

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

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2001 09 18  
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(81)	AP ARIPO	EA	EP	OA OAPI	60/125,050	1999 03 18	(US)
					60/172,283	1999 12 17	(US)
					09/521,845	2000 03 09	(US)

(71)

	44111	3800
(72)	15139	11 7429

15085

30034 111

(74)

(54) 가

1 2 1 1 2 2  
 (epitaxial gro  
 wth)

1

1999 12 17 가 60/172,283 1999 3 18 가  
 60/125,050 , 가

, (haze) 가 /  
 (IR) , /  
 (NIR) 가 /

, , , ,  
 ( , , , , ) 가 , ,  
 ( , , , , ) (UV) ( , , , , ) 가  
 ( , , , , ) (IR) ( , , , , ) (400nm, 780nm)  
 ( , , , , ) 가

,  
 가  
 (SnO<sub>2</sub>)  
 4,952,423 , (F) - 가

1/8in

가 ( : ASHRAE Standard Calculation Method). 1/8  
 1.00 1.00

(Sb)

가

가

$\text{Sb}_2\text{O}_3$ ,  $\text{TiO}_2$ ,  $\text{Co}_3\text{O}_4$ ,  $\text{Cr}_2\text{O}_3$ ,  $\text{InO}_2$  가

가

2,302,102

4,504,109

2,302,102

/

가

가 ( 0.2 )  
 가 가  
 (iridescence)

, 1.5%

가

2,302,102

가,

0% , , , , 0.2  
 , / , / , / ,  
 / ,  
 1 , 2 1 2 (breaker layer)  
 1 2 1 , 1 2 2 ,  
 (epitaxial gr  
 1 ; - 1200 2300  
 2 ; 3000 3600 , 1  
 , 1 2 1 2 ,  
 1 , 2 , 1 , 1  
 , , ,  
 700 3000 , , 1  
 50 3000 , ,  
 , , , ,  
 (strata) , 1 900 1500  
 , , , , 1200 3600  
 , , , , 985 214  
 , , , ,  
 1 , 2 , , 1 ,  
 2 , , , 1 2  
 1 , 1 , 2 , , 1 ,  
 2 , , , 1 2

1 ; 1 1 (dopant)  
2 ; 1 2 ; 1 2  
2 ; 1 2 ; 1 2  
1 2 ; 1 2 ; 1 2  
1 2 ; 1 2 ; 1 2  
3000 , , , 50  
1 , , 1 700 3000  
- .  
1 ( ) .  
2 ( ) .  
3 ( ) .  
4 (float) - ↗  
5 .  
6 5 .  
7 .  
8 - .  
9 - .  
10 9 .

Figure 4 consists of four SEM images arranged in a 2x2 grid. The top-left image shows a relatively smooth surface, labeled with a 1 and an arrow pointing to the left. The top-right image shows a more granular surface, labeled with a 1 and an arrow pointing to the right. The bottom-left image shows a porous structure, labeled with a 2 and an arrow pointing to the left. The bottom-right image shows a complex, multi-layered structure, labeled with a 2 and an arrow pointing to the right. The images are labeled with numbers 1, 2, and 3, and arrows indicate the direction of increasing magnification.

$$(14) \quad 1 \quad (16) \quad 2 \quad (20) \quad 1 \quad (16) \quad 2 \quad (20) \\ " \quad " \quad (18) \quad . \quad (22) \quad 2 \quad (20)$$

4,746,347 ; 4,792,536 ; 5,240,886 ; 5,385,872 ; 5,393,593  
 (12) , 2mm 13mm, 2.2mm  
 6mm .

(14) - , (magnetron sputter vapor deposition: MSVD), (CVD), - (sol - gel)

, (14) CVD

CVD

가

. CVD

, 1 (16) - . 1 (16)

, 1 (16) (12) 가 가 - 1 (1)

6) - 1 (16)

5,356,718

, 1 (16) , 5,356,718

(18) (18) (18)

2 (20)

(18) 1 (18) 1

(18) 1 (18)

(18) 1 (18)

가  
(P/Sn) 0.01 0.10, 가 0.03 (18) 0.08, 가 0.04 가 0.  
06 , (18) .

, (18) , , (18) , (Si/Sn) 20 %  
0.050, 가 0.010 0.035, 가 0.015 0.025 0.005  
(18) .

(22) 가 , ( 4,716,086 4,786,563  
가 ), ( 2,156,571 ), ( 5,425,861 ; 5,344,7  
18 ; 5,376,455 ; 5,584,902 ; 5,834,103 ; 5,532,180  
5/29883 ), ( 09/058,440 ) , WO 9

t) CVD , (14) CVD (coater slo  
CVD , , (pool) 4,853,257  
, CVD , , , 3,652,2  
46 ; 4,351,861 ; 4,719,126 ; 4,853,257 ; 5,356,718 ; 5,776,236

, - / / -  
- 1 (16) , (MBTC)  
SbCl<sub>3</sub> SbCl<sub>5</sub> , , , , SbCl<sub>5</sub> 10  
MBTC SbCl<sub>5</sub> 20 % 2300 1 (16)

1 MBTC 1 ( ) (18)  
(TEP) TEP , MBTC TEP 20 %  
10 % , 가 3 % (18) (18) ,  
600 (18) 2 , , , ,  
(14) (14) .



12) 가 가  
 (42) (42) 50 3000 , (42) 1000  
 (42) (CVD) , (42)  
 (MSVD) (42) (42)

1 (44) 15 % 1 (44) 700 3000 10 % 30  
 %, 15 % 20 % (18) 1 (44)  
 (44) 가 1500 2000 , 1000 , (18)  
 2000 , 1500 , 1000 , (18)

, 2 (46) 1 (44) 2 (46) 3 2 (46) , /  
 (18) 1 (44) 2 (46) 0 3000 10 % 30 %  
 , 2 (46) , 가 2 (46) 2 (46) , 1 (44) 가  
 (3000 ) , , 2 (46) , 2 (46) (0 ), (0 )  
 , , 1 (44) 가 (700 ) ,  
 , 2 (46) 1500 (3000 )  
 , , 2 (46) 2000  
 , , 1500 2000

, , , 0.2 , 1.5%  
 (18) 0.5 , 0.44

(42)

, 1 2 (18)  
 , , 1  
 1 2

1

5가 (MBTC; ELF (Atochem) N.A. 5가  
 (TEP), (TFA), MