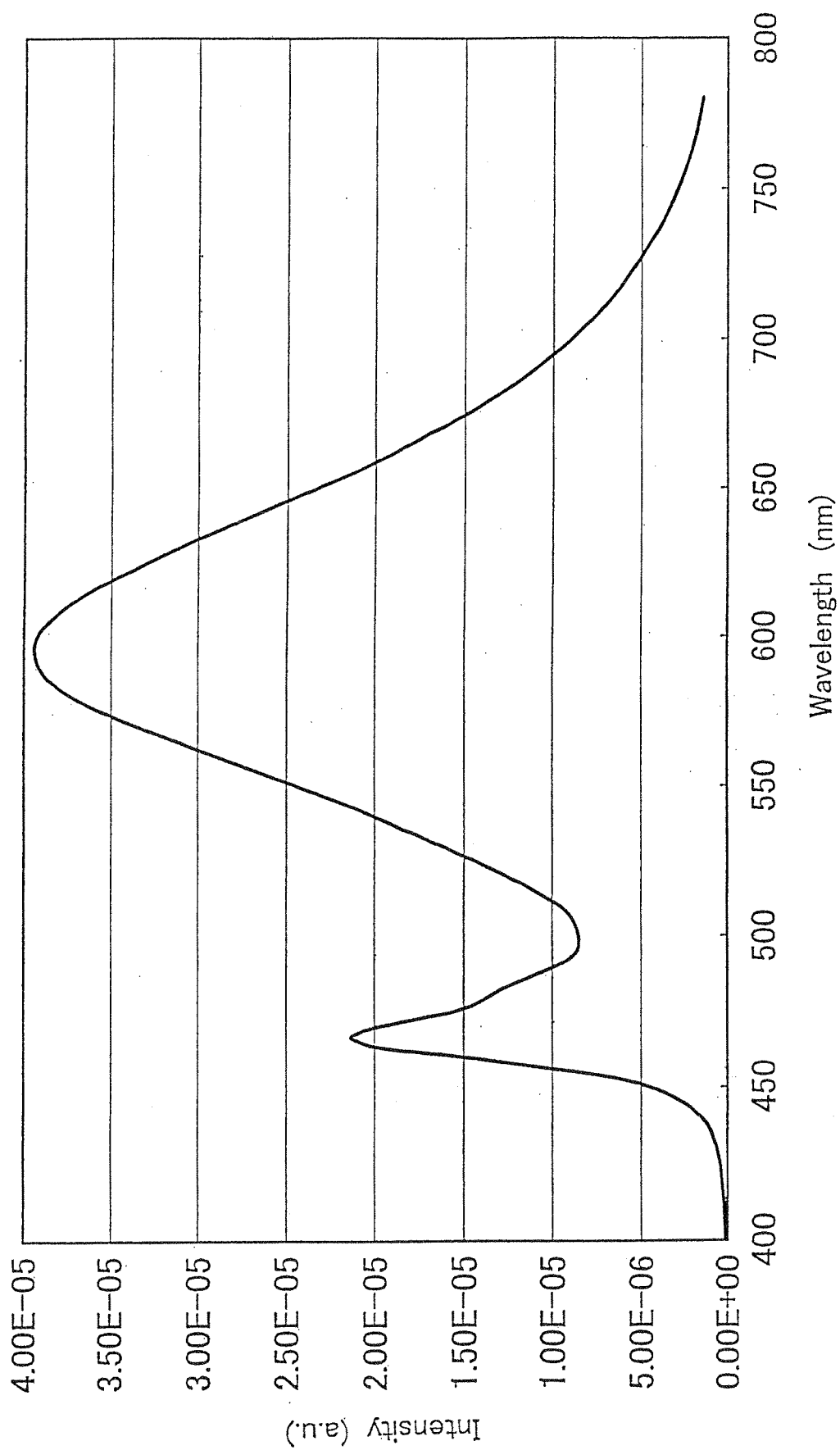
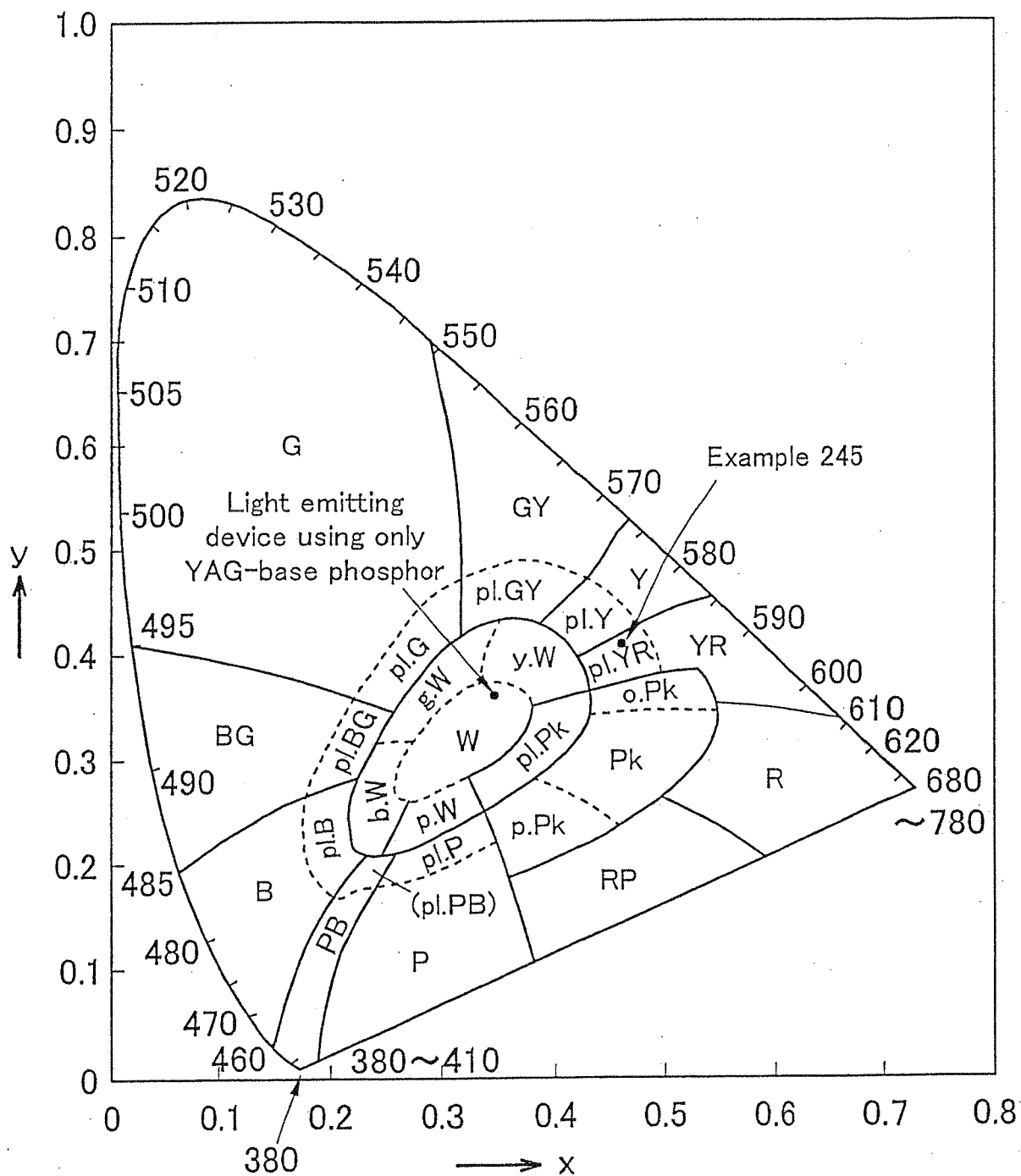


Fig. 42



G : Green
Y : Yellow
R : Red
B : Blue
W : White
P : Purple
GY : Yellow green
YR : Yellow red
RP : Red purple
BG : Blue green
PB : Blue purple
Pk : Pink

pl.Y : pale yellow
pl.G : pale green
pl.B : pale blue
pl.P : pale purple
pl.Pk : pale pink
pl.PB : pale blue purple
pl.GY : pale yellow green
pl.BG : pale blue green
pl.YR : pale yellow red

b.W : Bluish white
g.W : Greenish white
p.W : Purplish white
y.W : Yellowish white
o.Pk : Orange pink
p.Pk : Purplish pink

Fig. 43

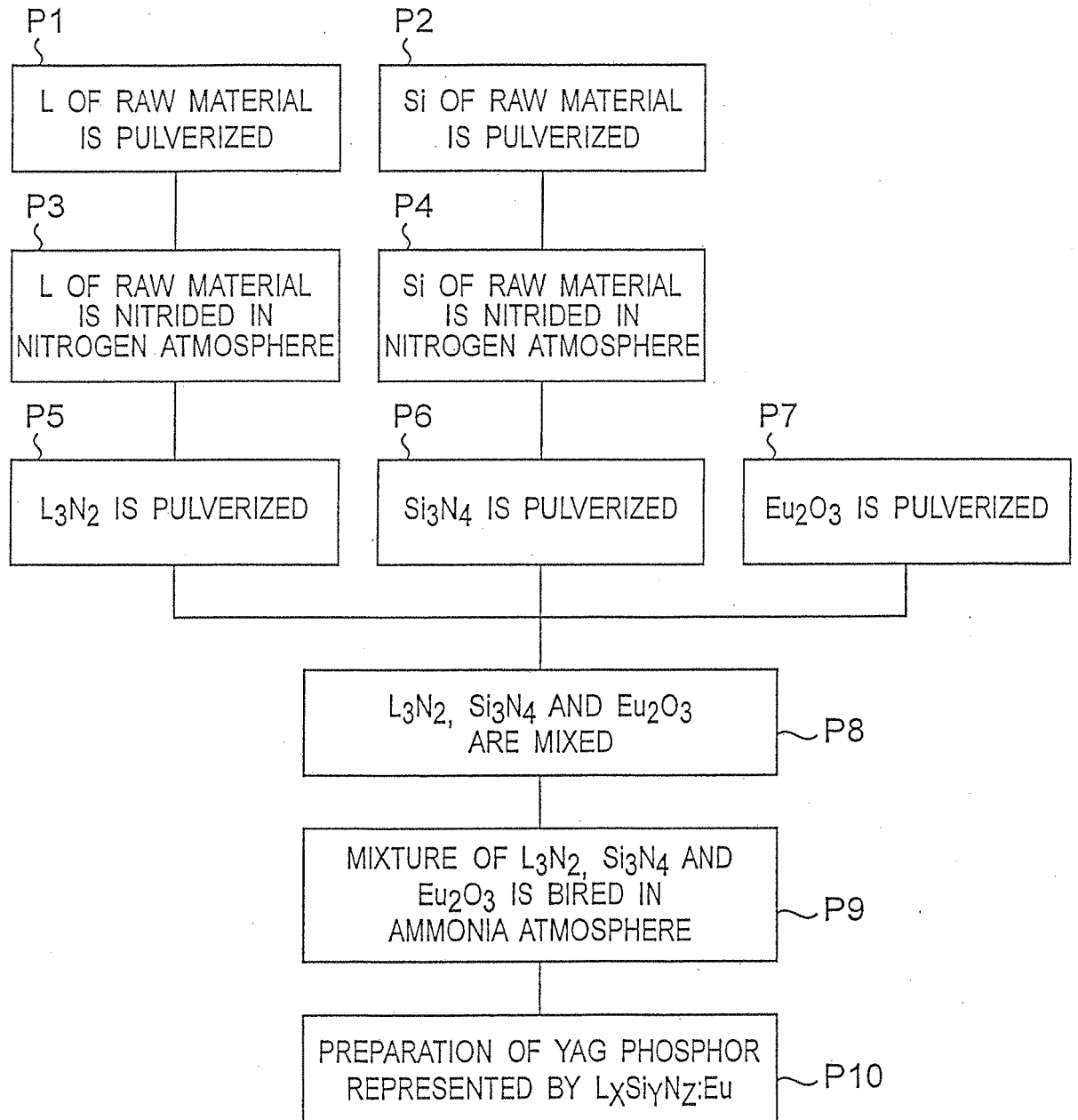
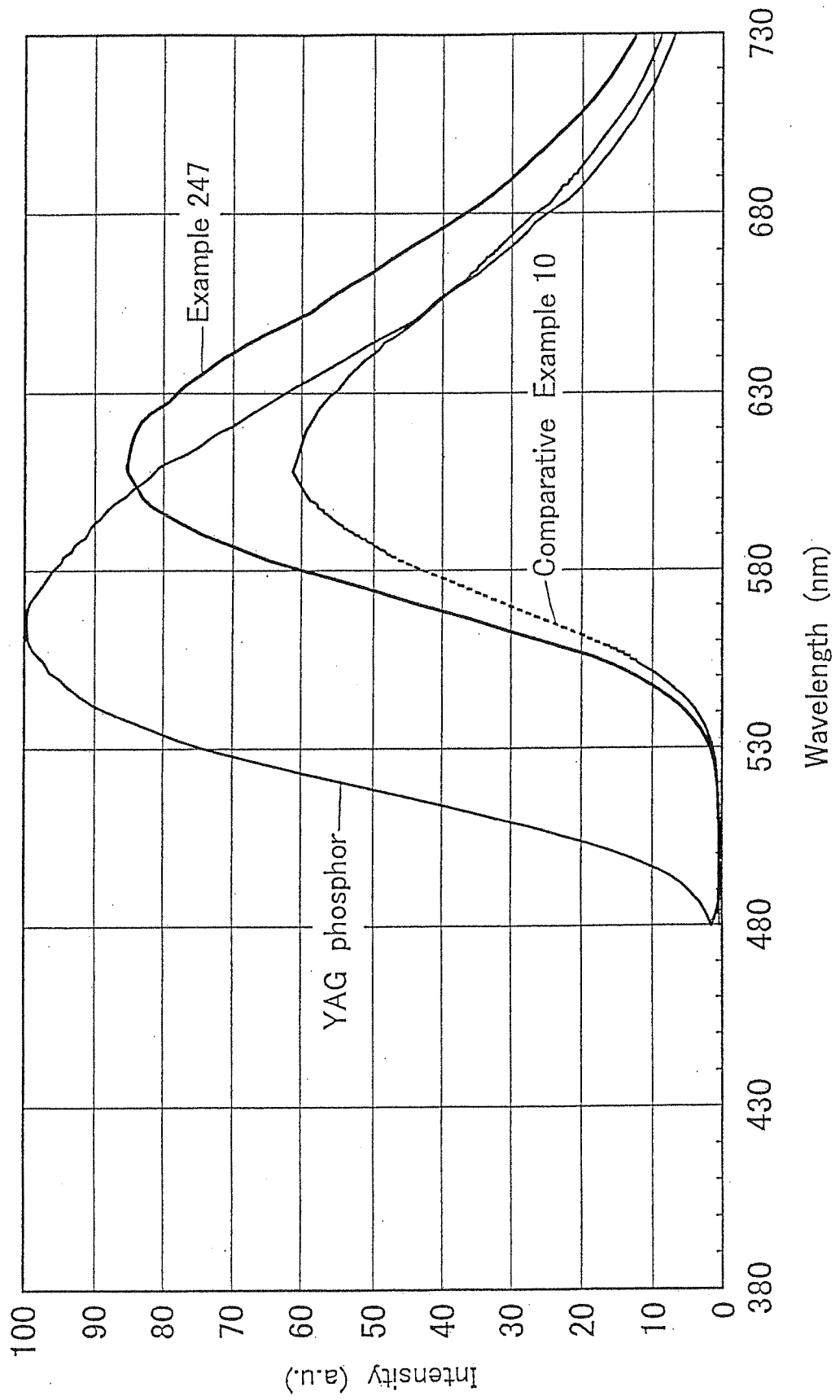


Fig. 44

Emission spectrum (EX=460nm)



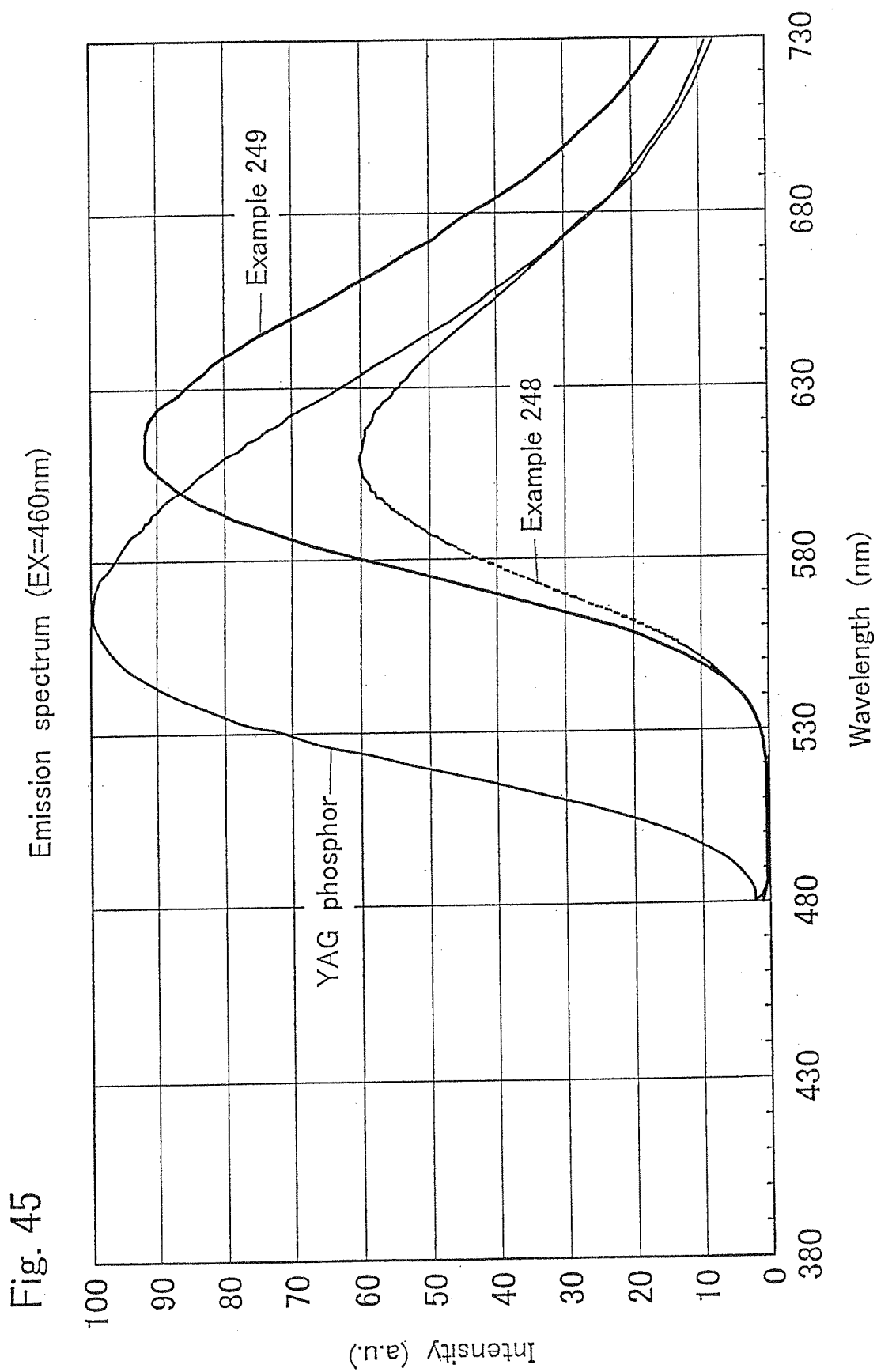
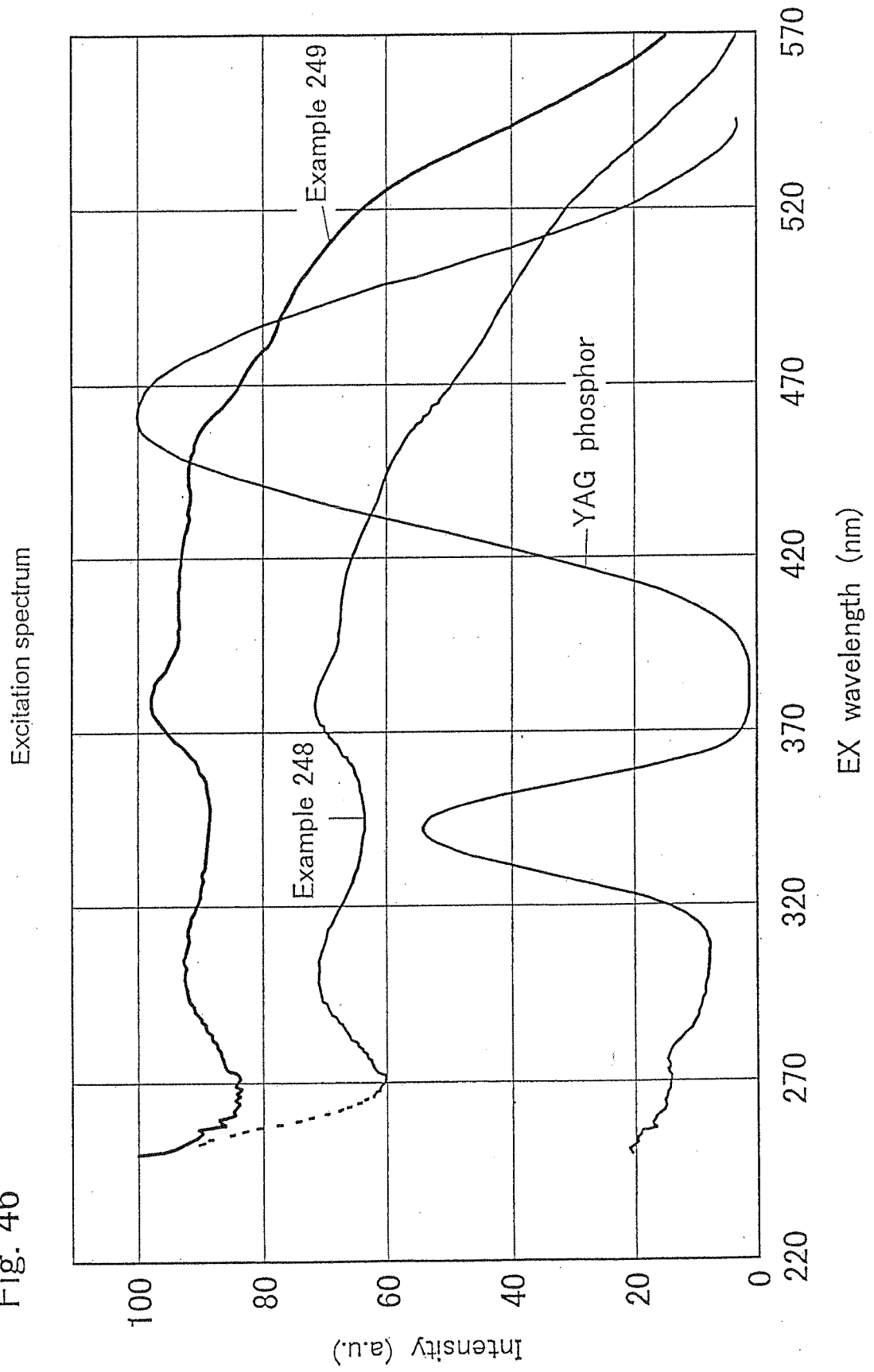
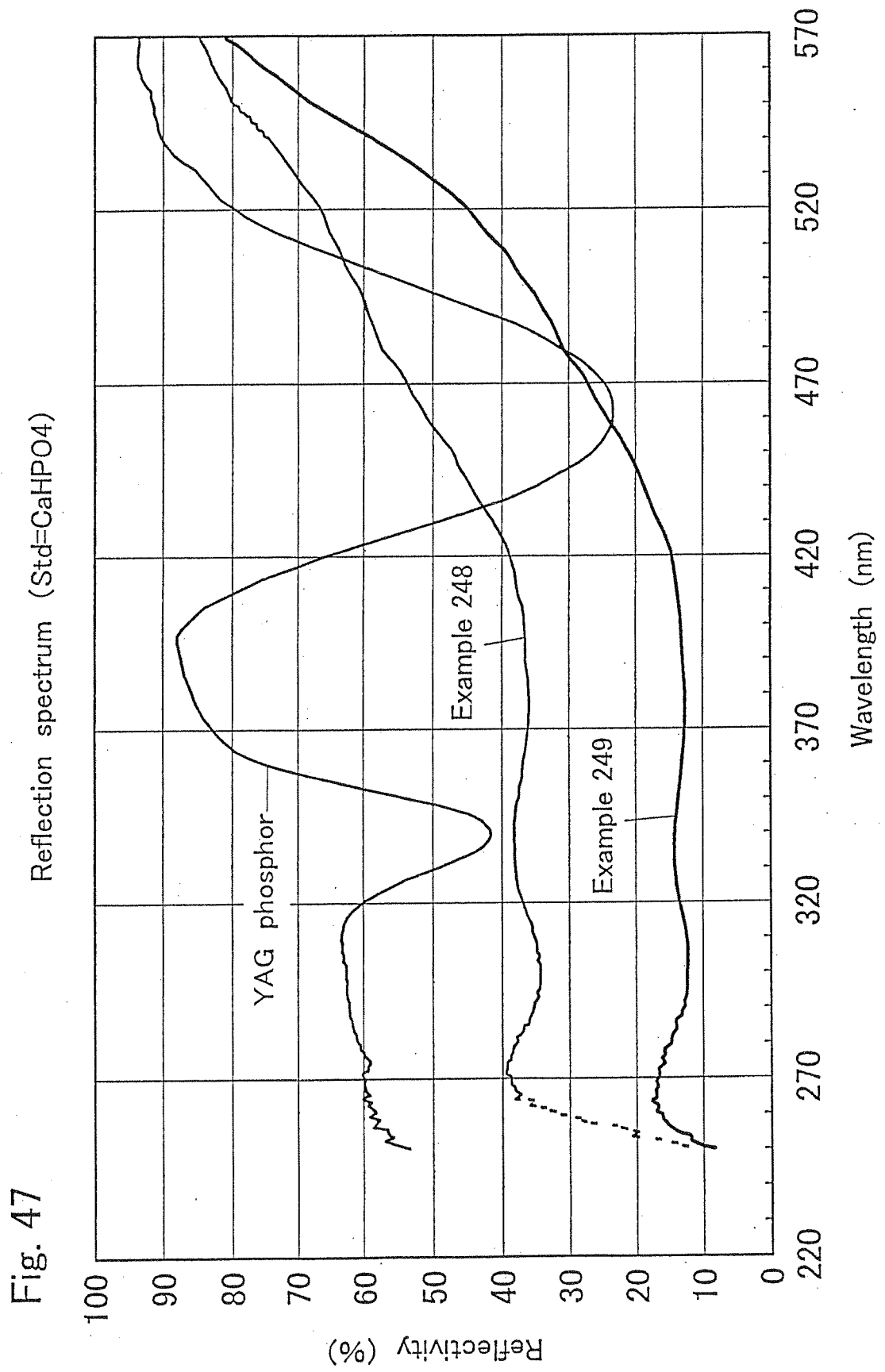
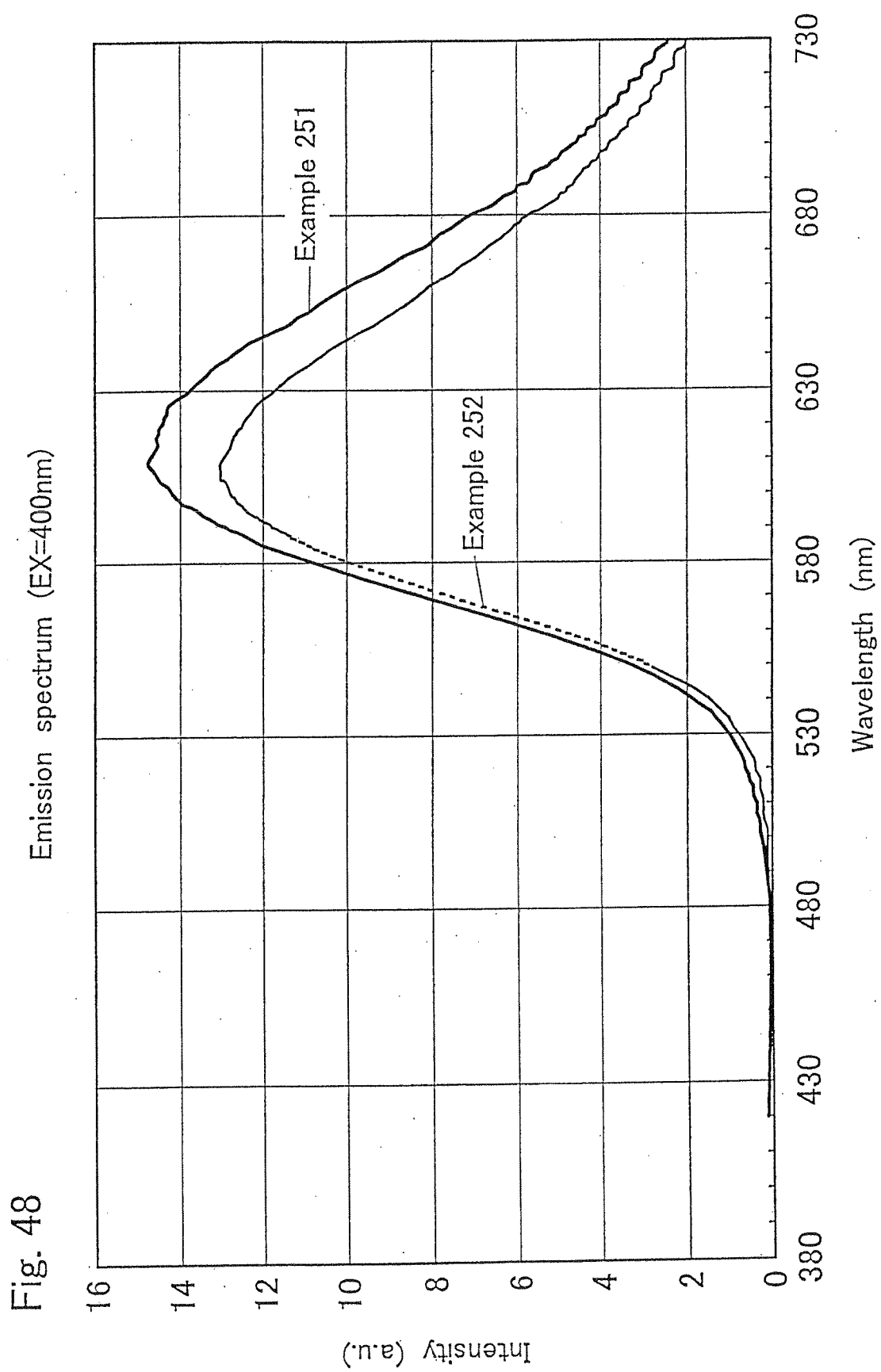
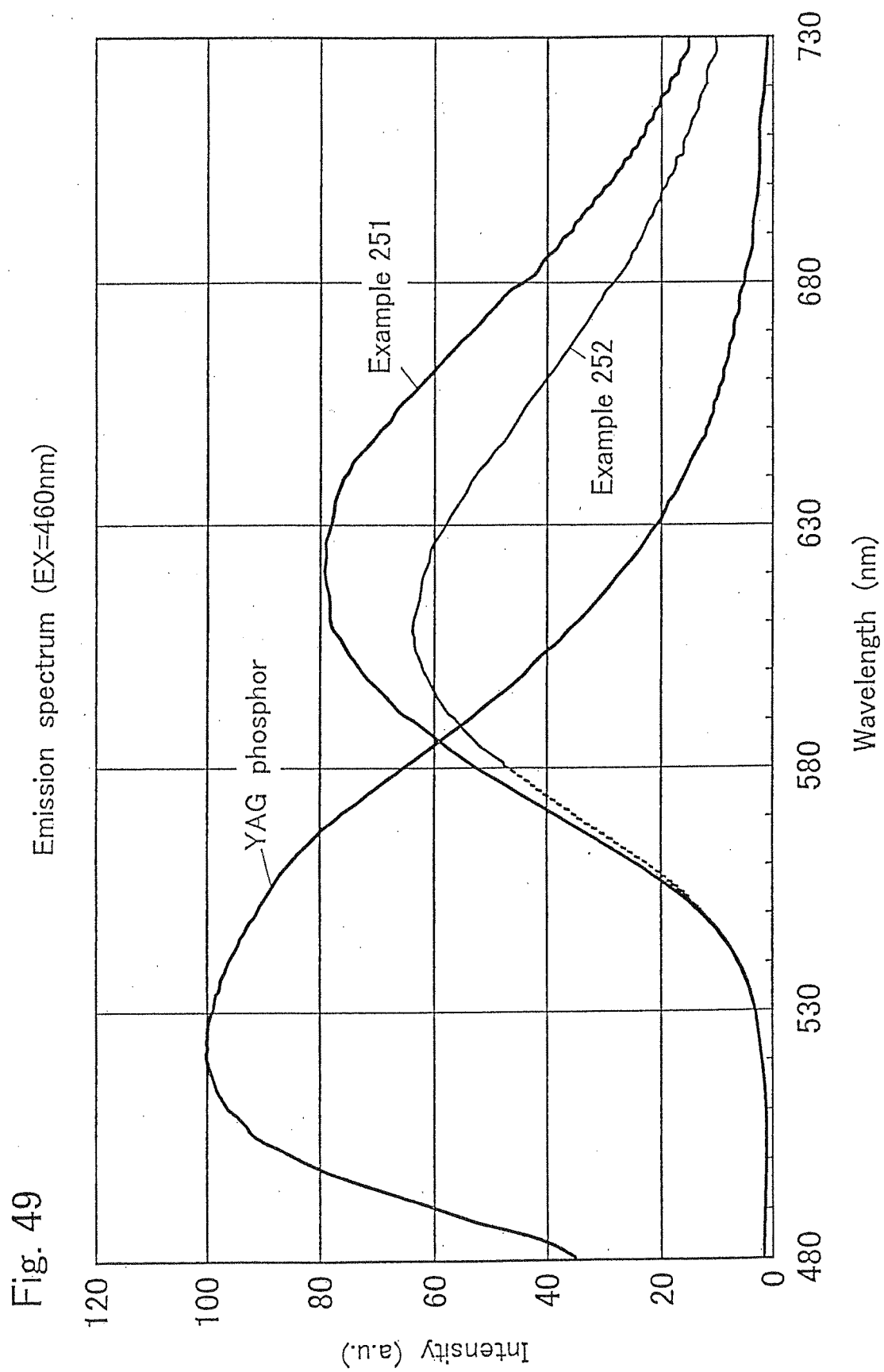


Fig. 46









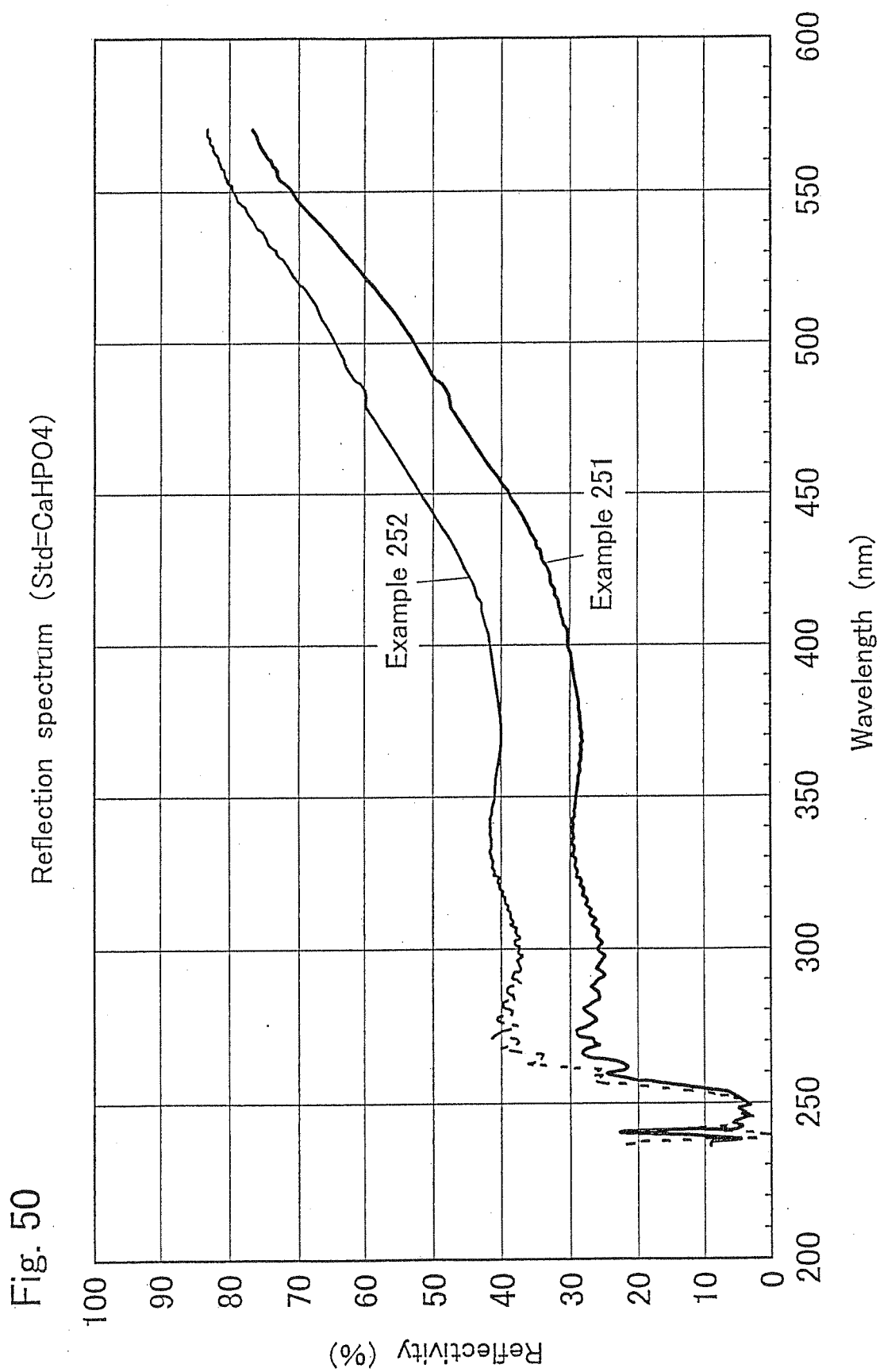
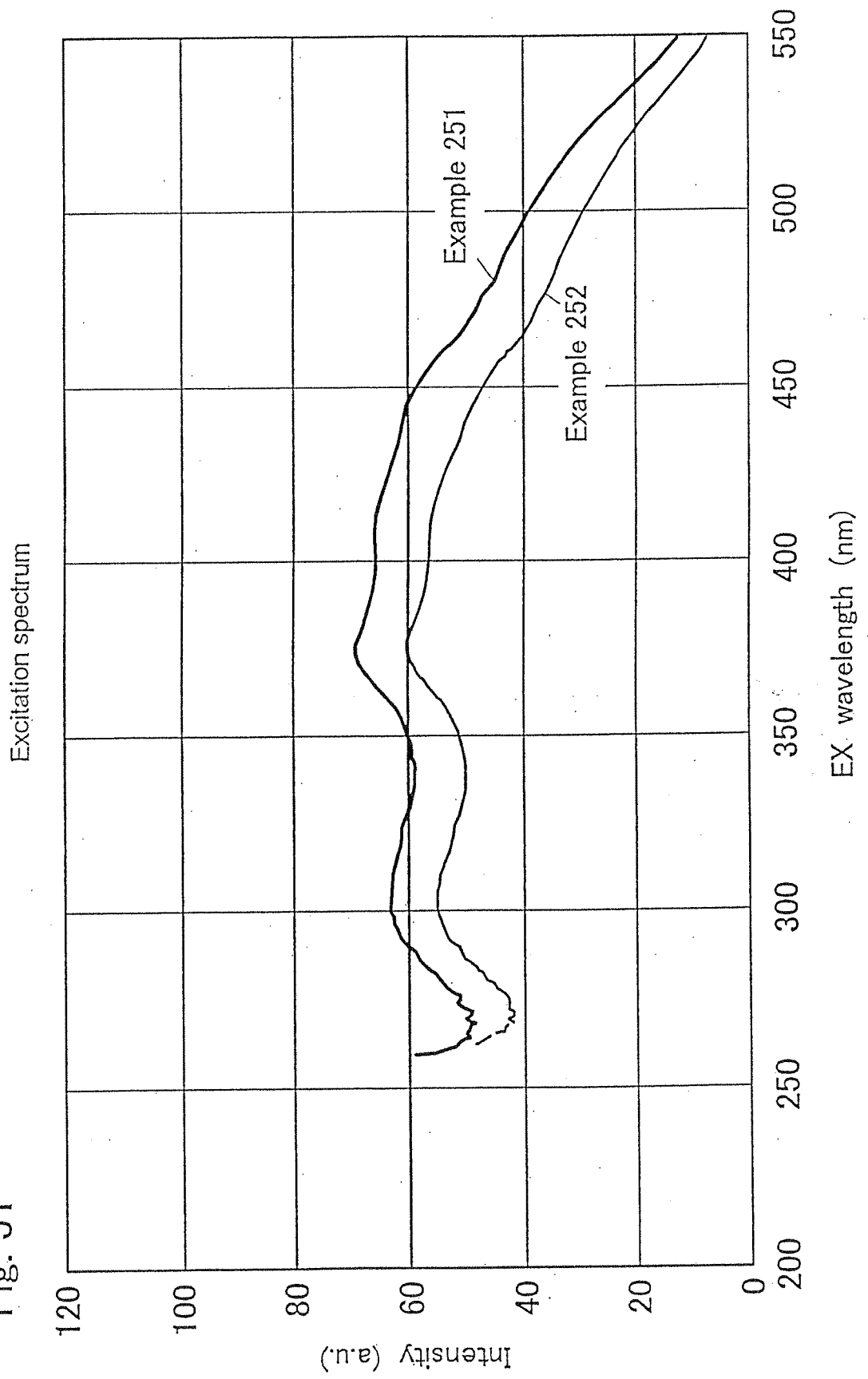


Fig. 51



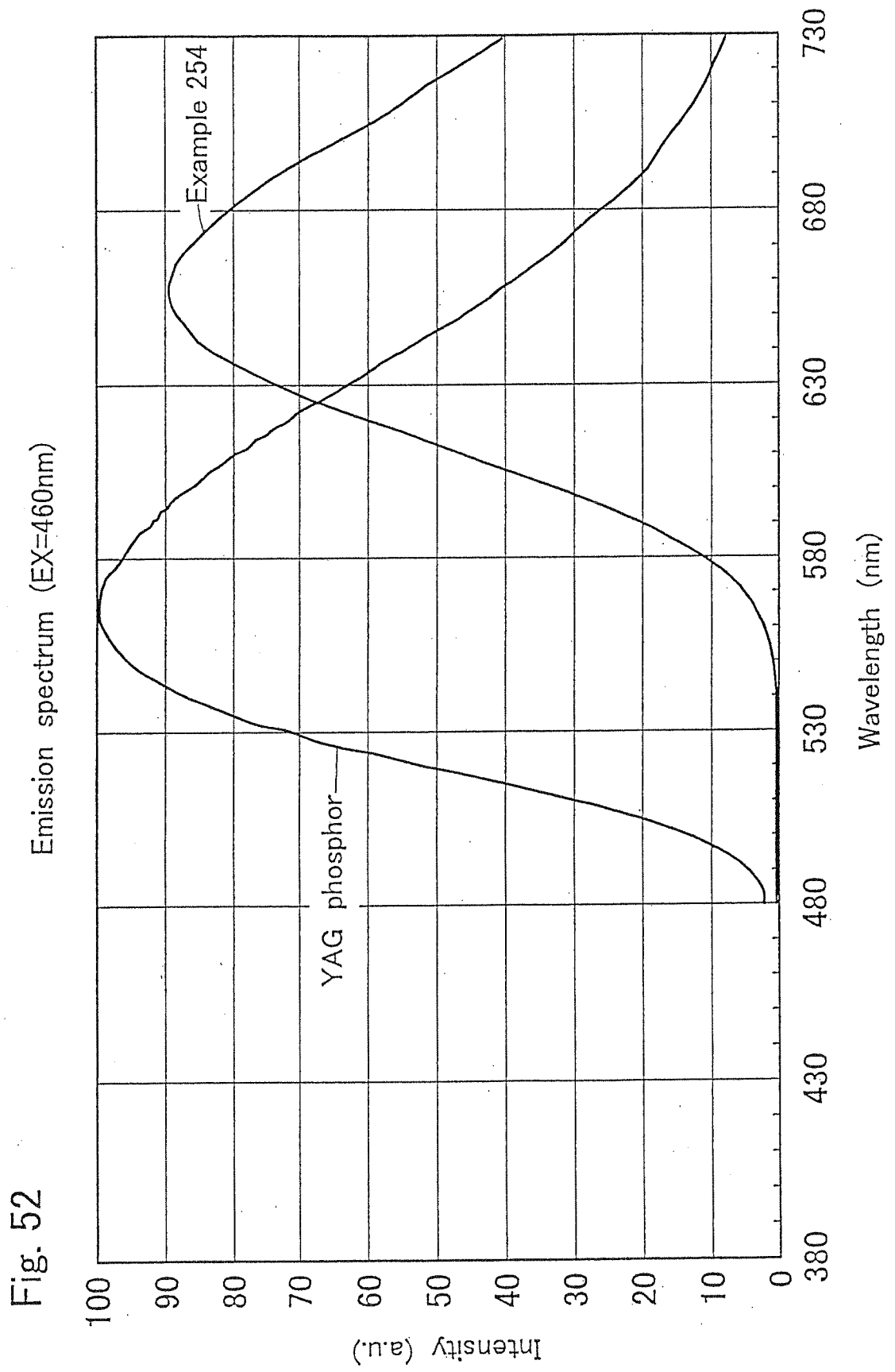


Fig. 53

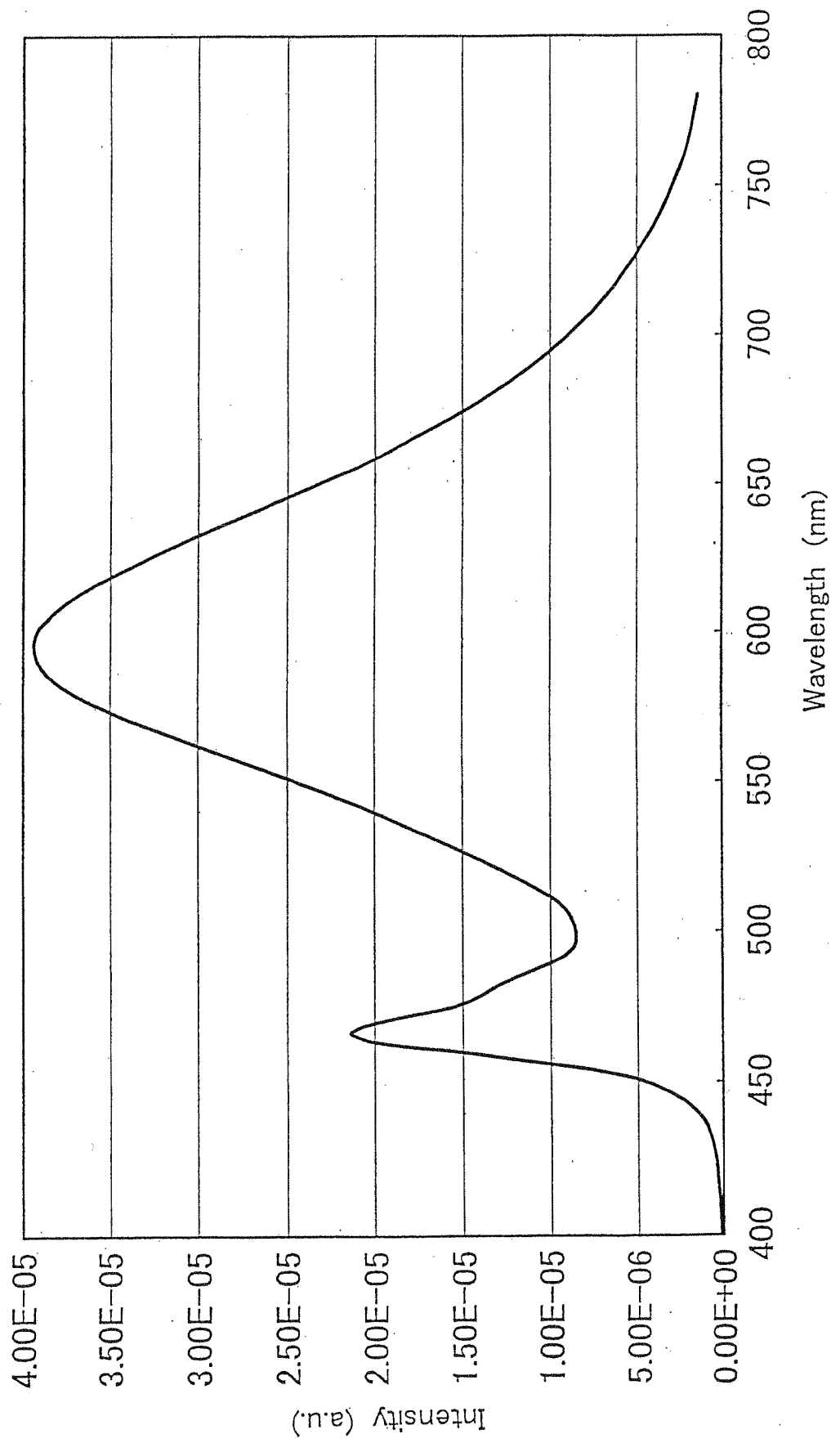
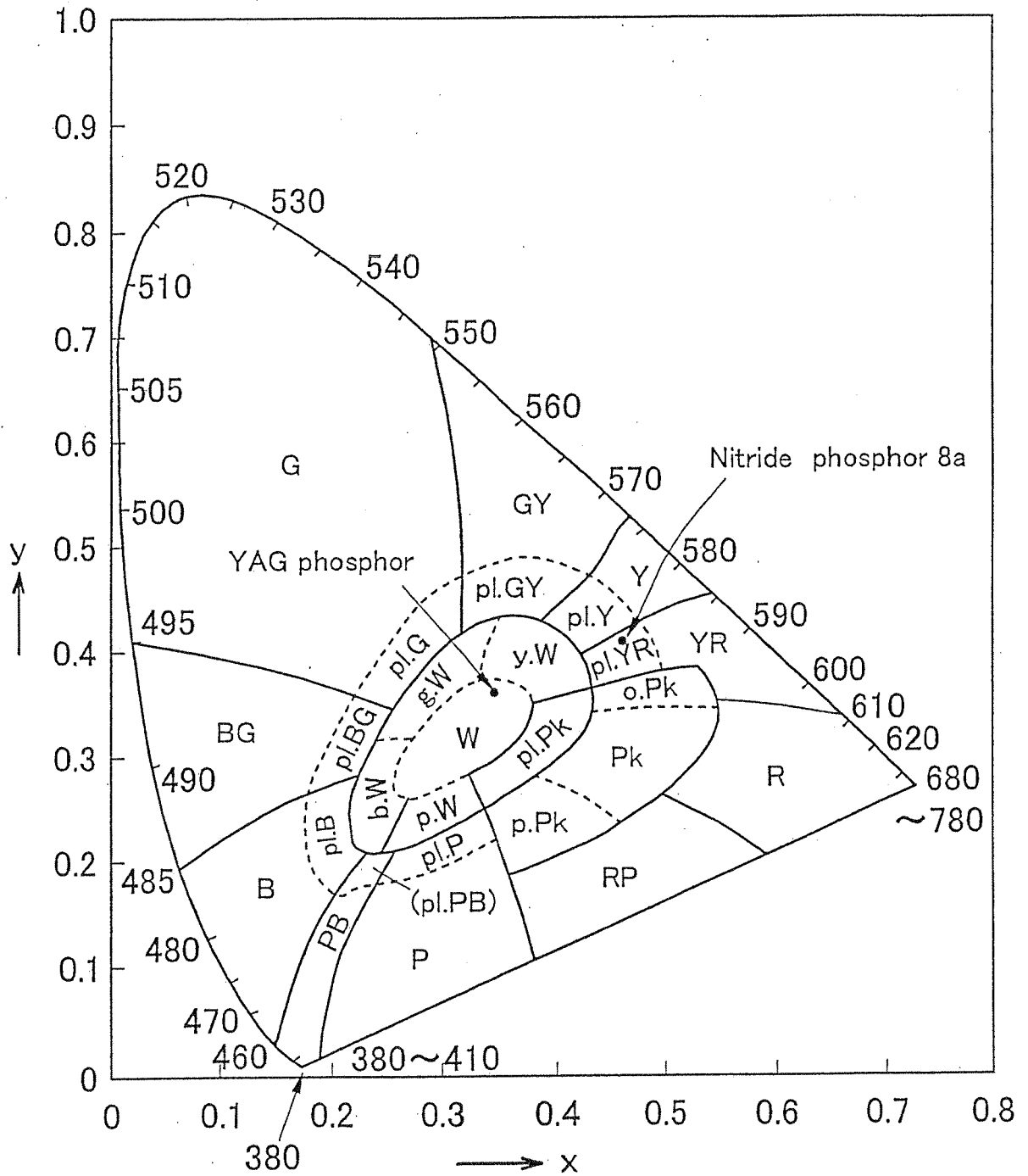


Fig. 54



G : Green
 Y : Yellow
 R : Red
 B : Blue
 W : White
 P : Purple

GY : Yellow green
 YR : Yellow red
 RP : Red purple
 BG : Blue green
 PB : Blue purple
 Pk : Pink

pl.Y : pale yellow
 pl.G : pale green
 pl.B : pale blue
 pl.P : pale purple
 pl.Pk : pale pink
 pl.PB : pale blue purple
 pl.GY : pale yellow green
 pl.BG : pale blue green
 pl.YR : pale yellow red

b.W : Bluish white
 g.W : Greenish white
 p.W : Purplish white
 y.W : Yellowish white
 o.Pk : Orange pink
 p.Pk : Purplish pink

Fig. 55

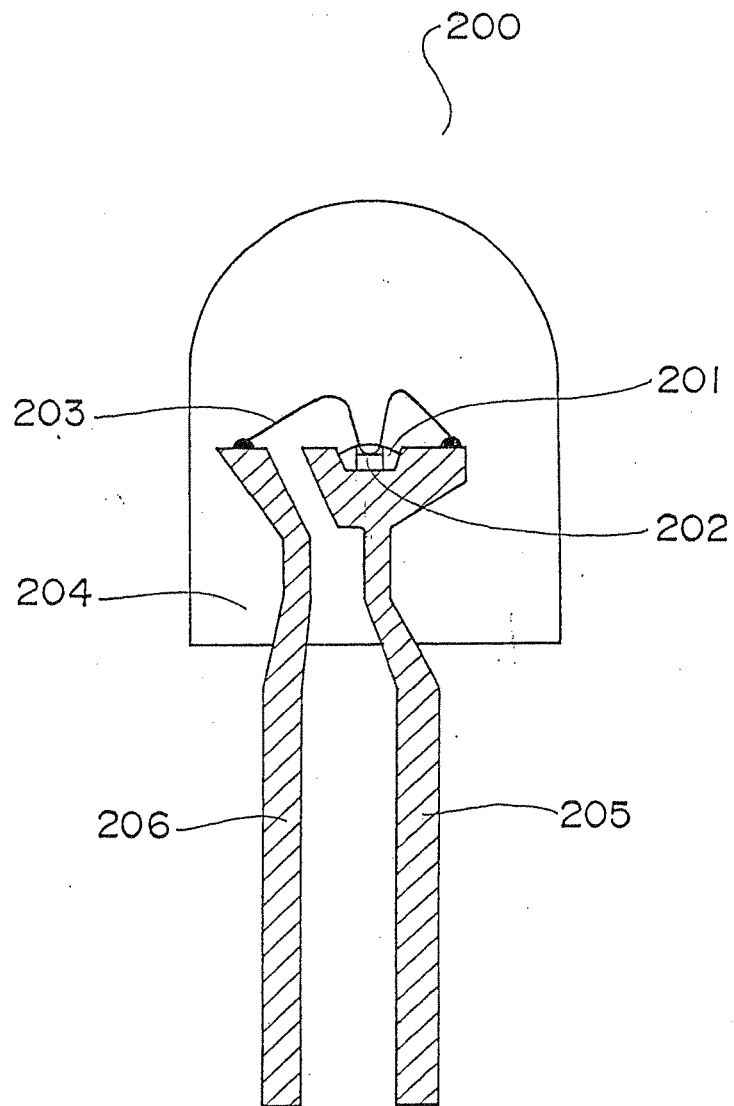
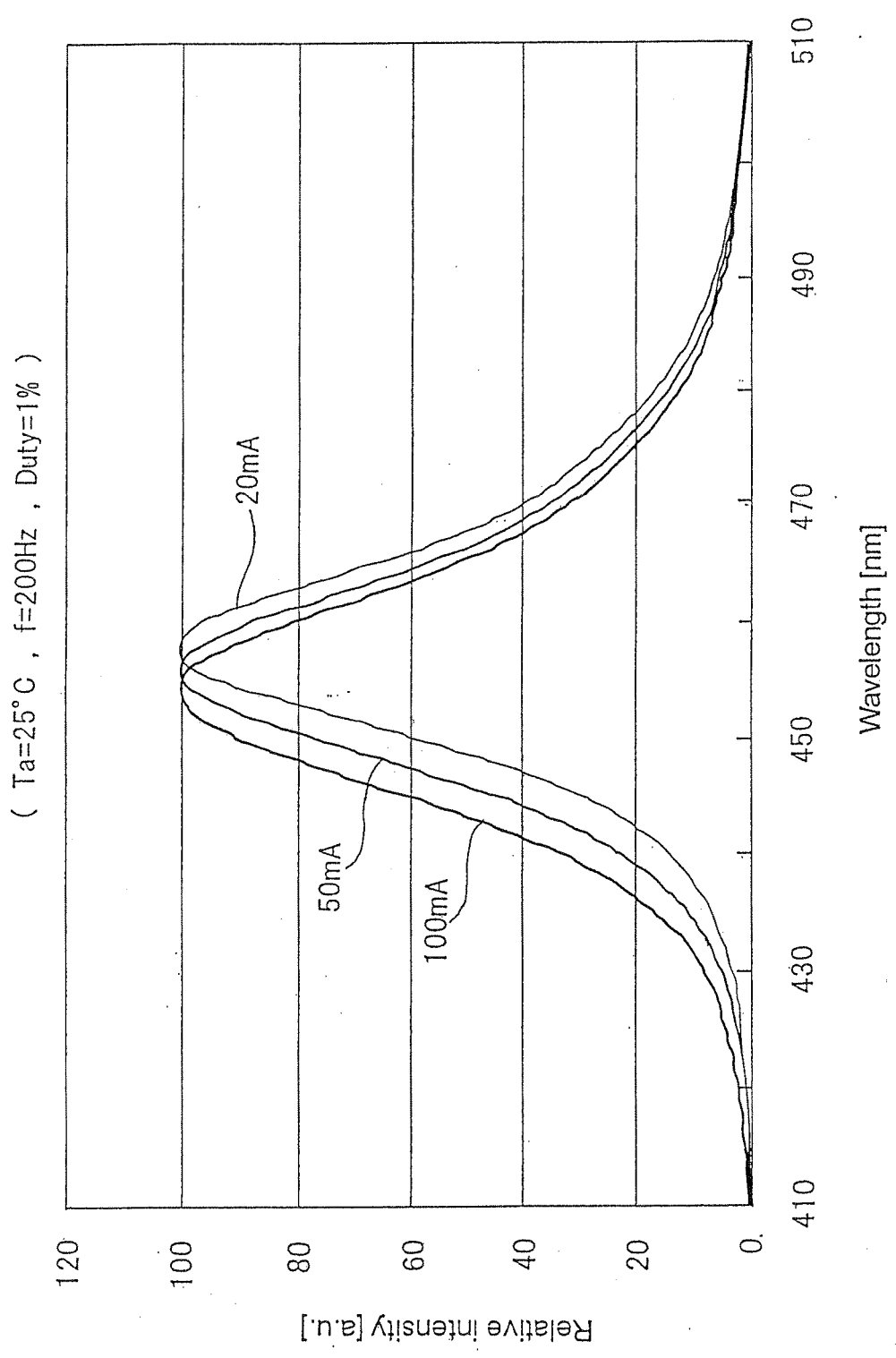
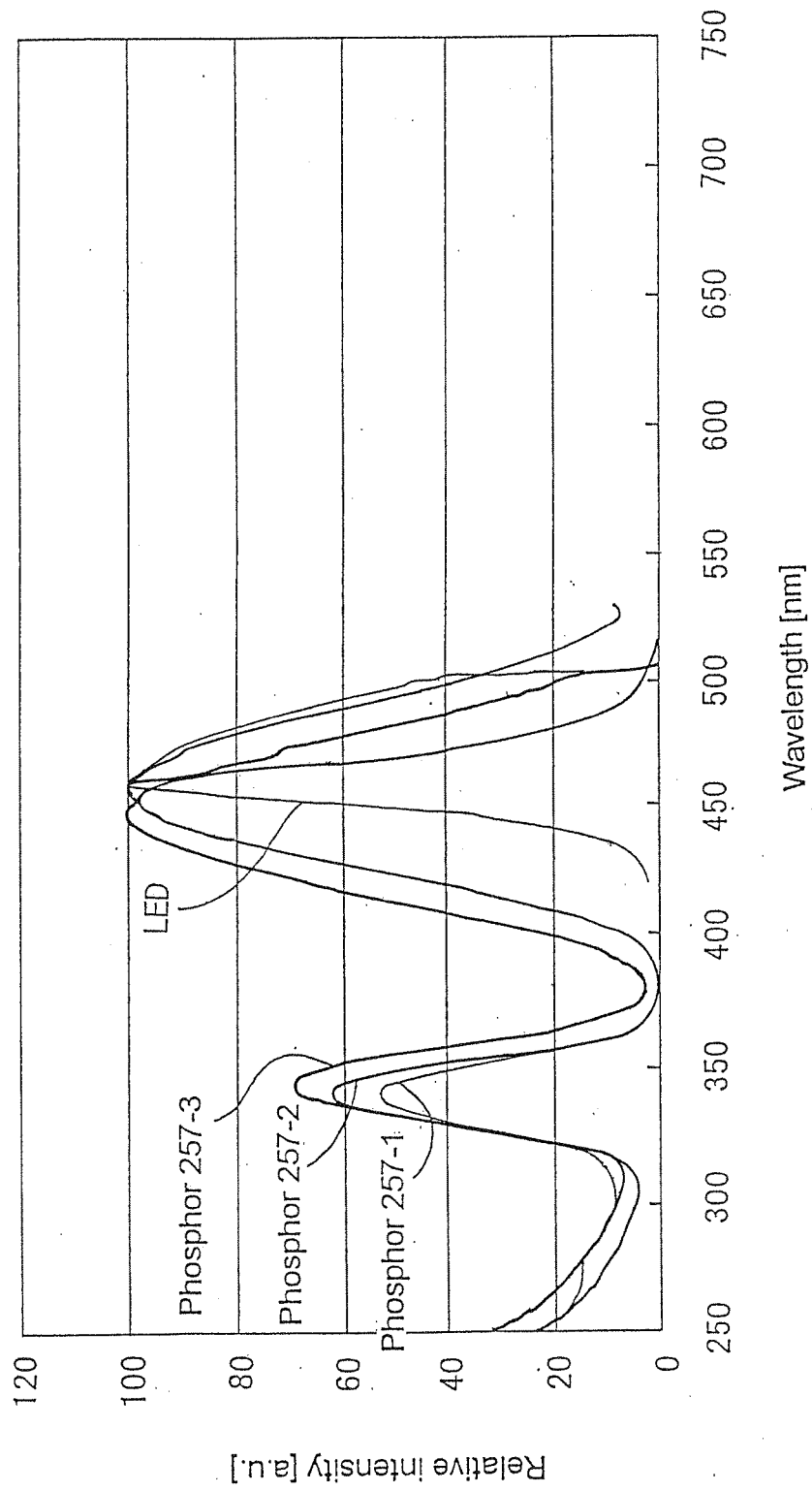


Fig. 56



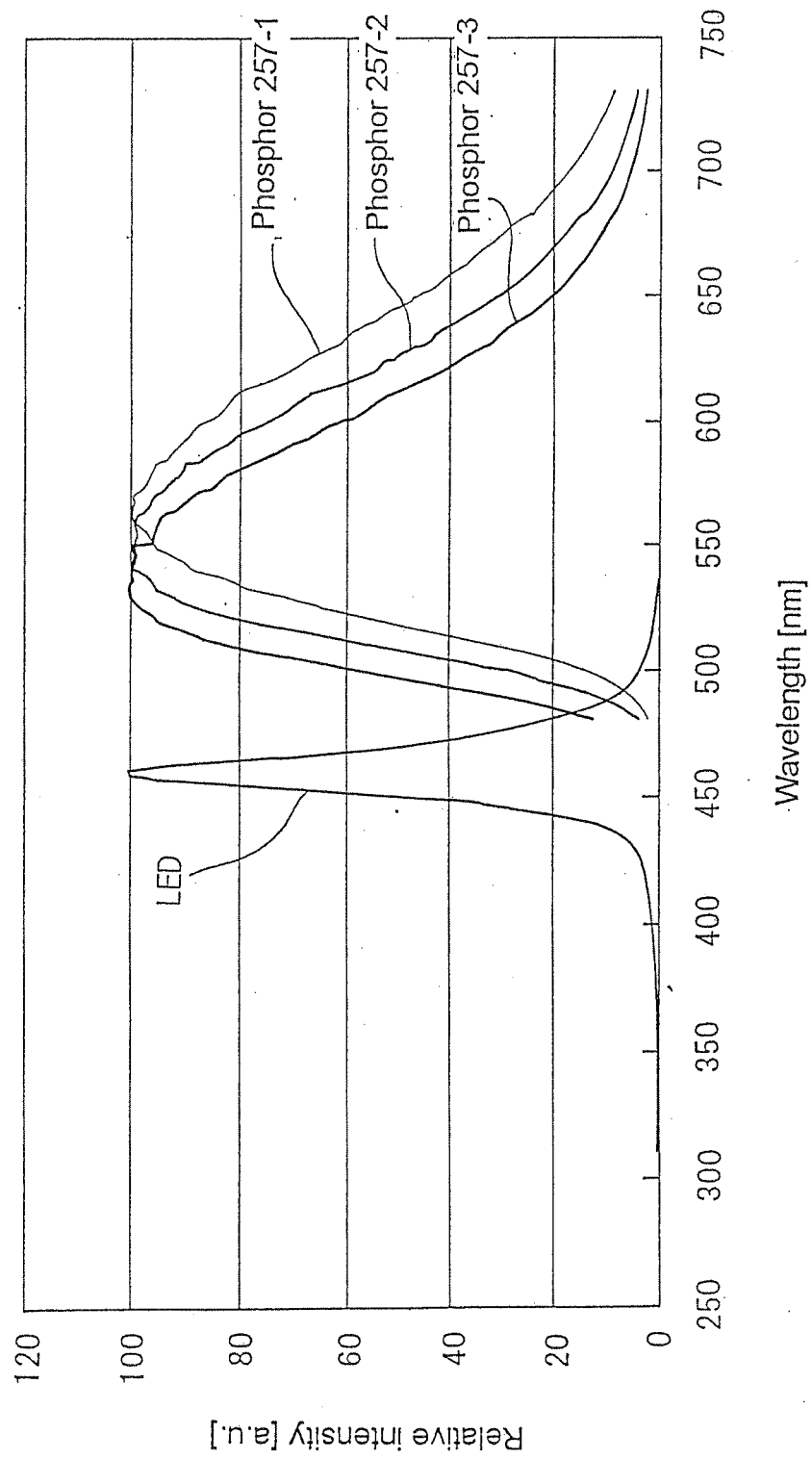
Electric current - relative luminescence spectra of LED of 460nm for exciting a phosphor

Fig. 57



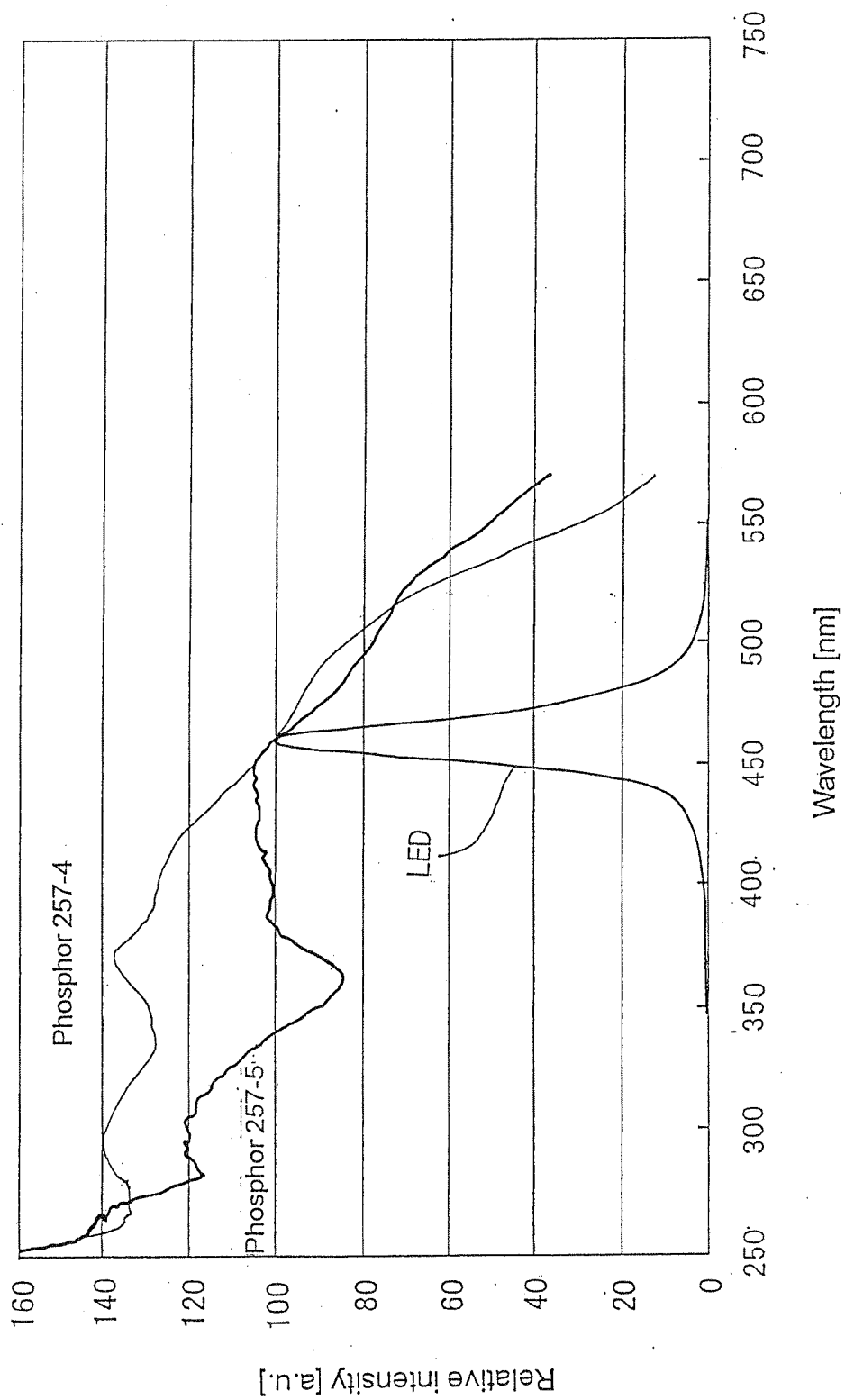
Excitation absorption spectra of YAG-base phosphors

Fig. 58



Luminescence spectra of YAG-base phosphors

Fig. 59



Excitation absorption spectra of Nitride-base phosphors

Fig. 60

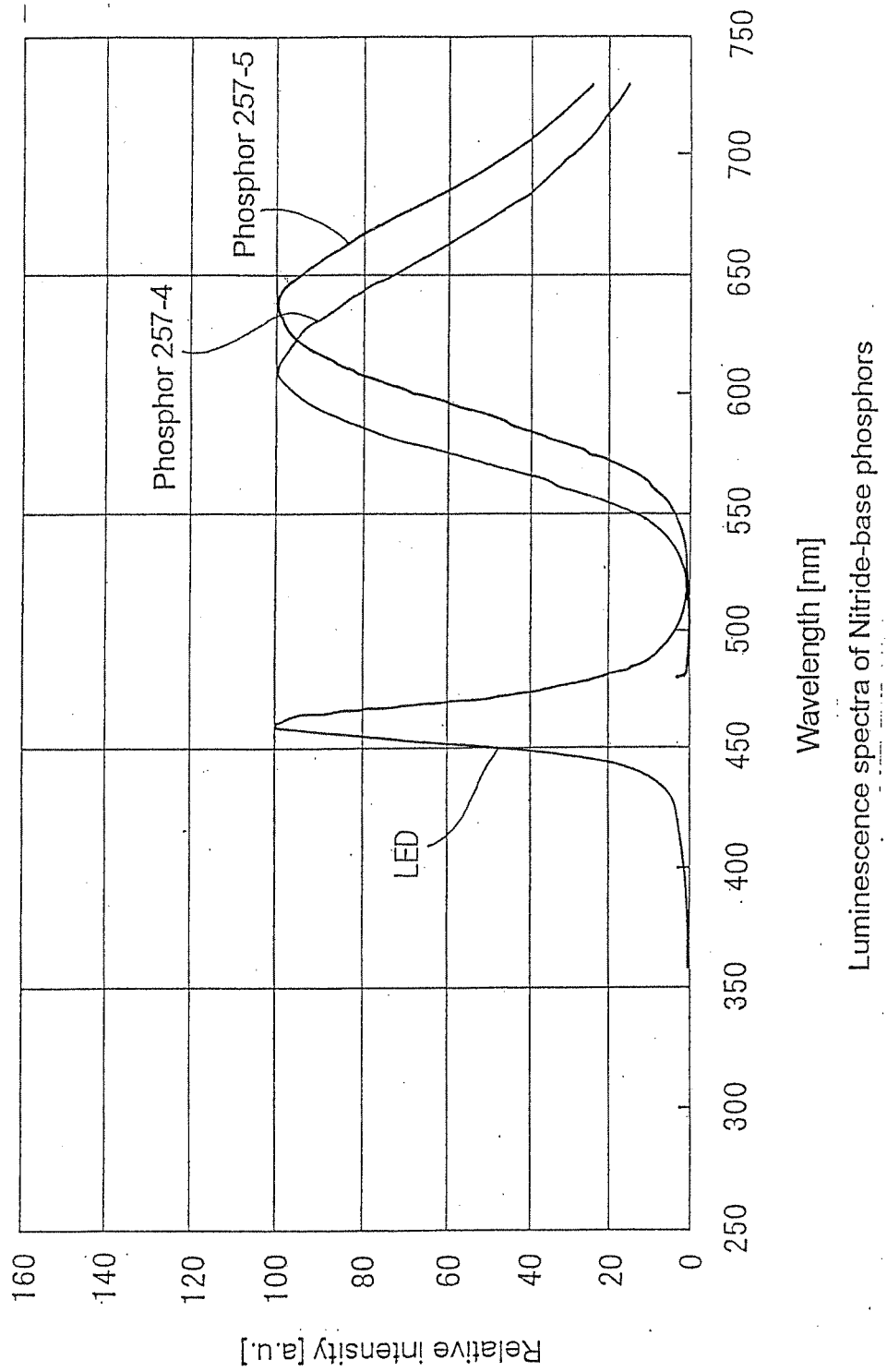


Fig. 61

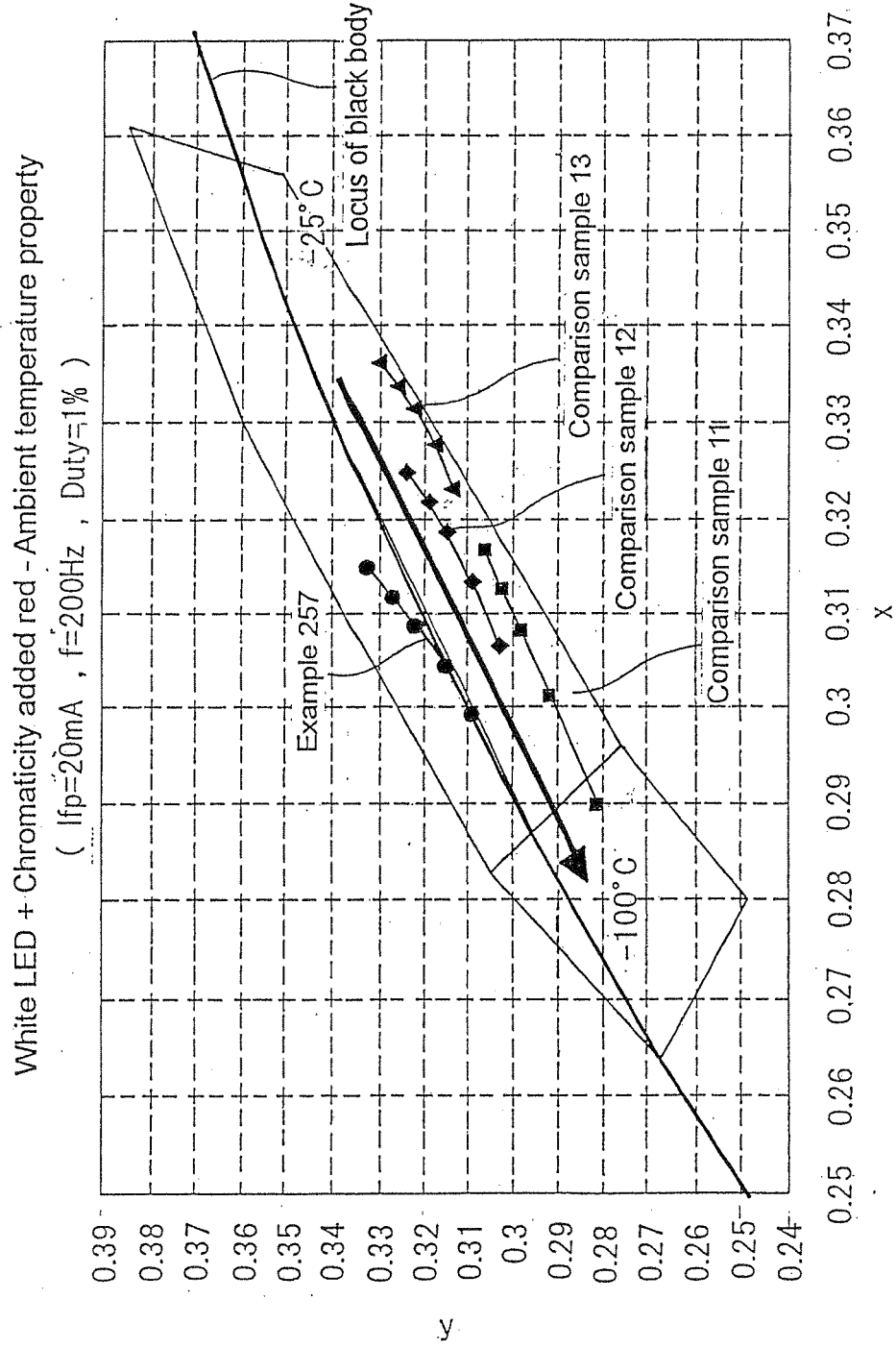


Fig. 62

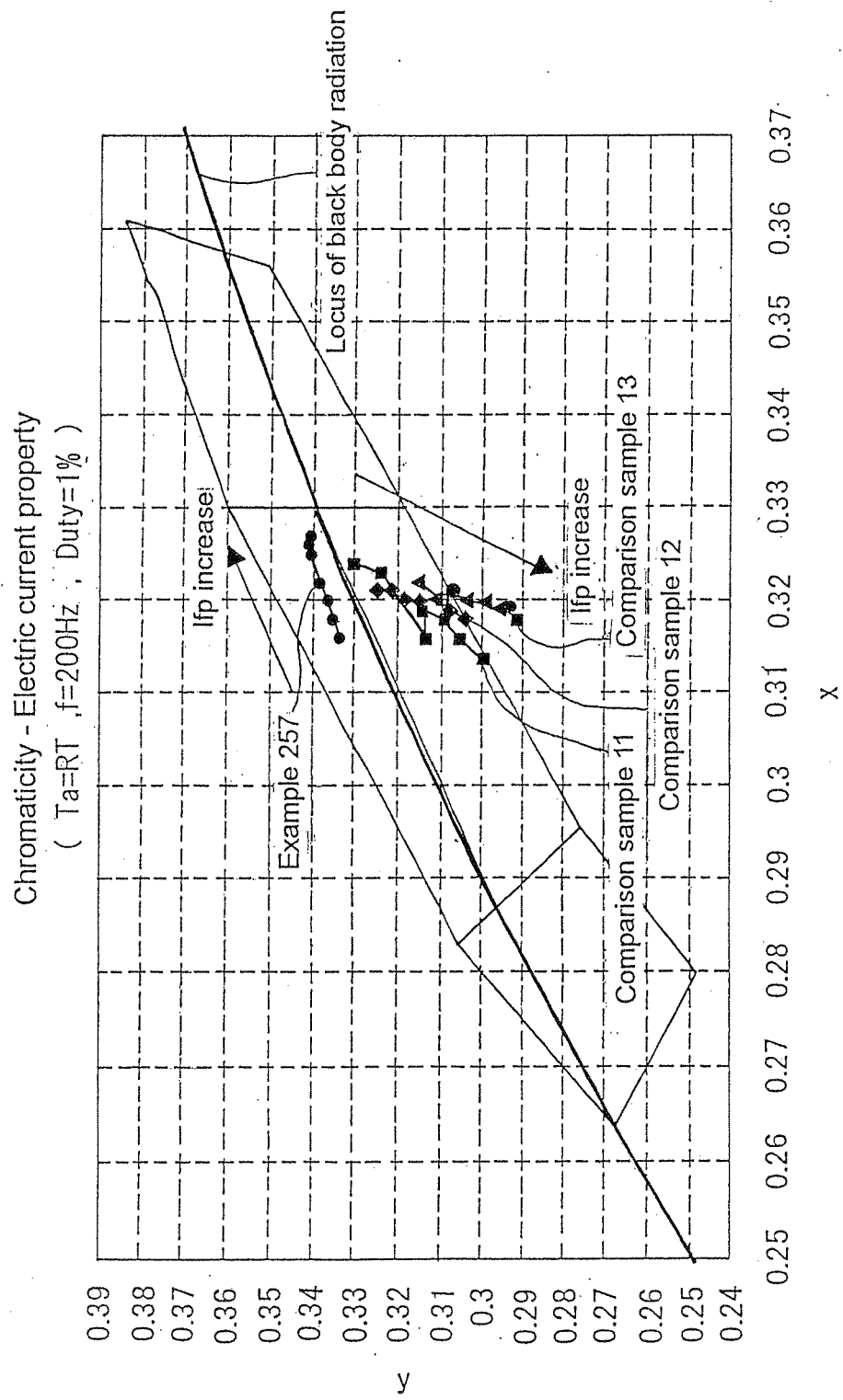


Fig. 63

White LED + Electric current - Chromaticity diagram of Chromaticity added red
(If=1, 5, 10, 20, 40, 60, [mA]. Ta=RT. measurement by DC)

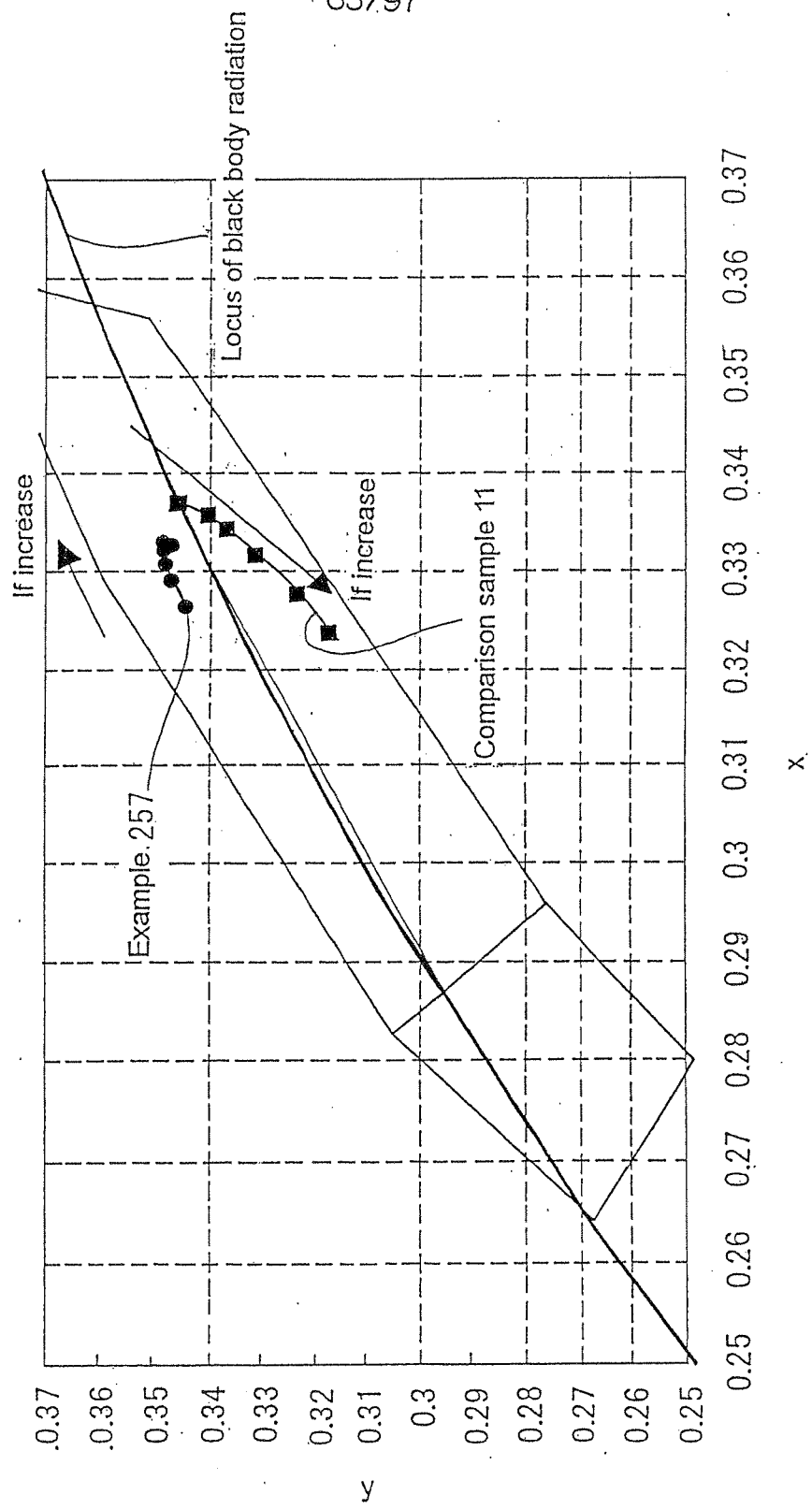


Fig. 64

Ambient temperature - Relative light output of the phosphor 257-1
($I_{fp}=20\text{mA}$, $F=200\text{Hz}$, Duty=1%)

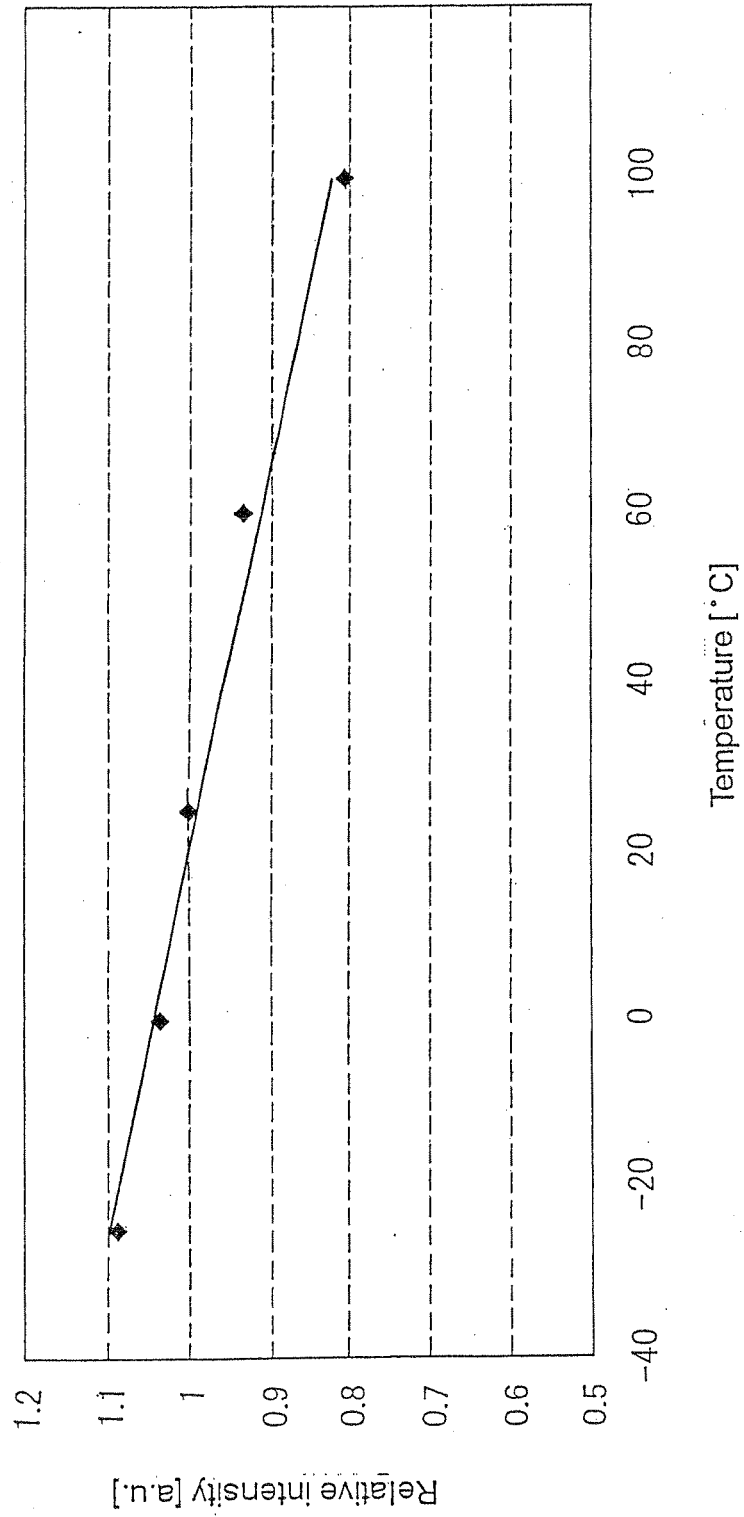


Fig. 65

Ambient temperature - Relative light output of the phosphor 257-2
(Ifp=20mA. F=200Hz. Duty=1%)

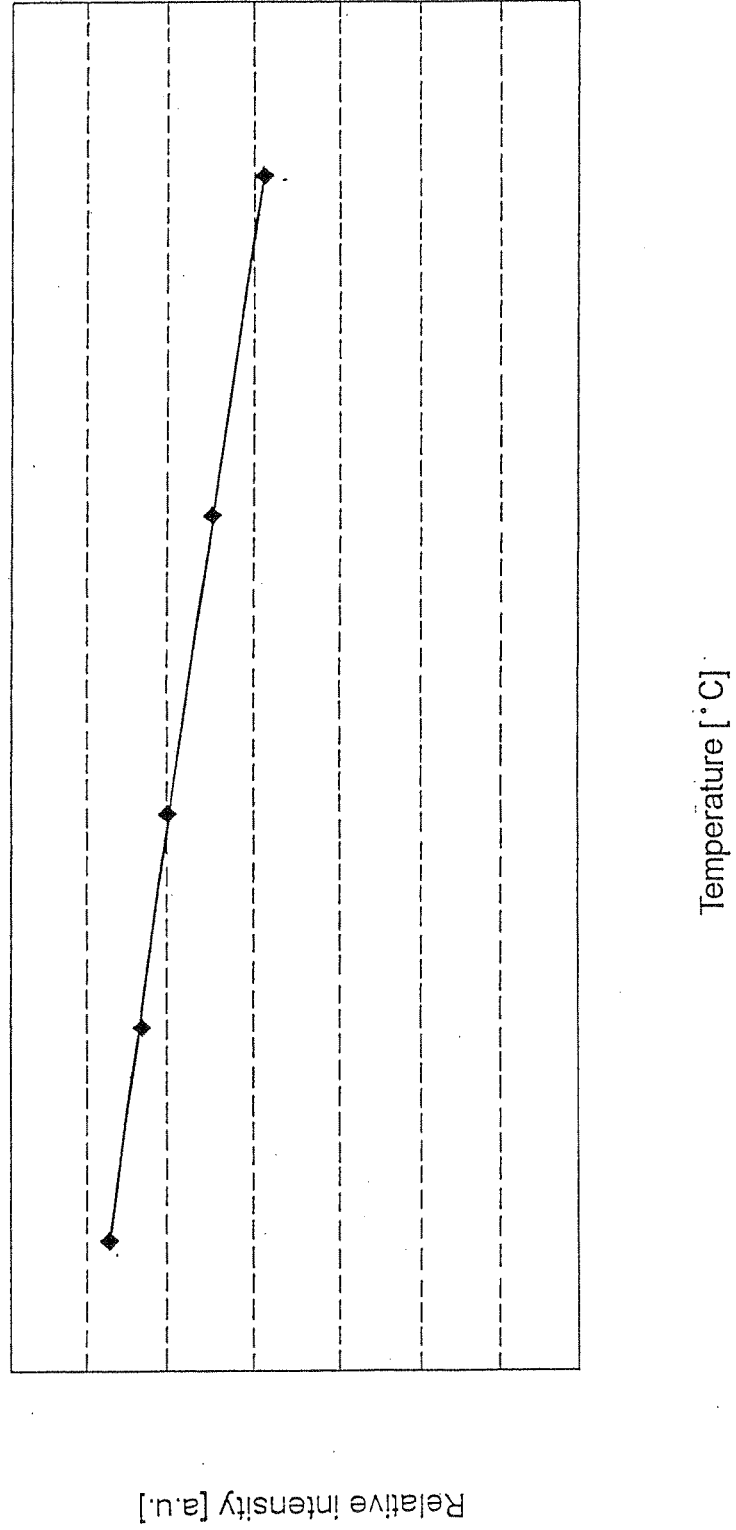


Fig. 66

Ambient temperature - Relative light output of the phosphor 257-3
(Ifp=20mA. F=200Hz. Duty=1%)

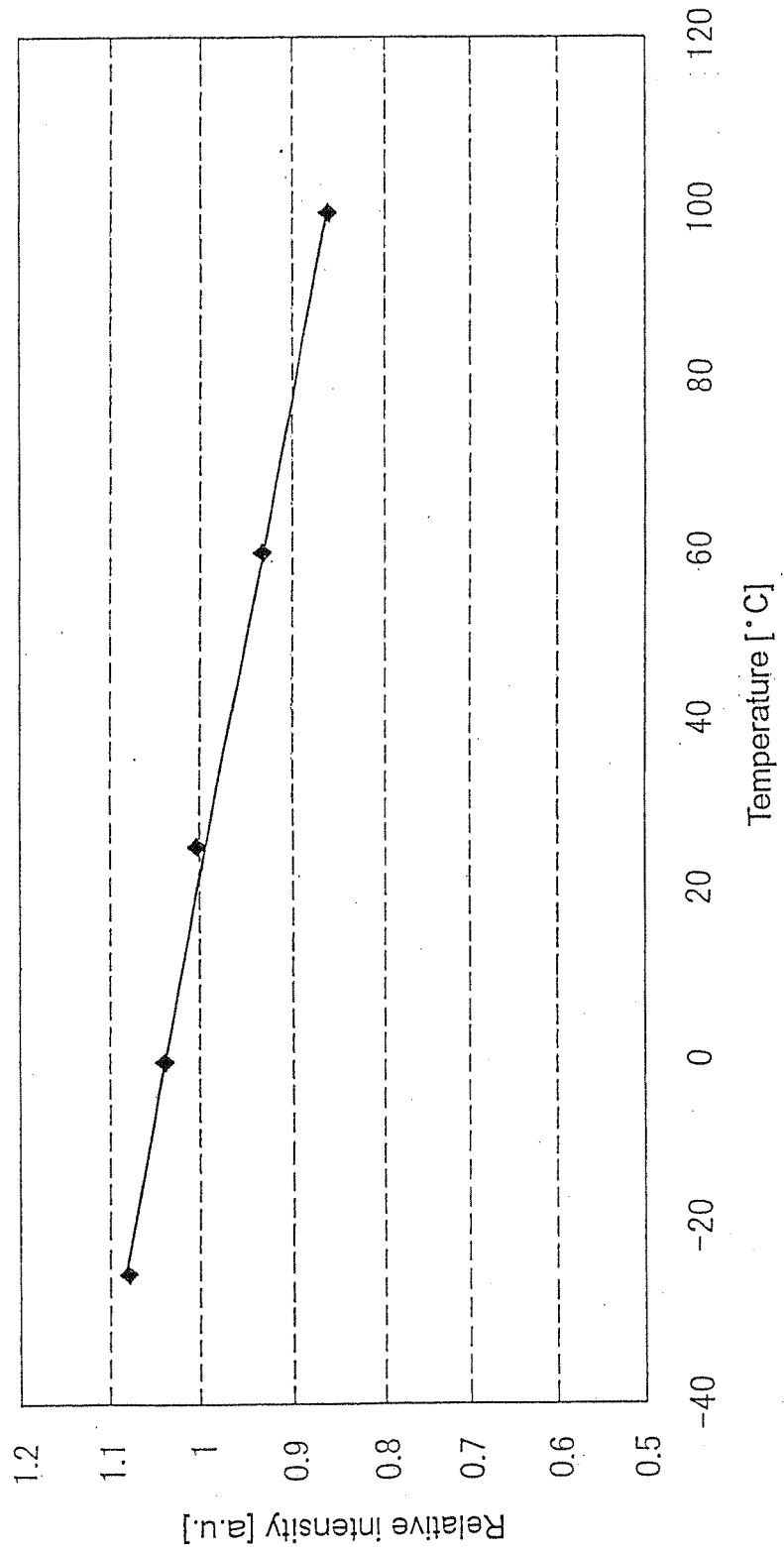


Fig. 67

Ambient temperature - Relative light output of the phosphor 257-4
($I_{fp}=20\text{mA}$. $F=200\text{Hz}$. Duty=1%)

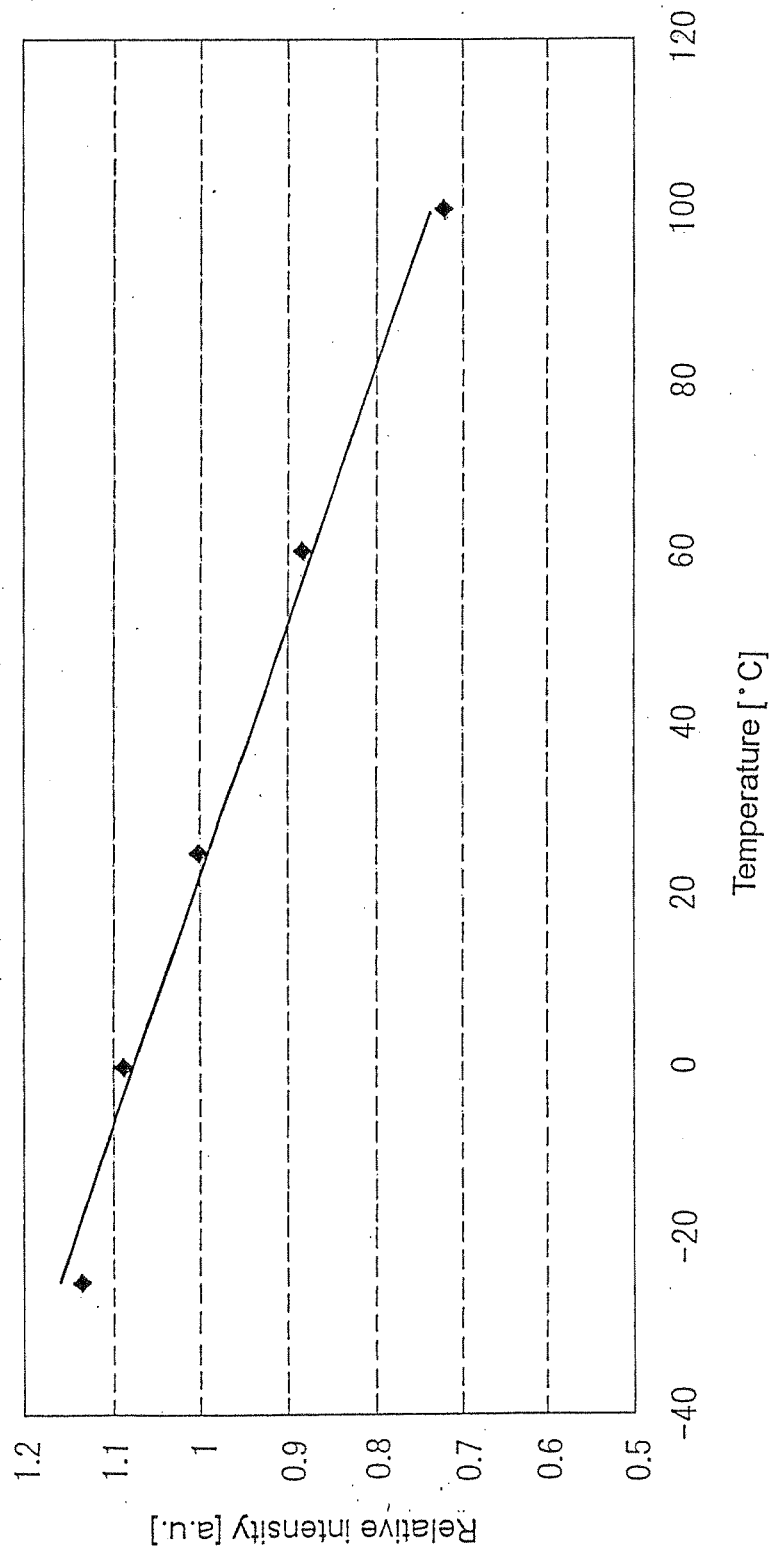


Fig. 68

Ambient temperature - Relative light output of the phosphor 257-5

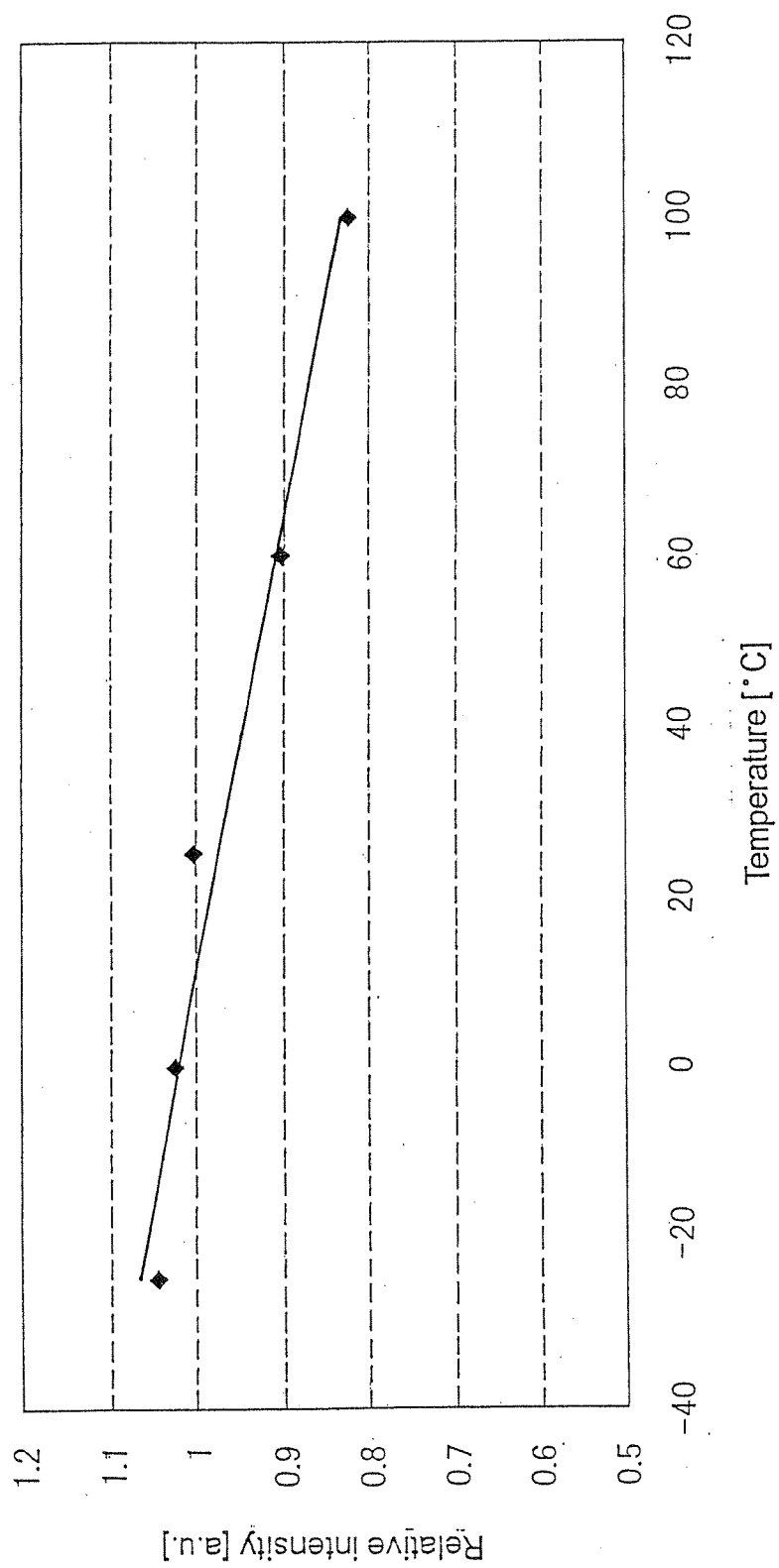
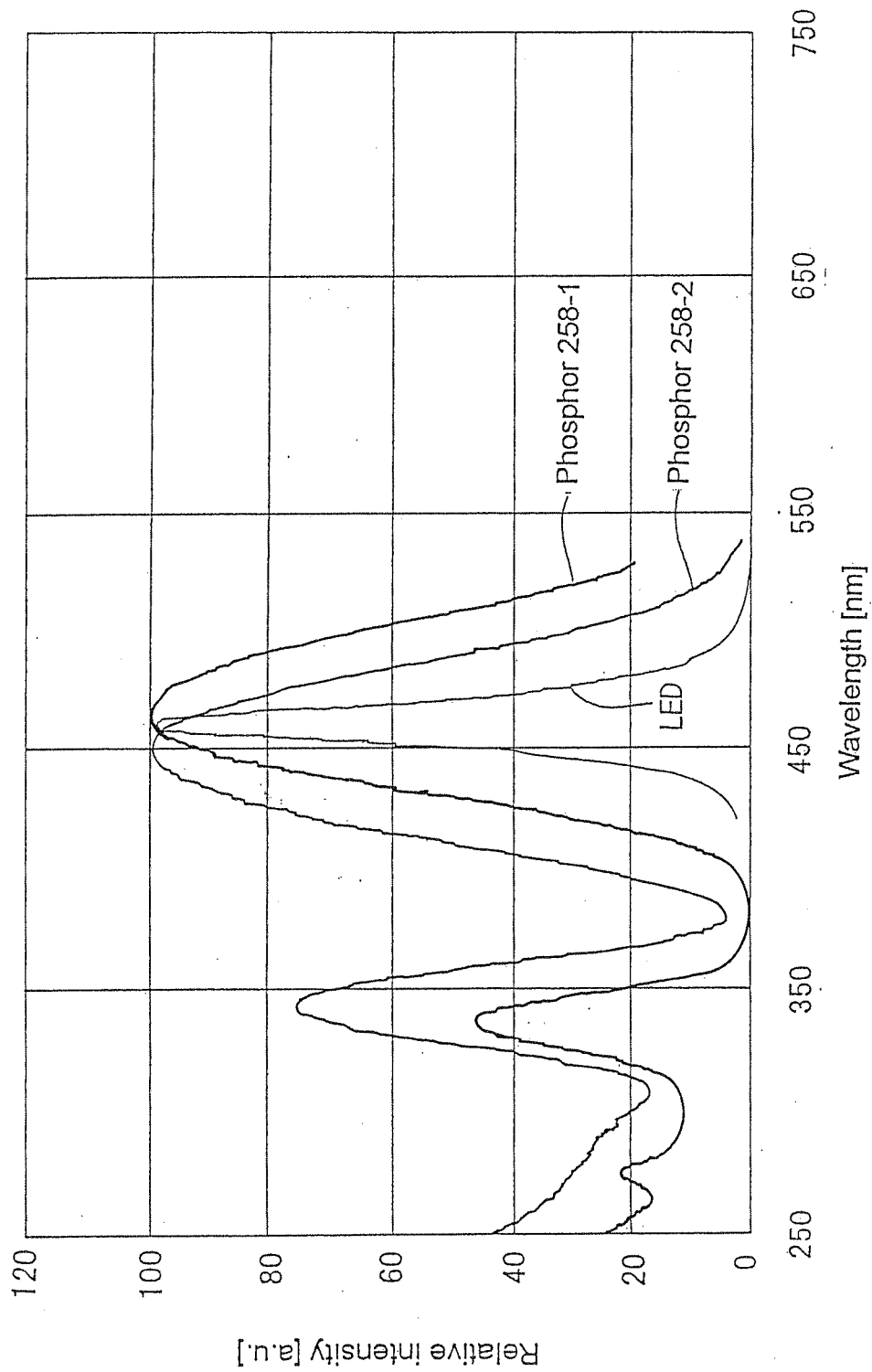
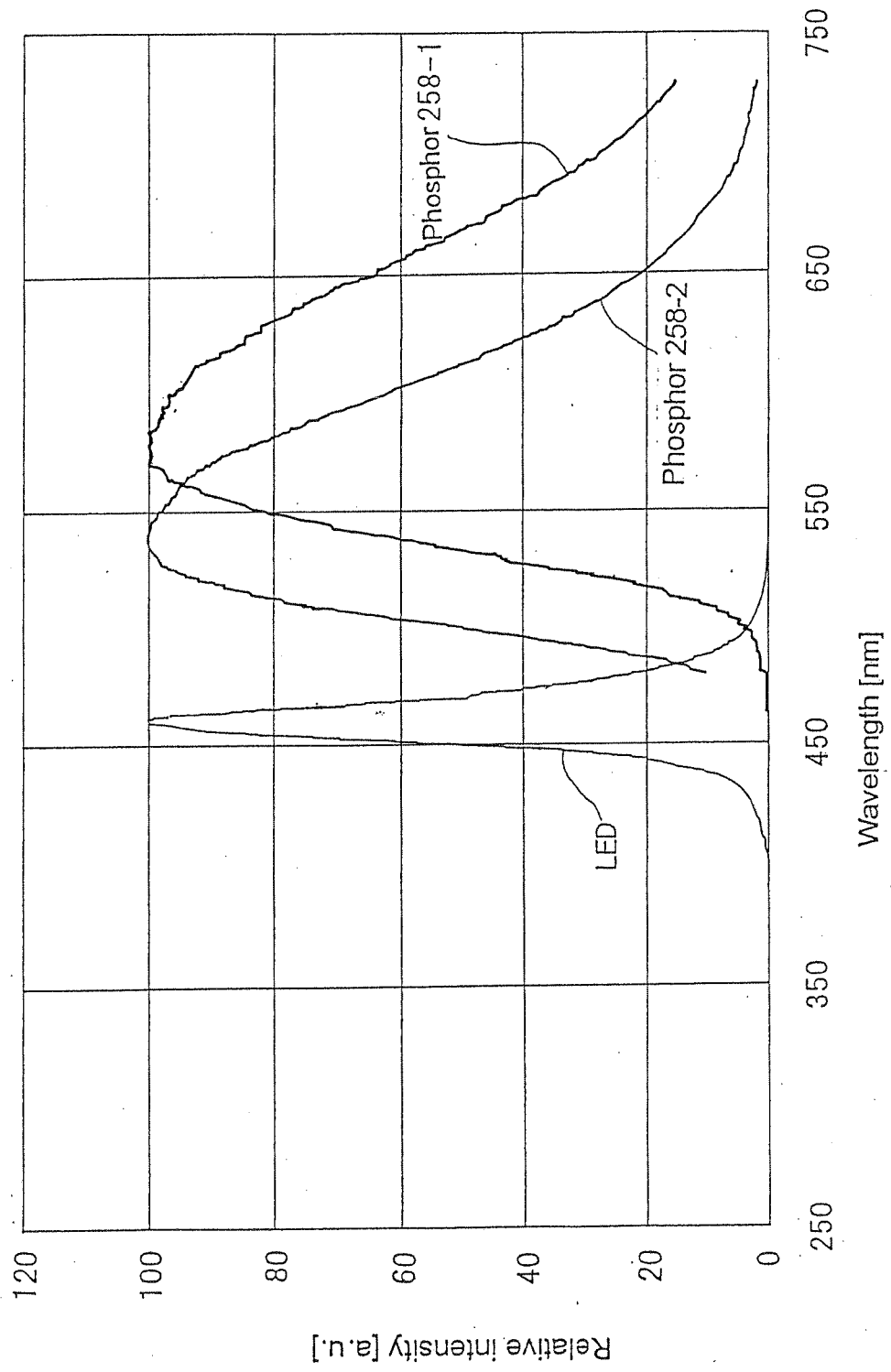
($I_{fp}=20\text{mA}$, $f=200\text{Hz}$, Duty=1%)

Fig. 69



Excitation absorption spectra of the YAG-base phosphors

Fig. 70



Luminescence spectra of YAG-base phosphors

Fig. 71

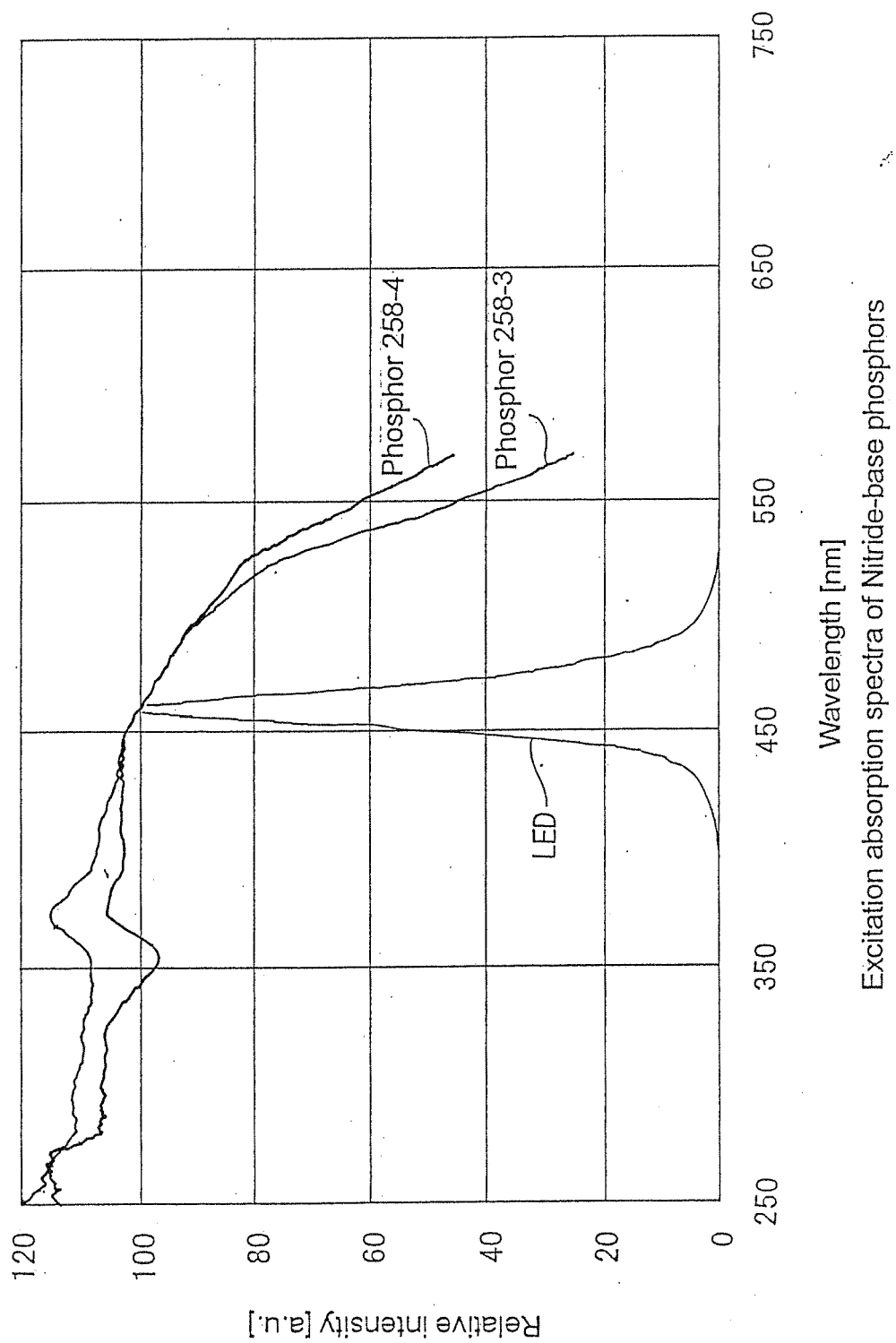


Fig. 72

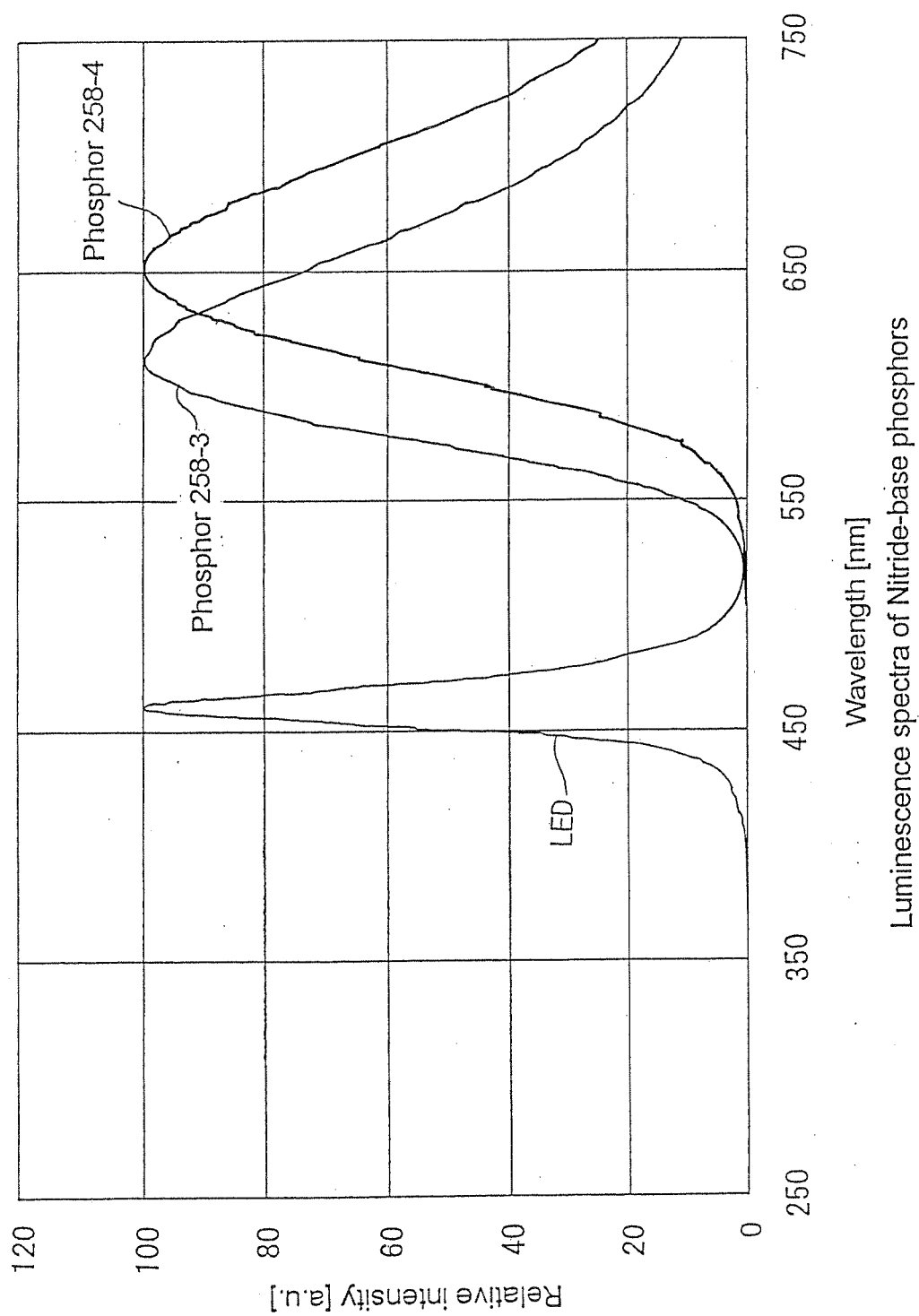


Fig. 73

Electric current - Chromaticity property
($T_a = RT$. $I_f = DC$ drive)

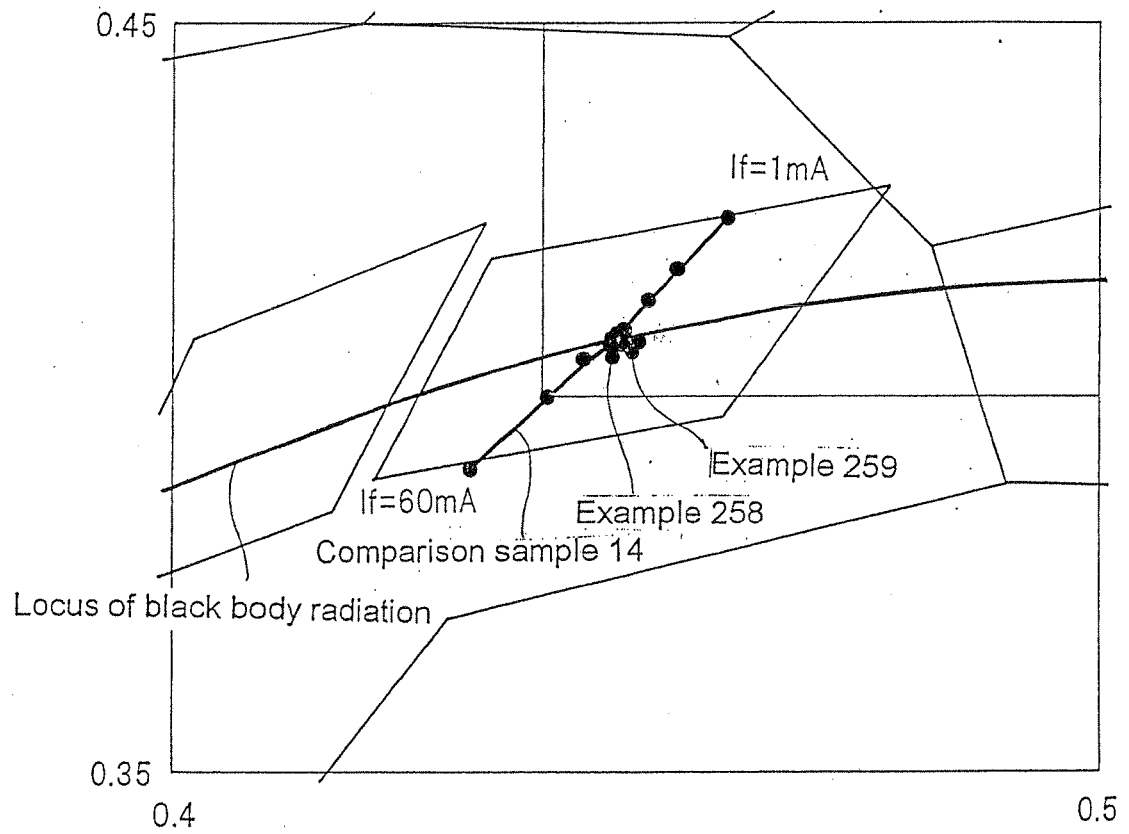


Fig. 74

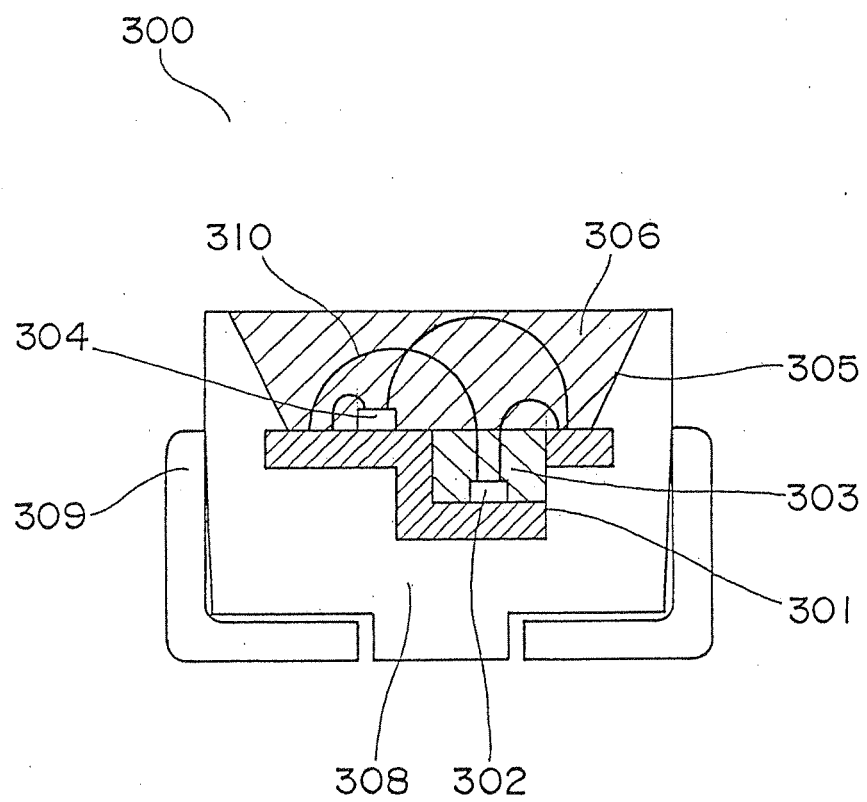


Fig. 75

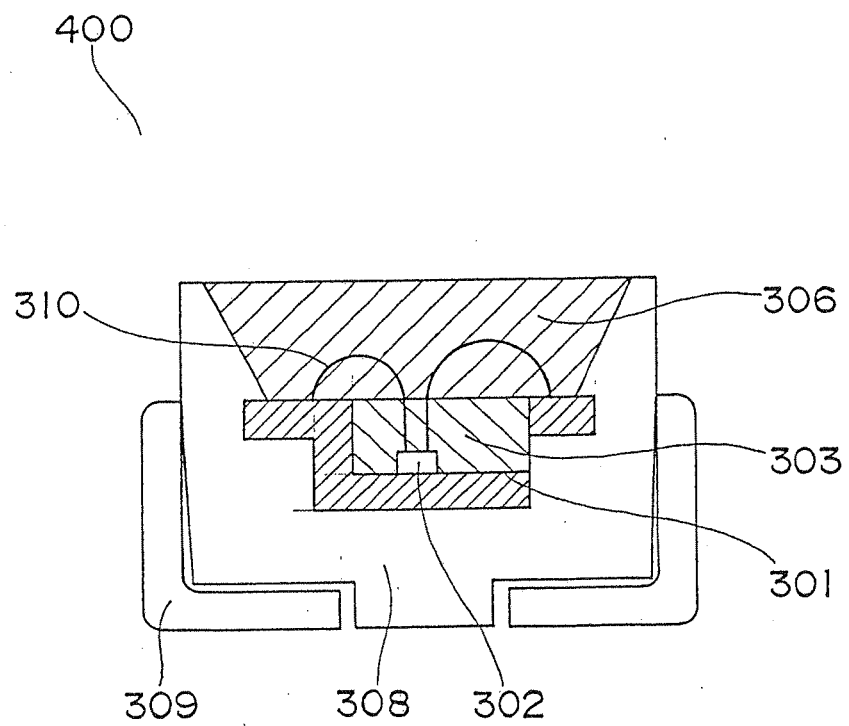


Fig. 76

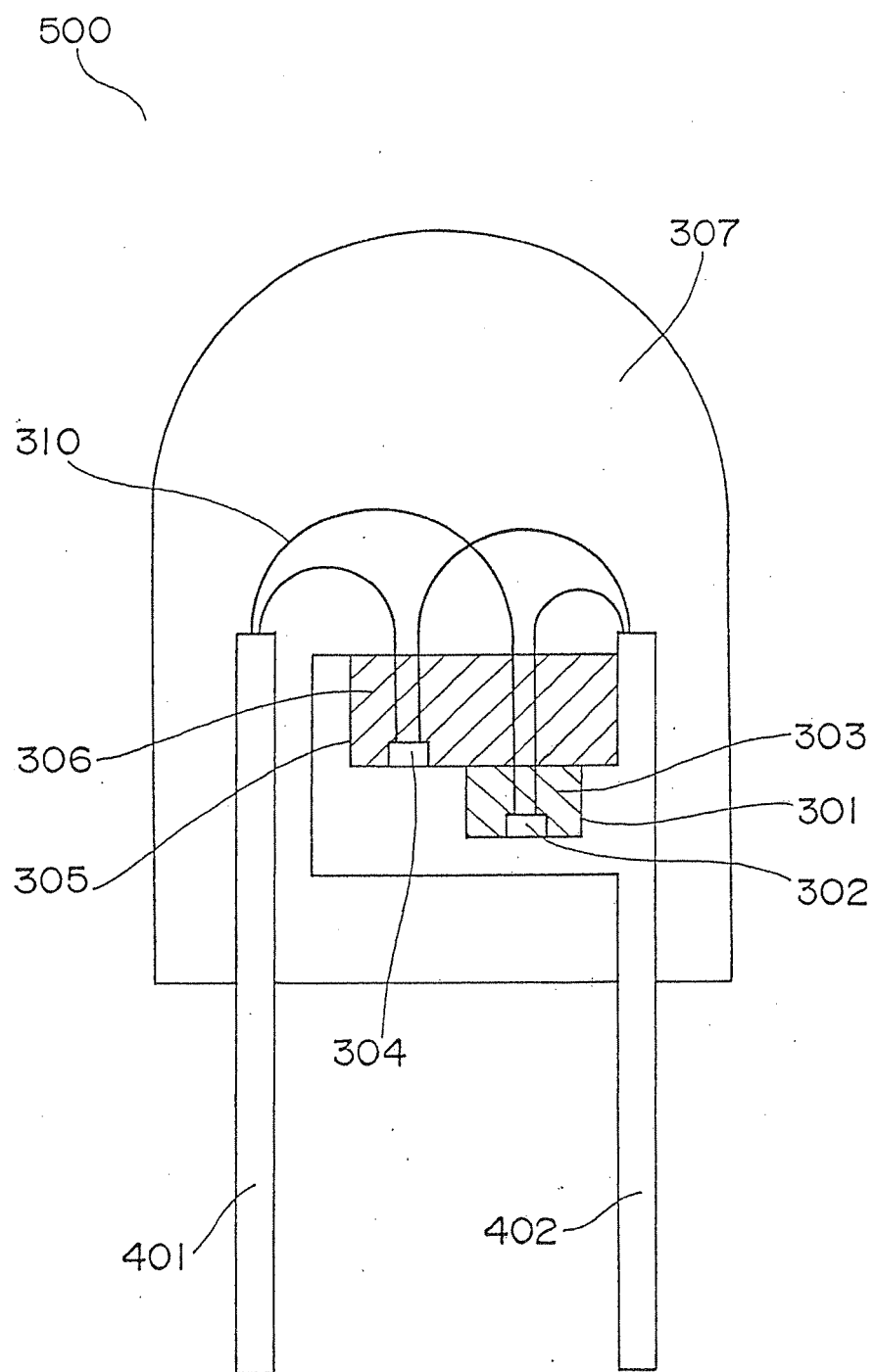


Fig. 77

600

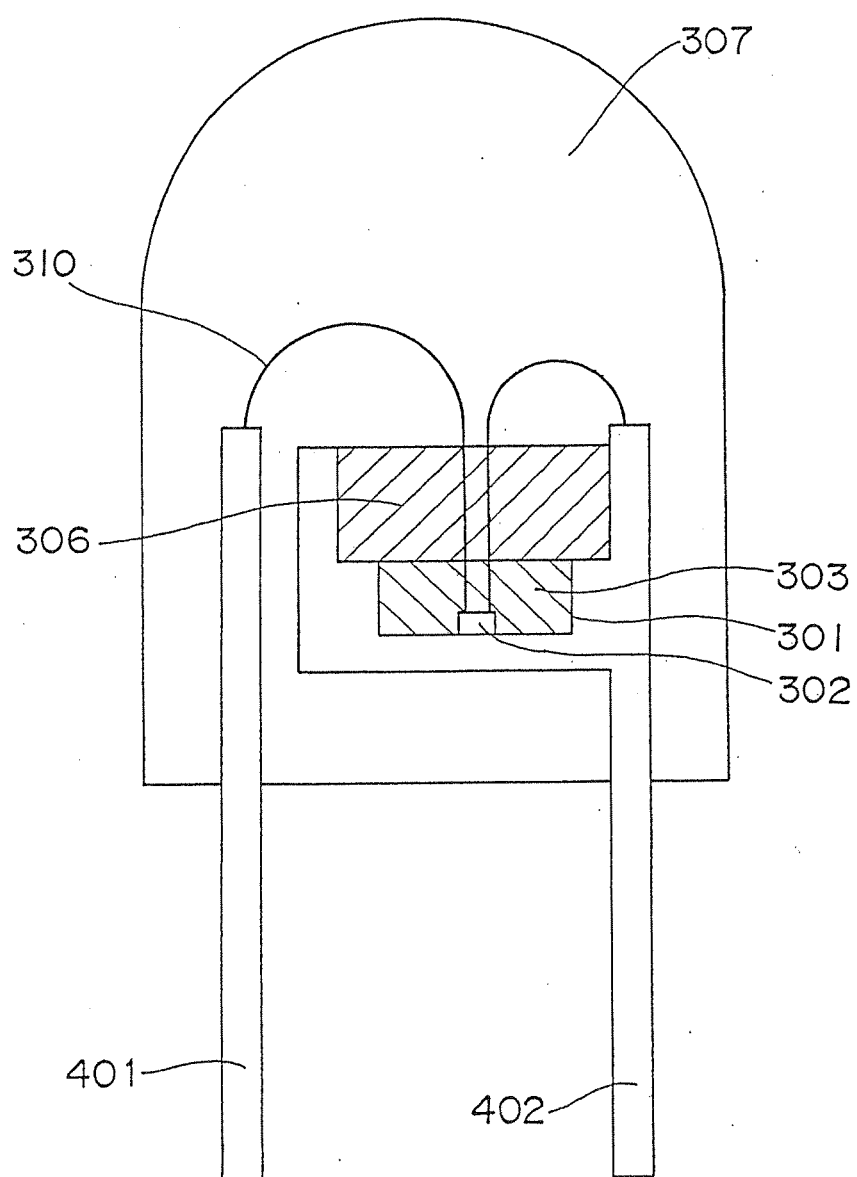


Fig. 78A

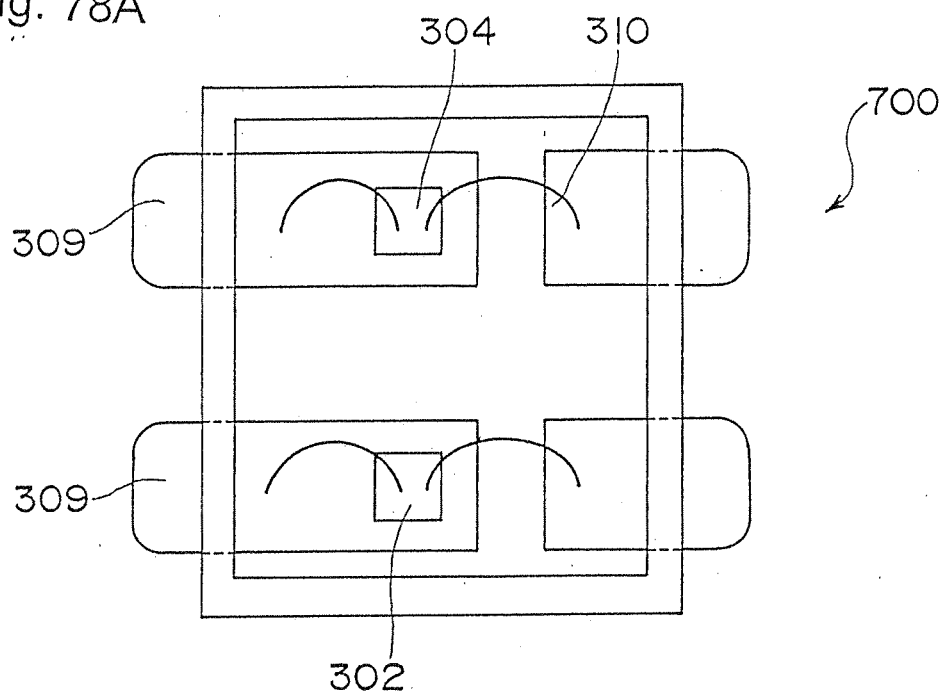


Fig. 78B

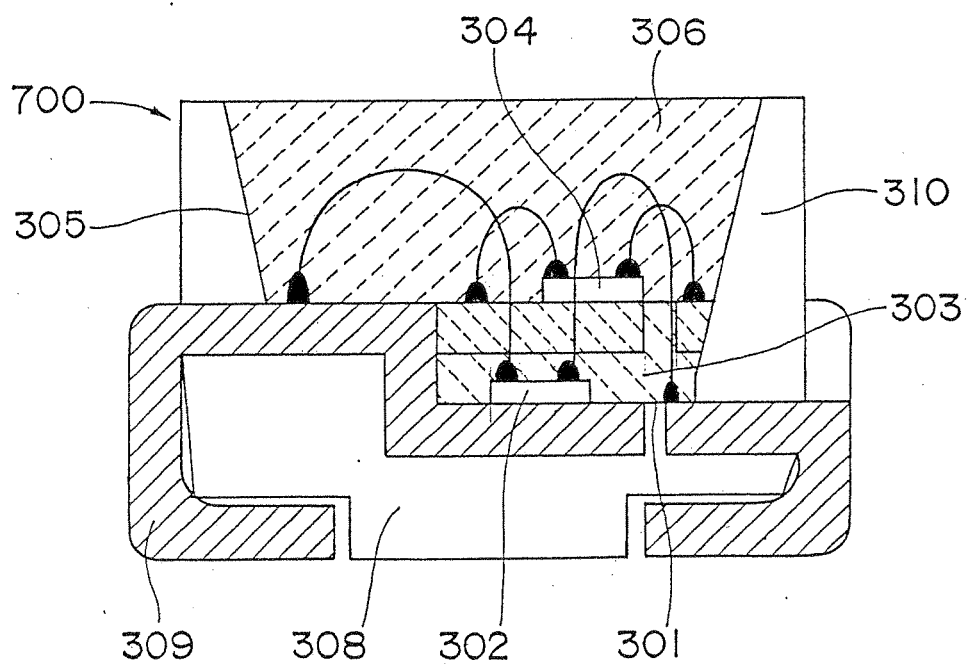
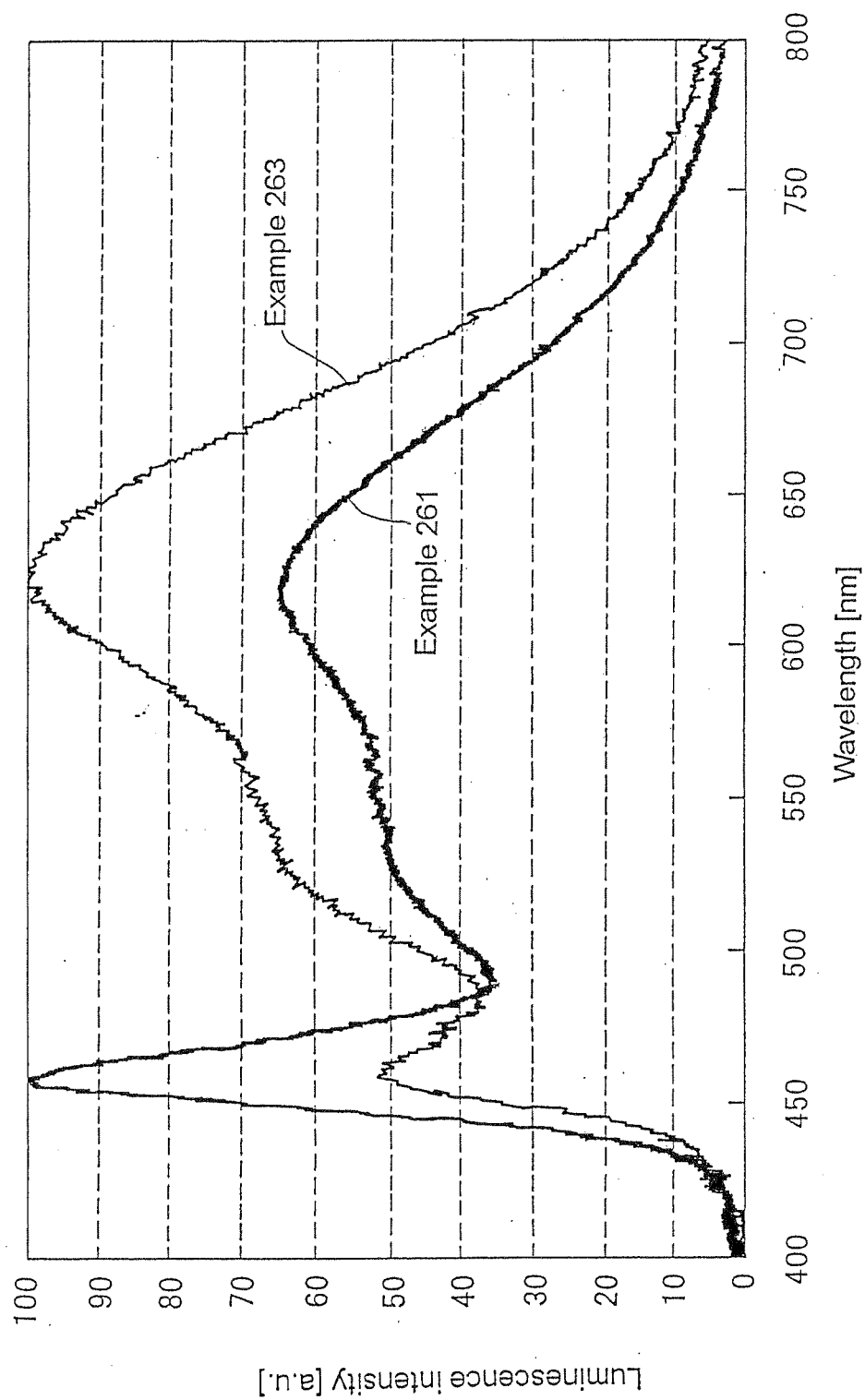


Fig. 79

Luminescence spectra of Examples 261, 263



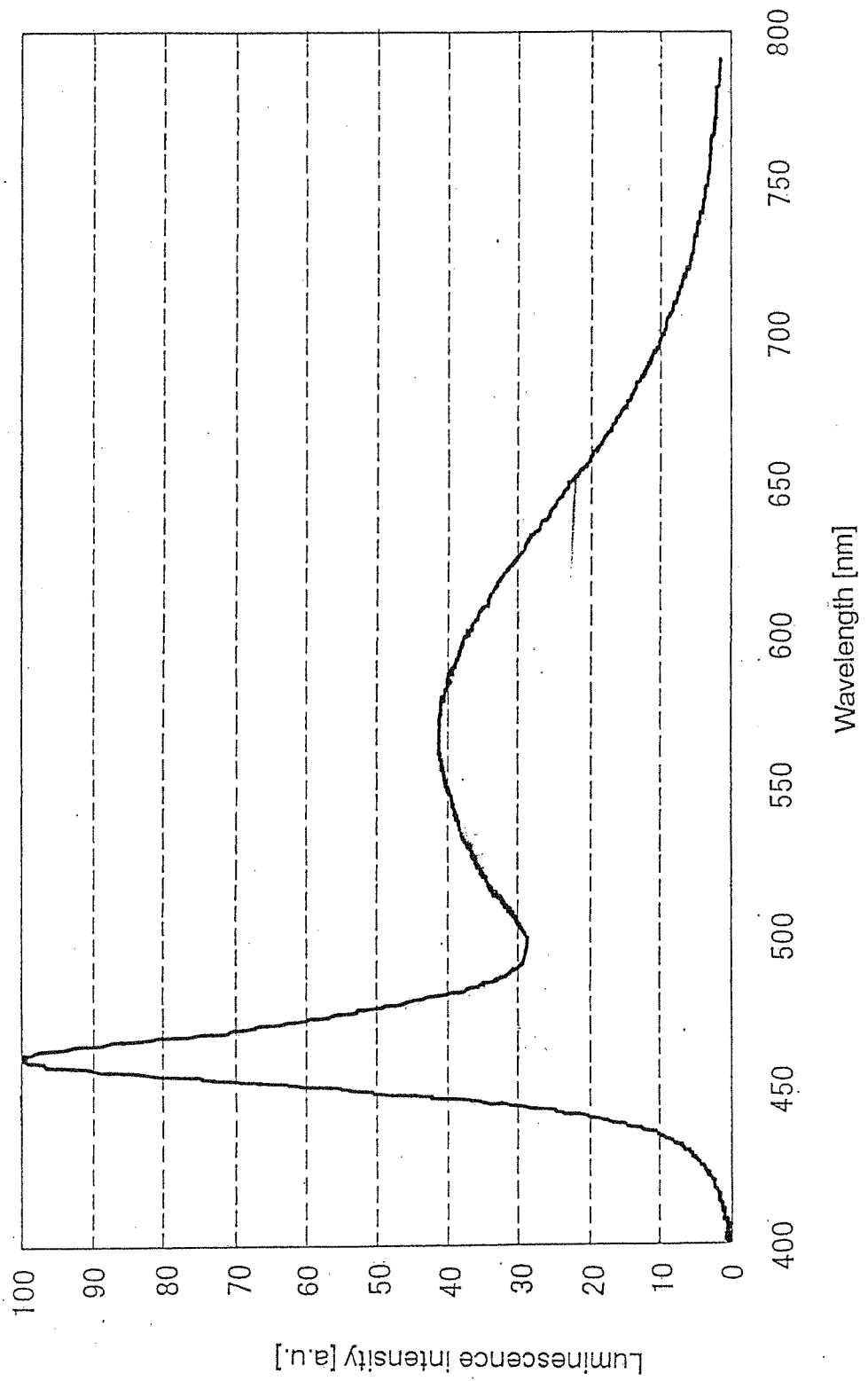
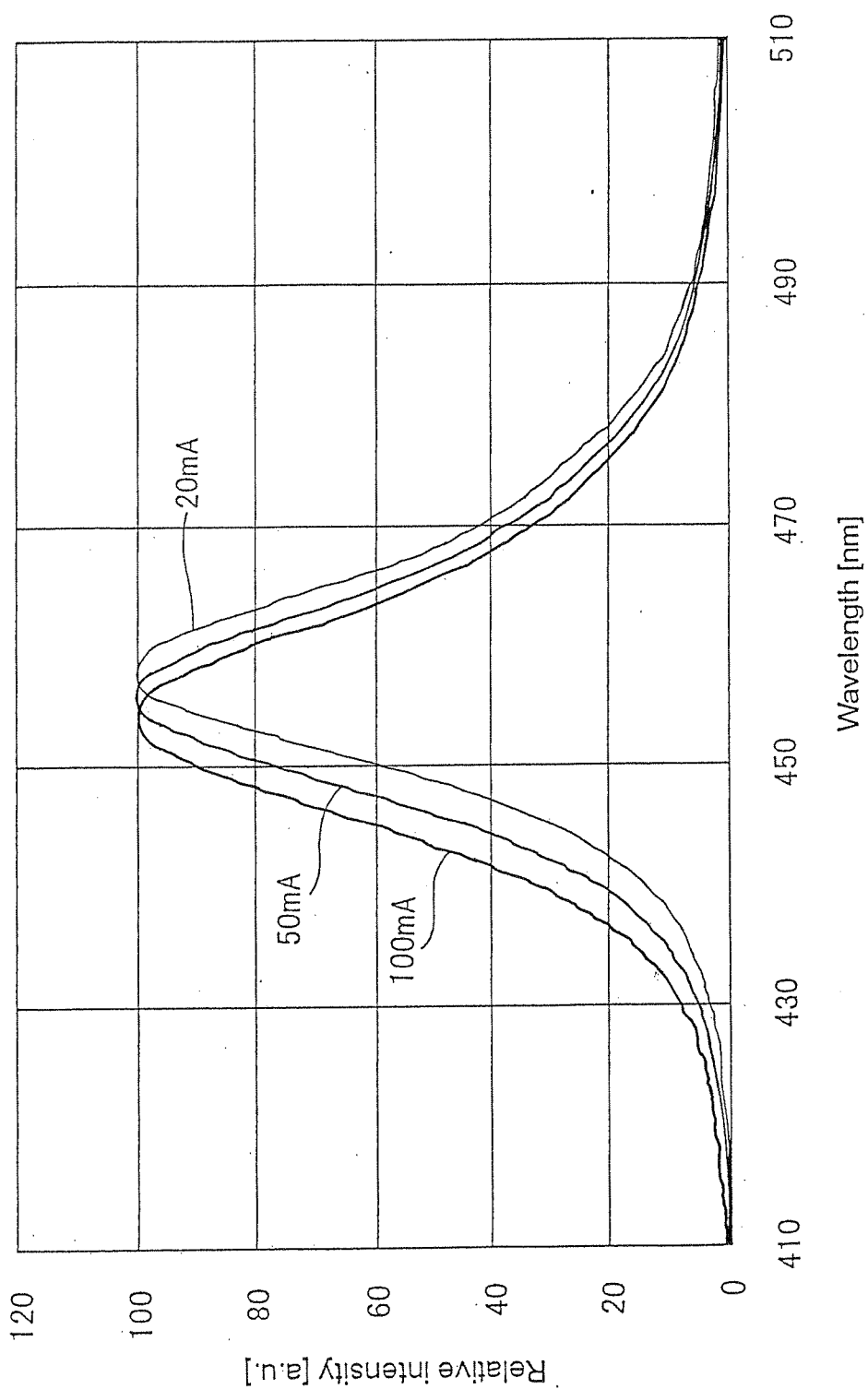


Fig. 80

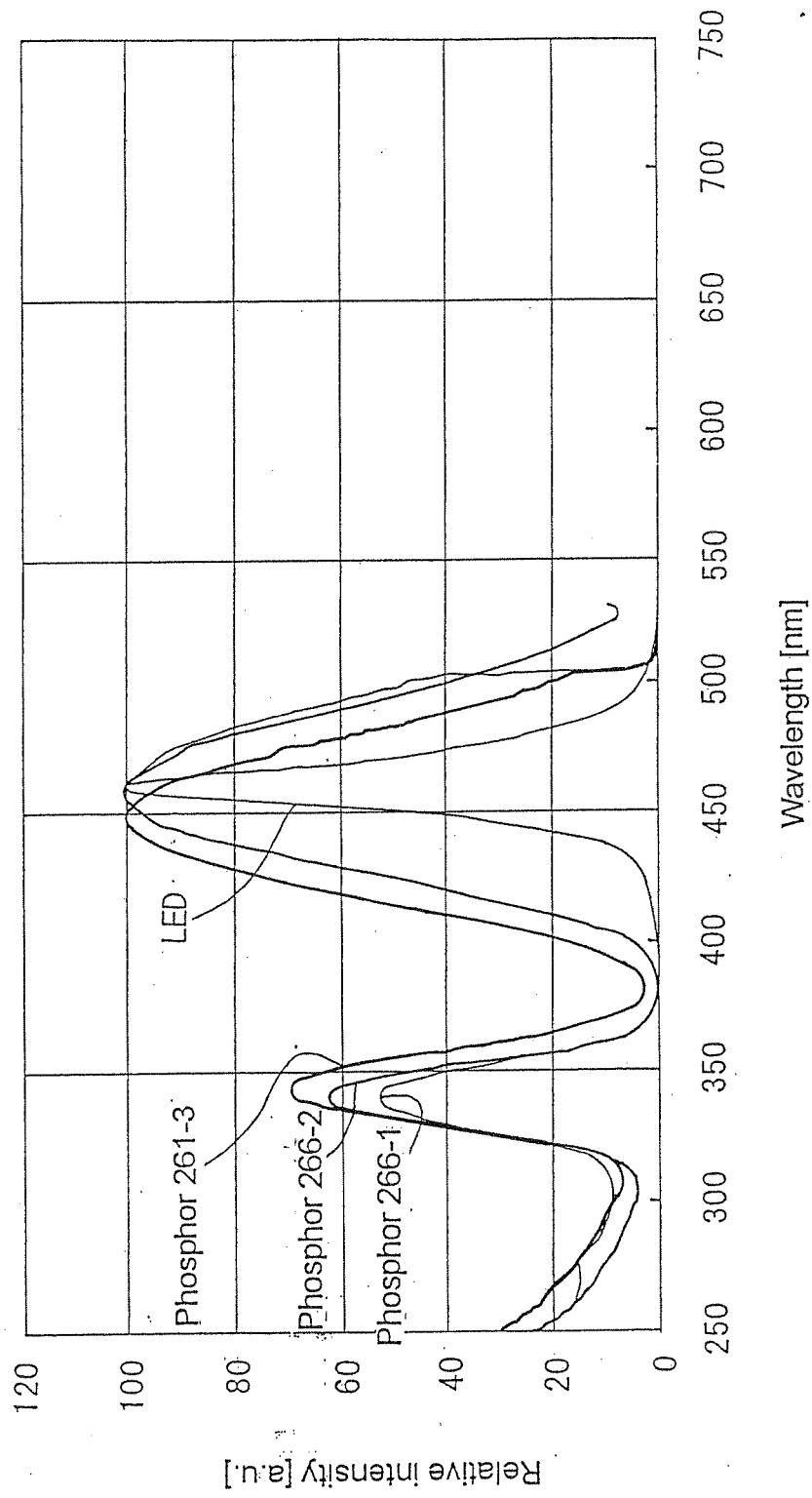
Fig. 81

($T_a=25^{\circ}\text{C}$, $f=200\text{Hz}$, $\text{Duty}=1\%$)



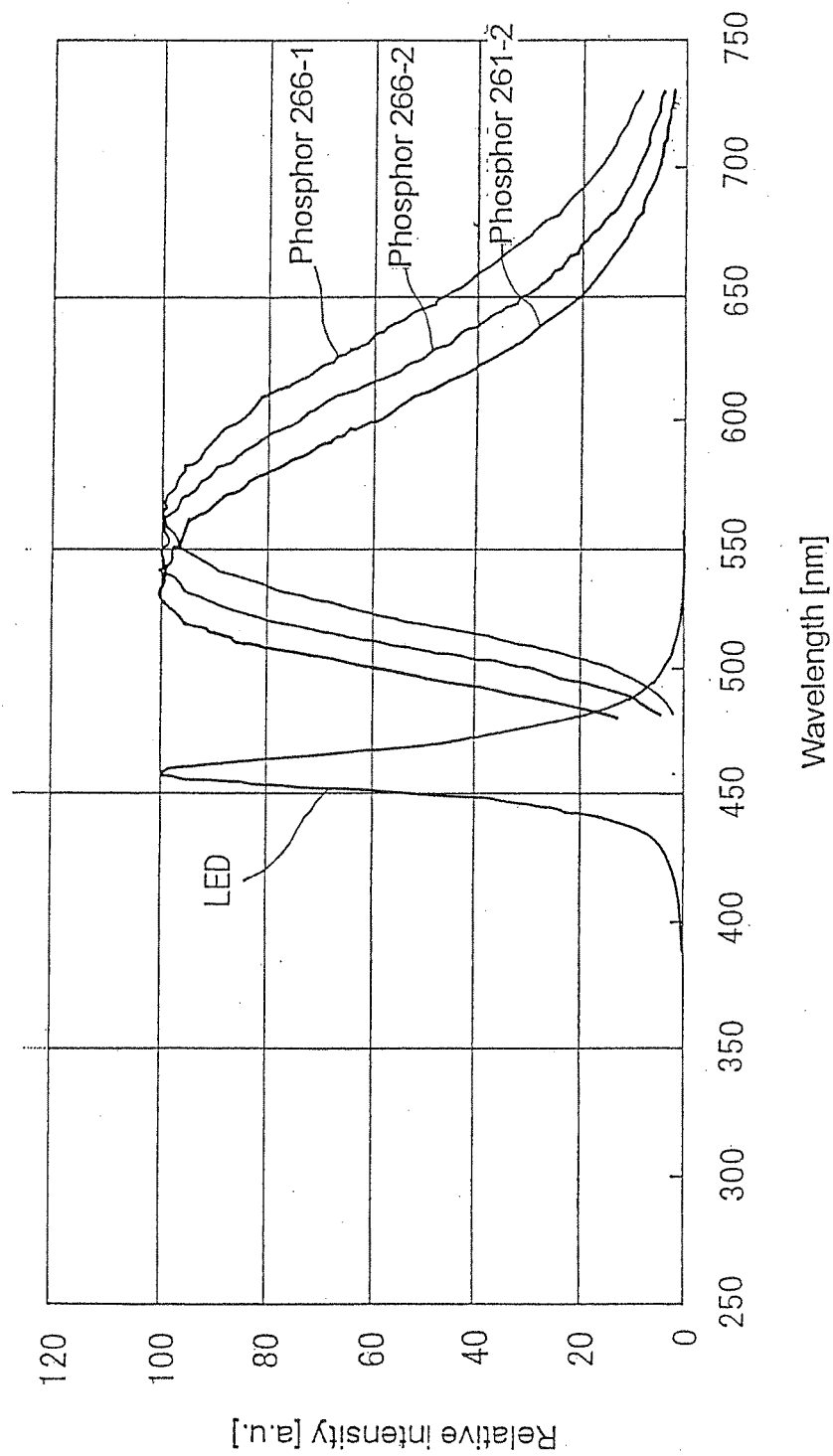
Electric current - relative luminescence spectra of LED of 460nm for exciting a phosphor

Fig. 82



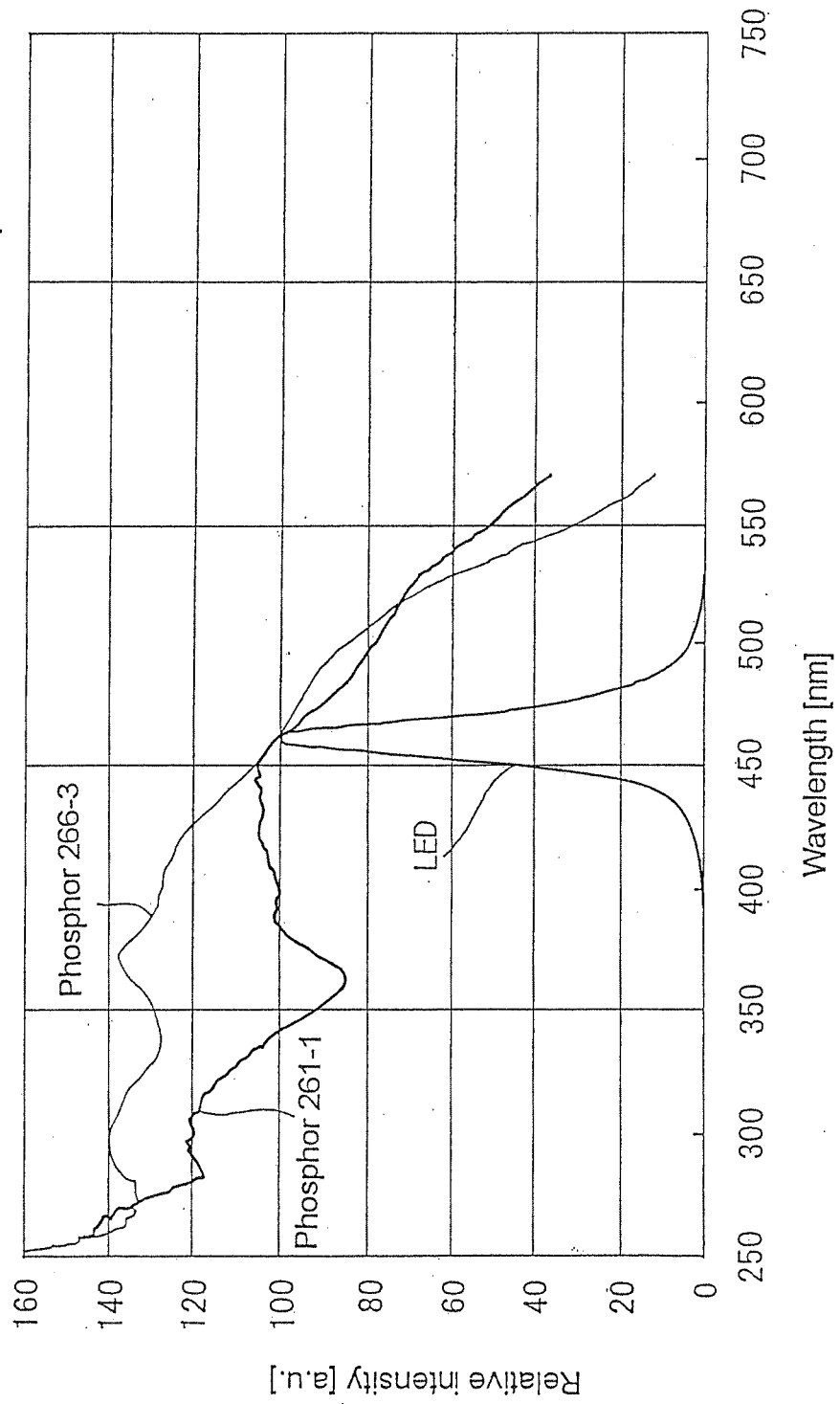
Excitation absorption spectra of YAG-base phosphors

Fig. 83



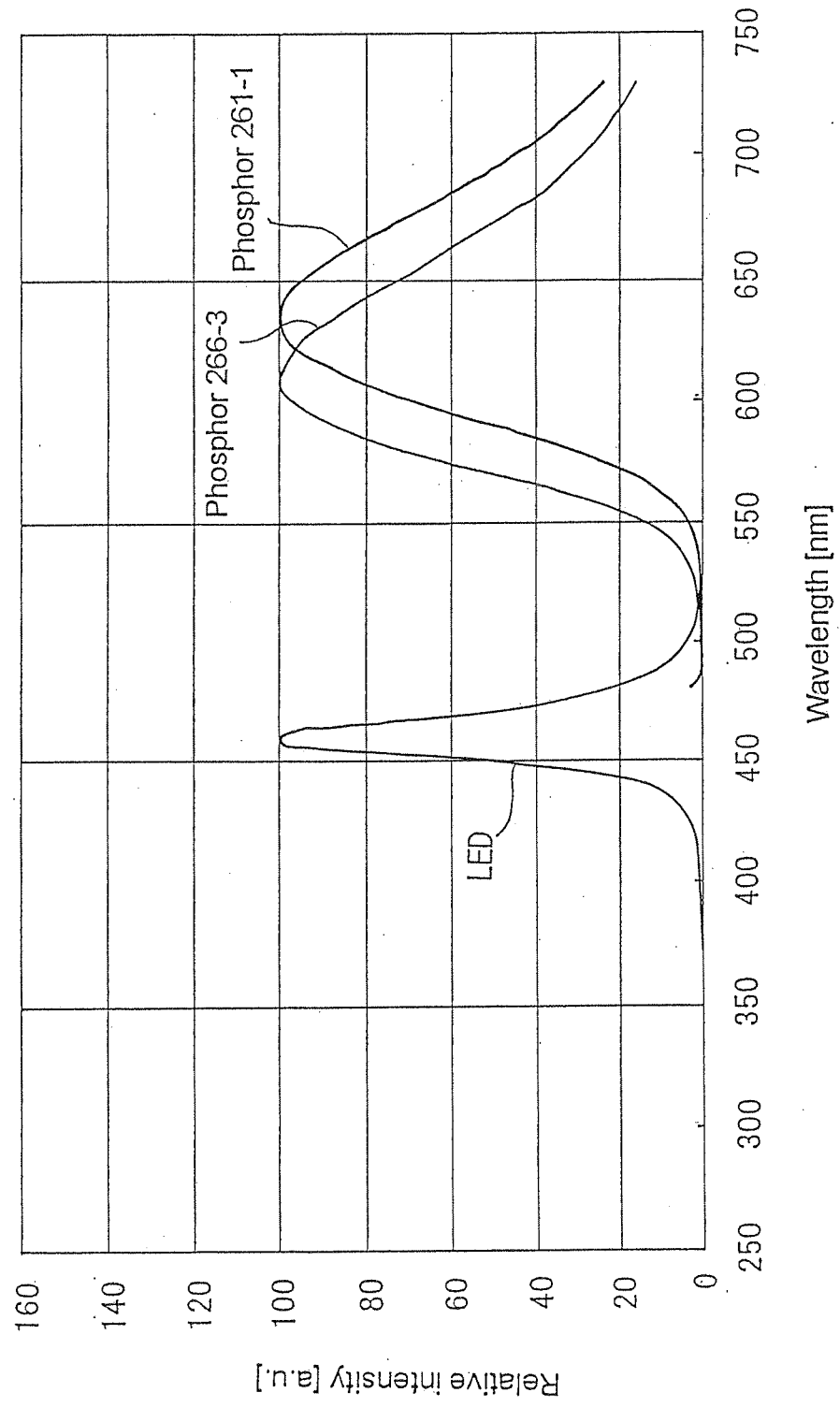
Luminescence spectra of YAG-base phosphors

Fig. 84



Excitation absorption spectrum of Nitride-base phosphors

Fig. 85



Luminescence spectra of Nitride-base phosphors

Fig. 86

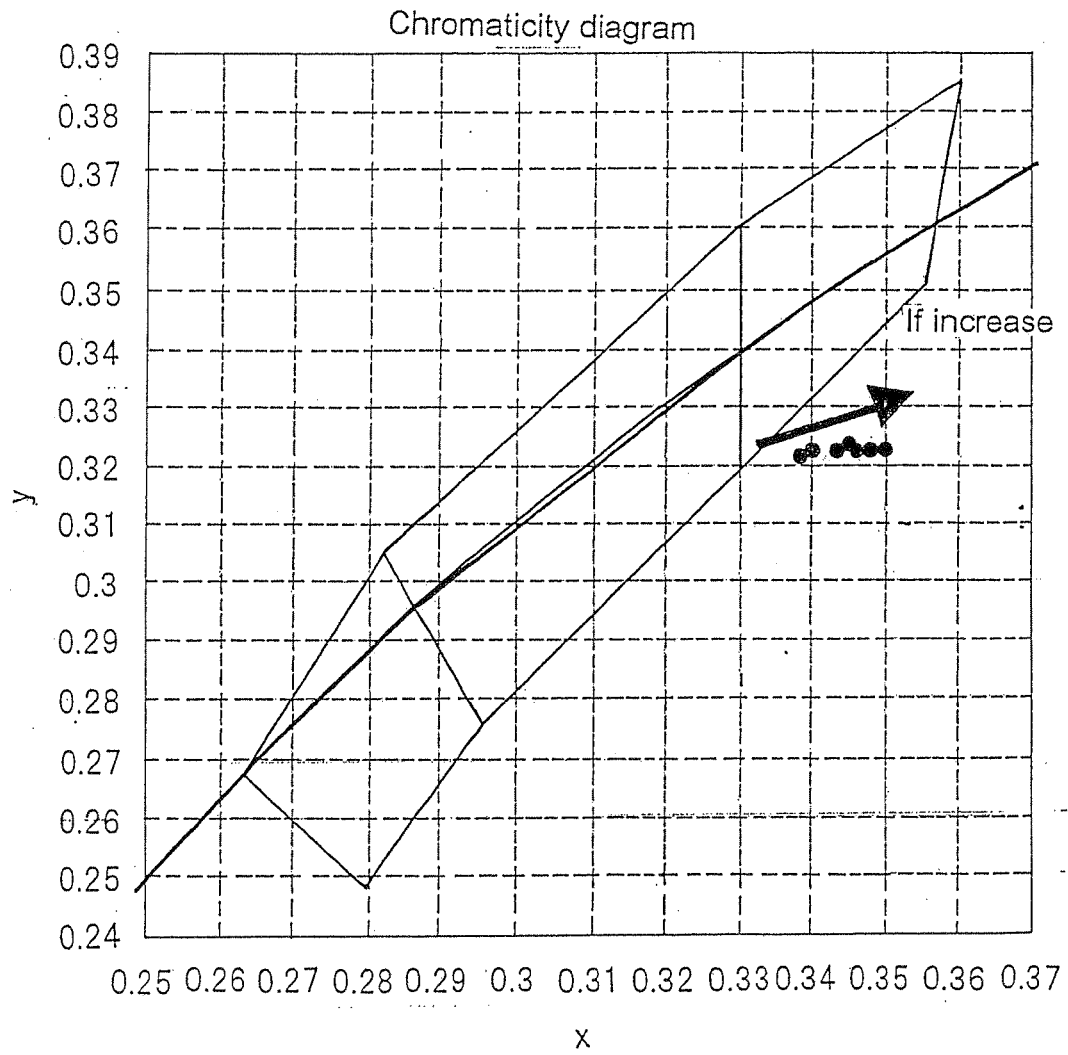


Fig. 87

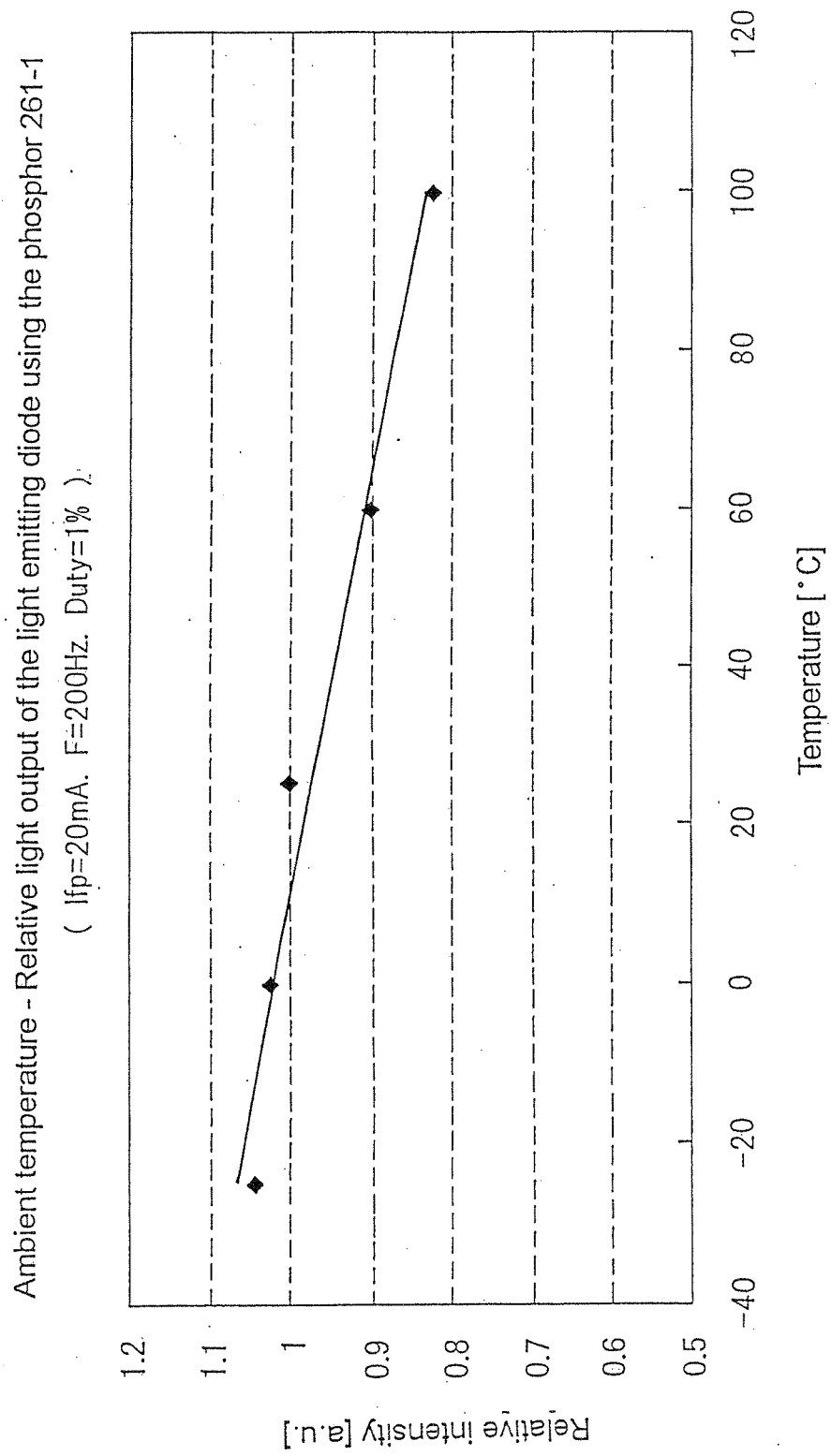


Fig. 88

Ambient temperature - Relative light output of the light emitting diode using the phosphor 261-2
(Ifp=20mA. F=200Hz. Duty=1%)

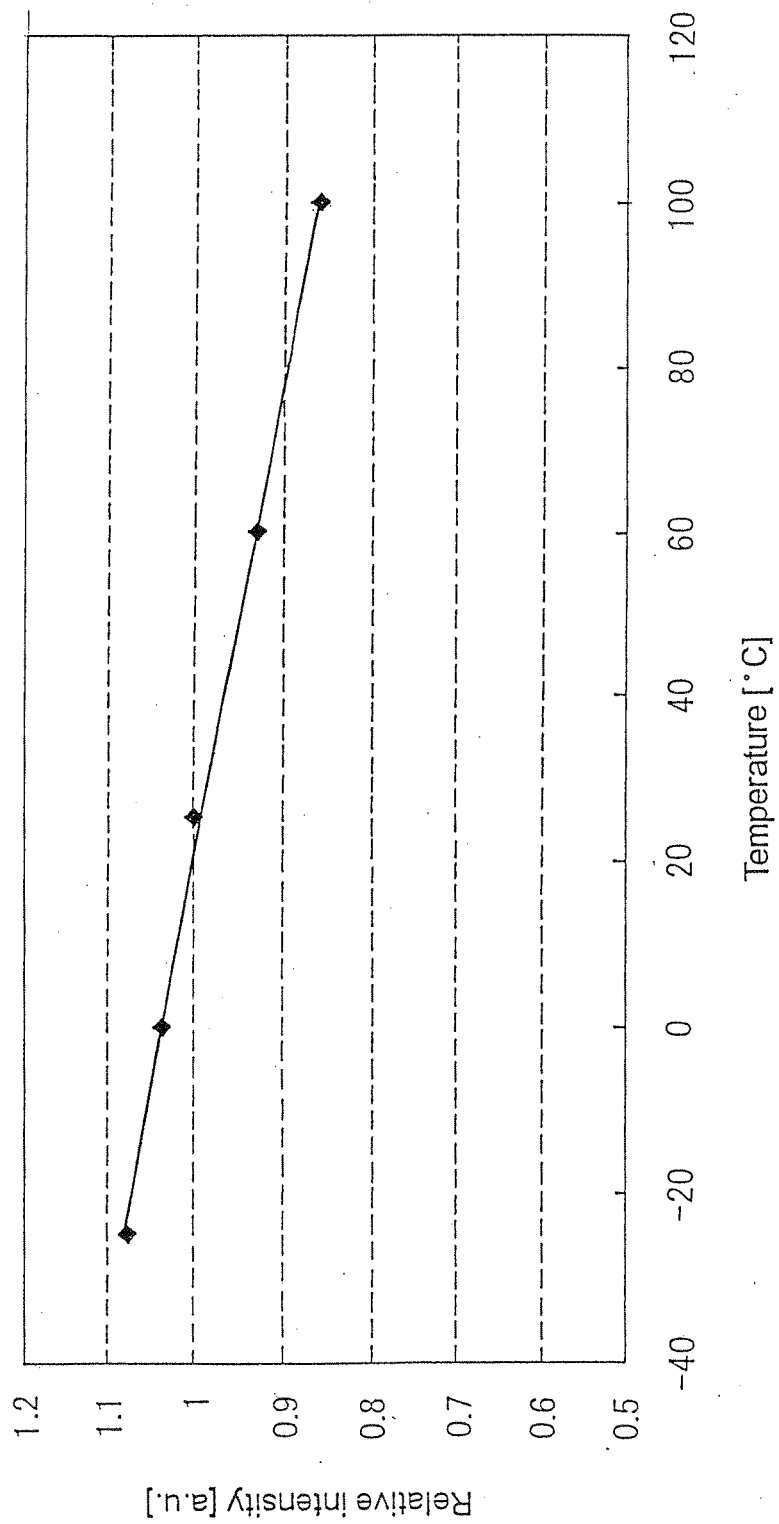


Fig. 89

Ambient temperature - Relative light output of the light emitting diode using the phosphor 266-1
($I_{fp}=20\text{mA}$, $F=200\text{Hz}$, Duty=1%)

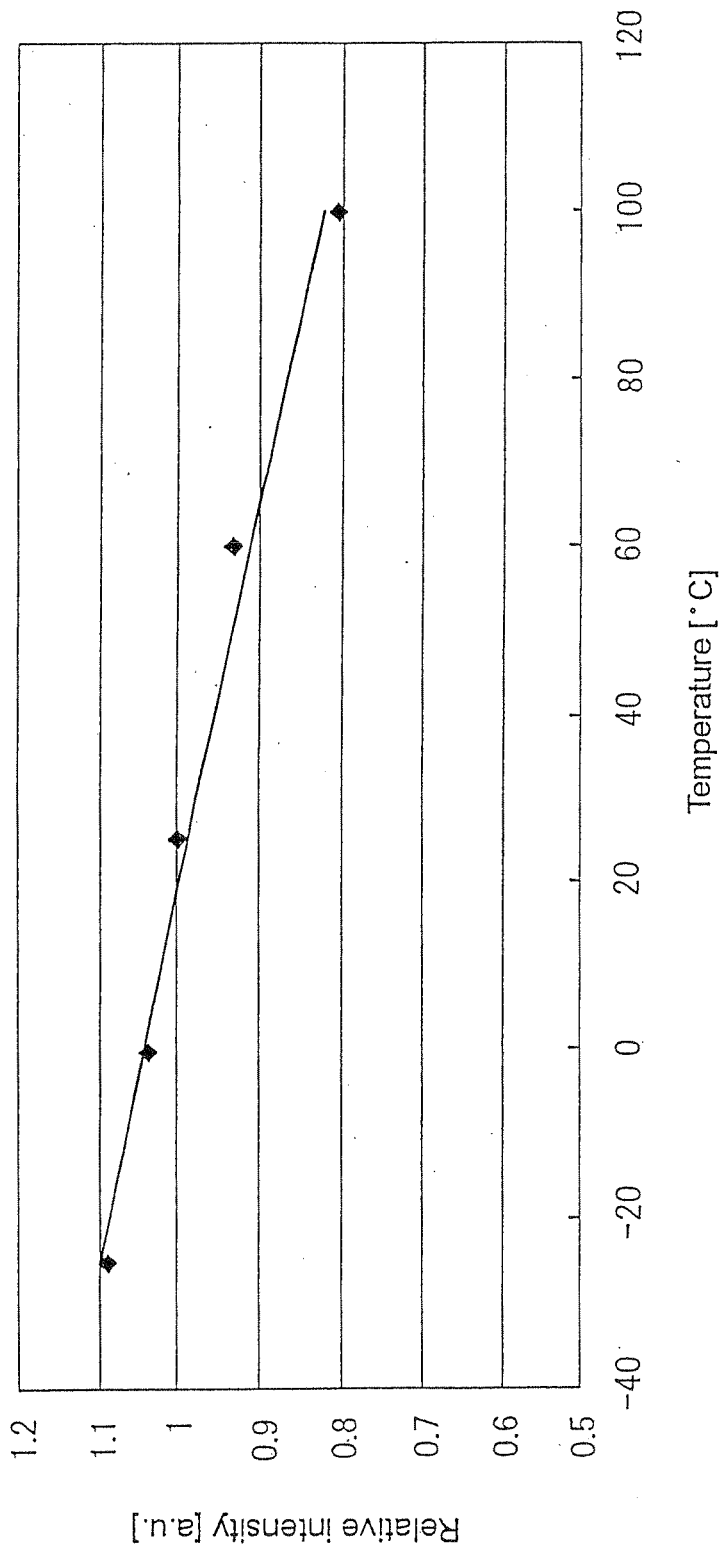


Fig. 90

Ambient temperature - Relative light output of the light emitting diode using the phosphor 266-2
($I_{fp}=20\text{mA}$. $F=200\text{Hz}$. Duty=1%)

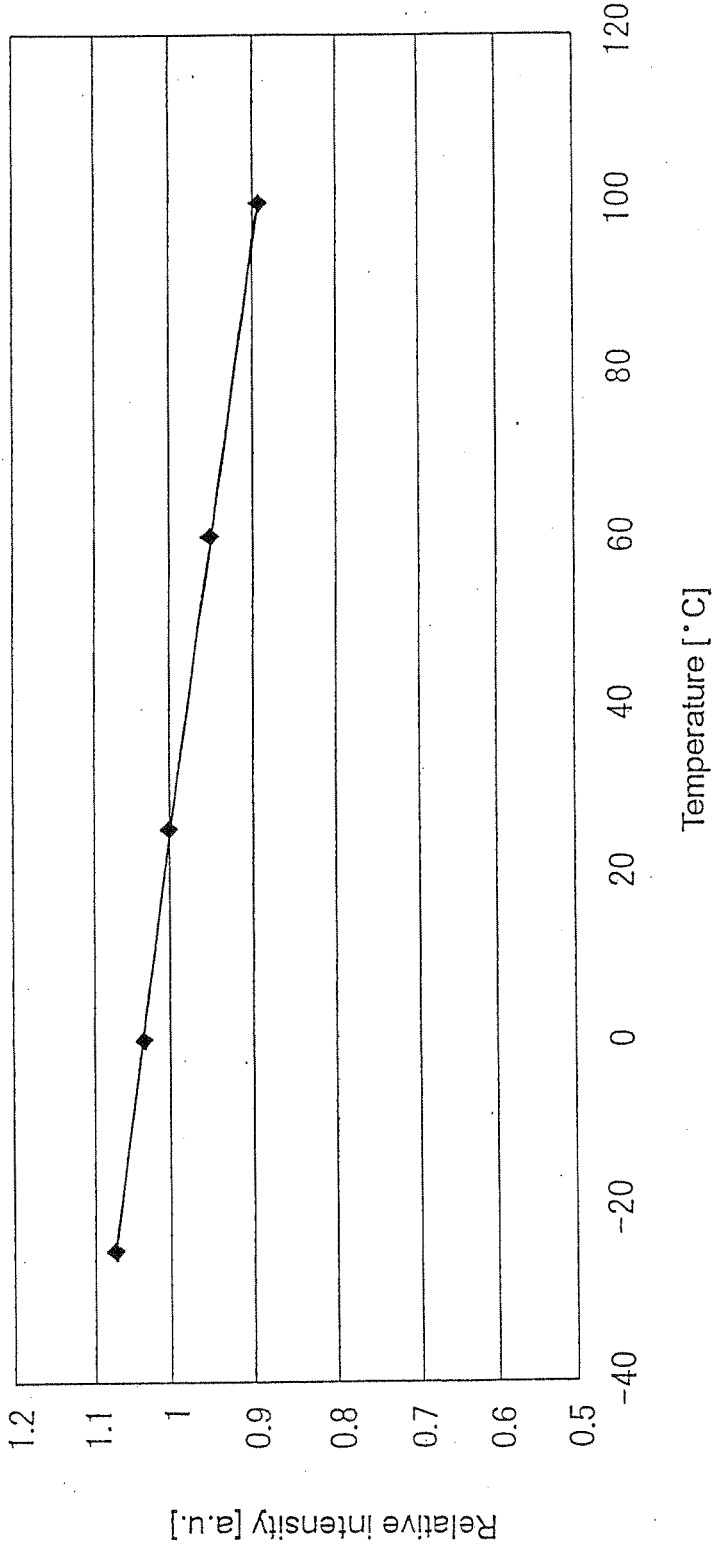


Fig. 91

Ambient temperature - Relative light output of the light emitting diode using the phosphor 266-3
($I_{fp}=20\text{mA}$, $F=200\text{Hz}$, Duty=1%)

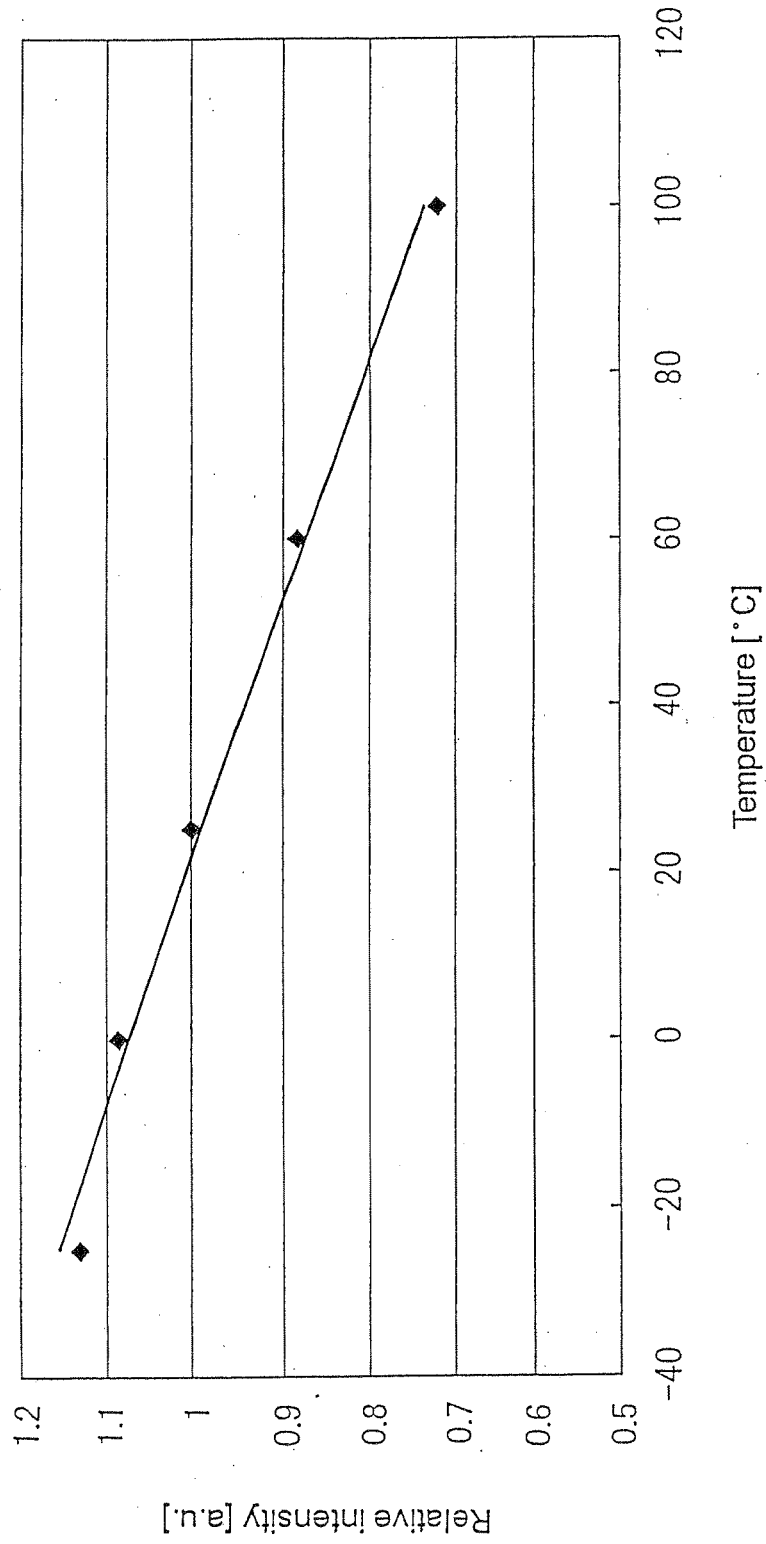
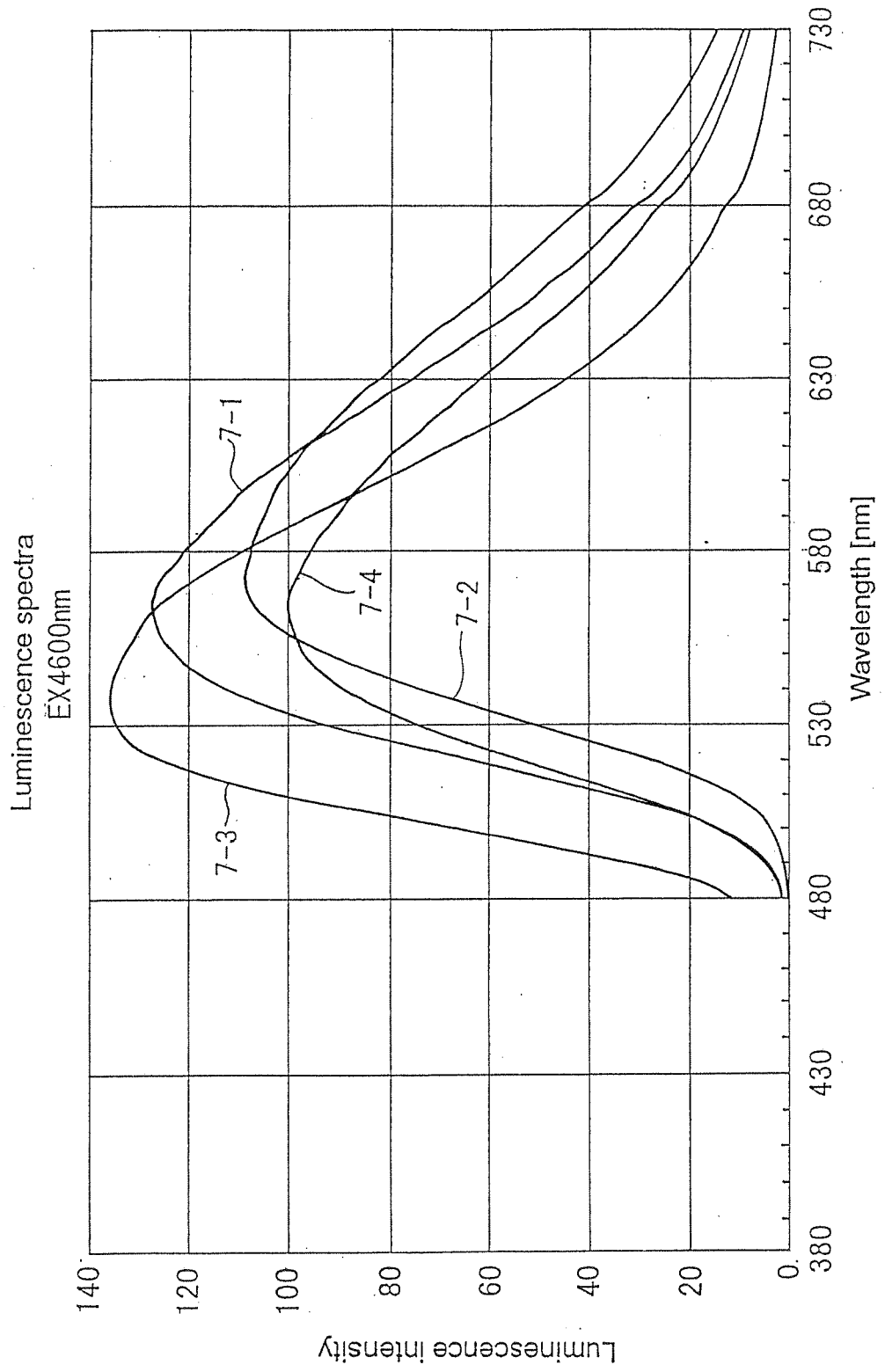


Fig. 92



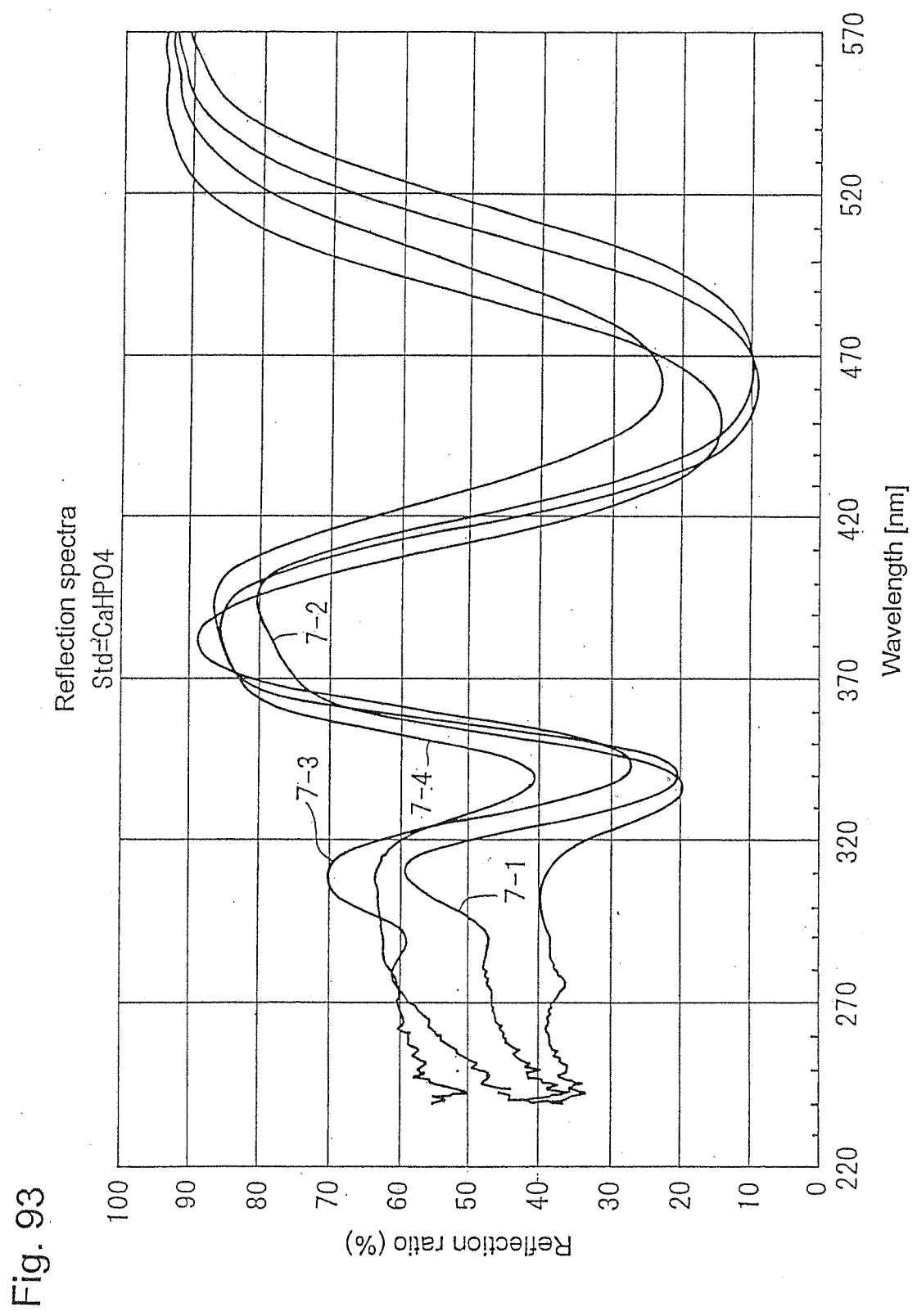


Fig. 94

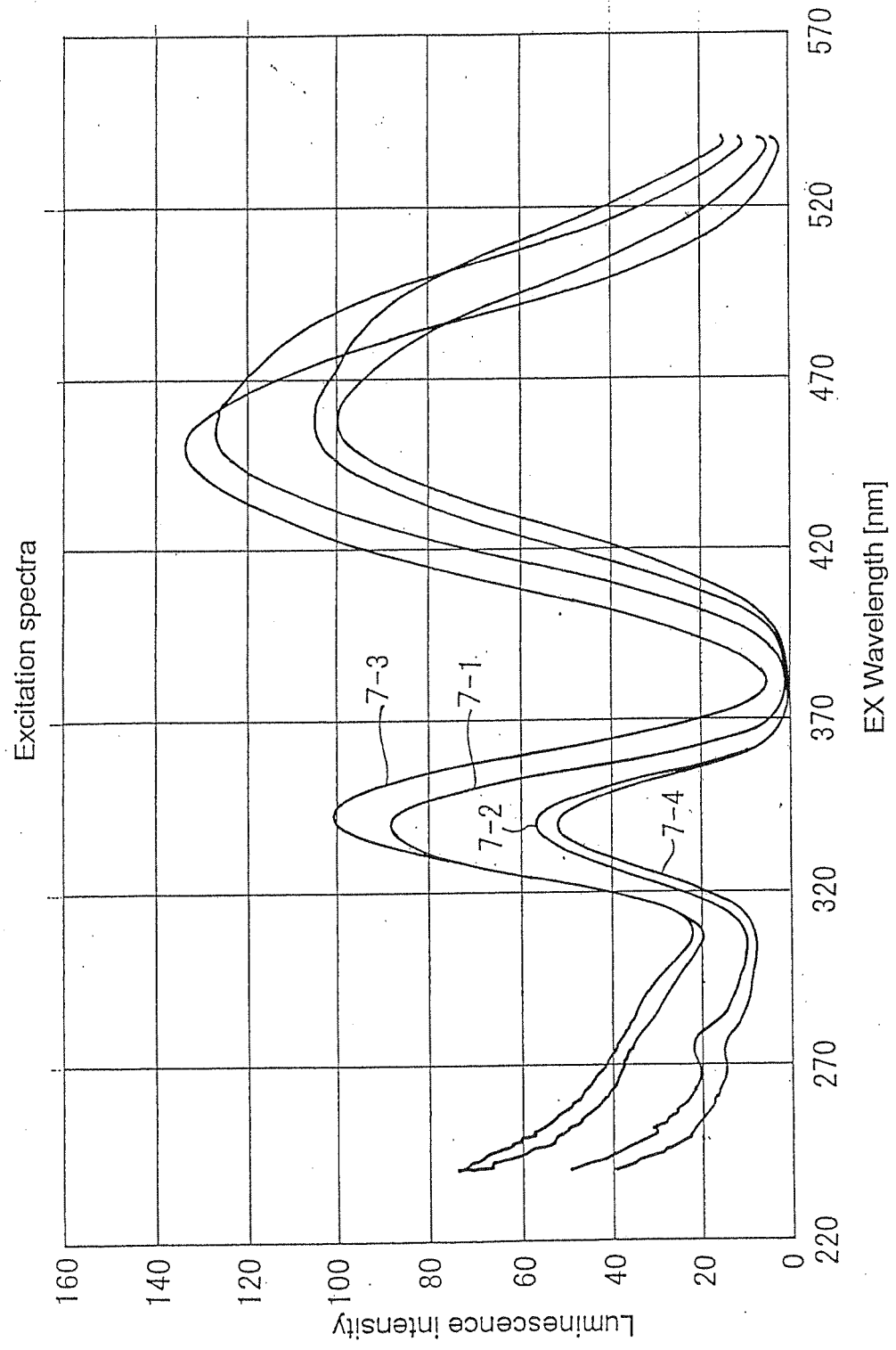


Fig. 95

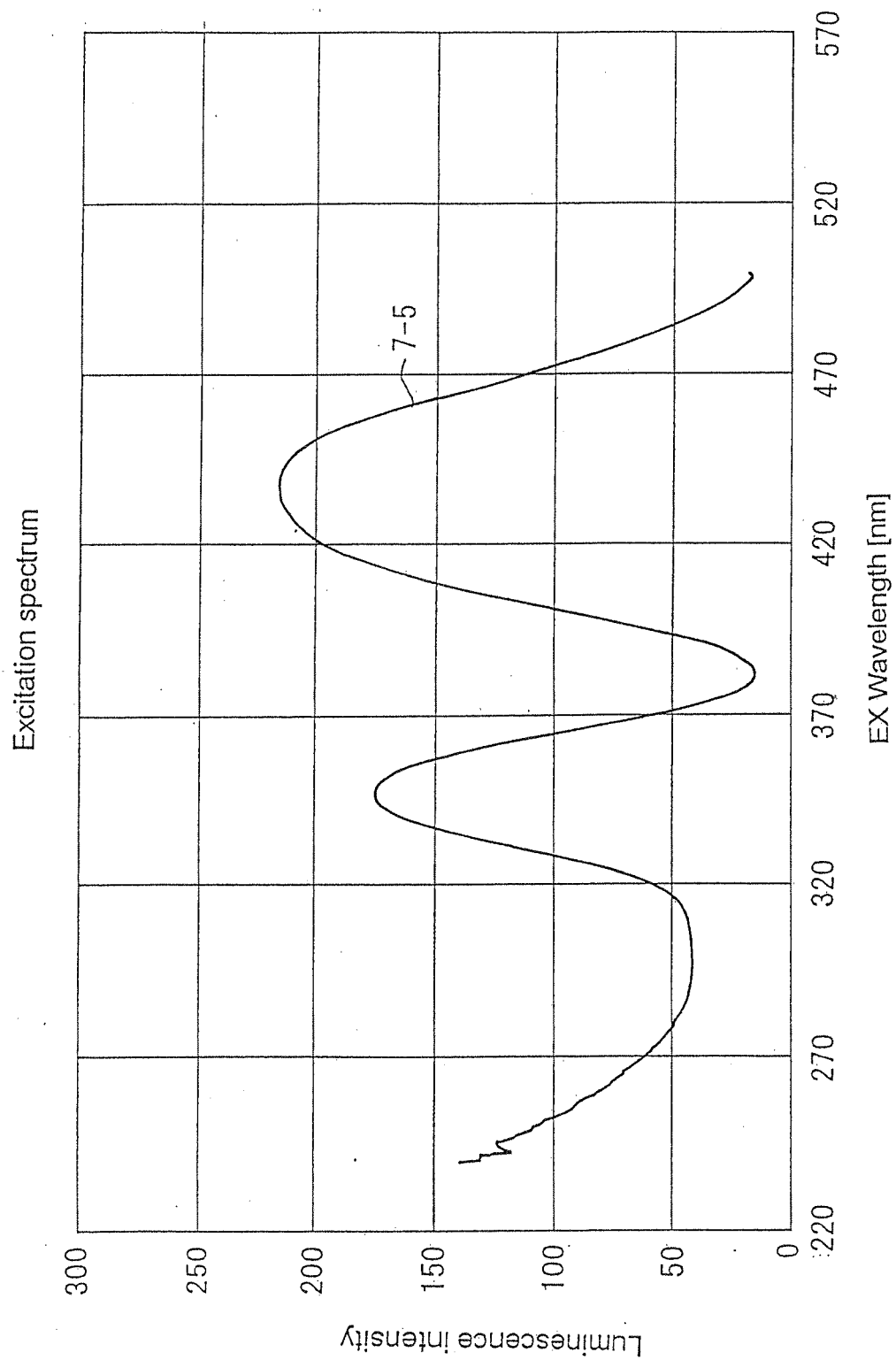


Fig. 96

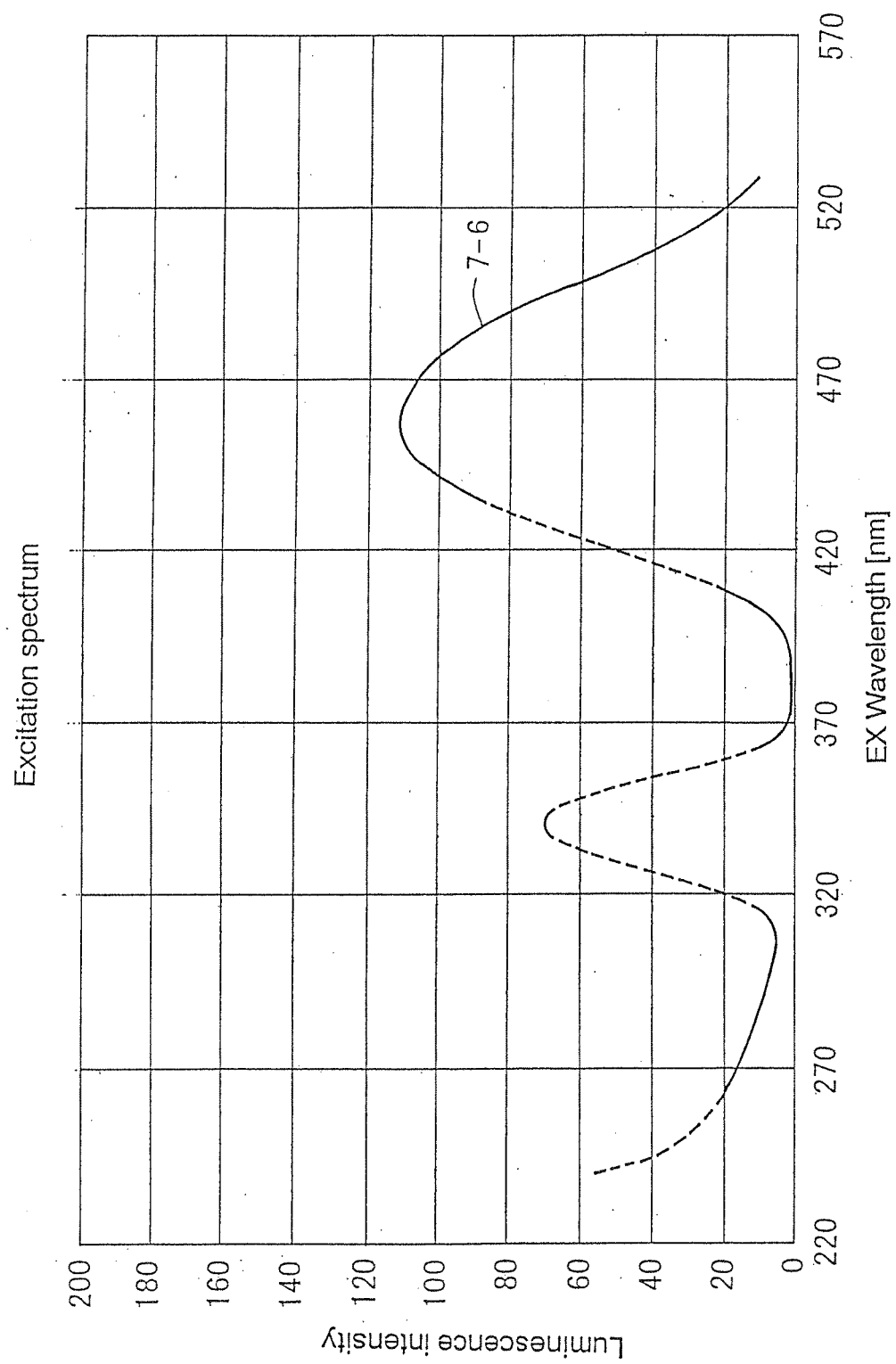


Fig. 97

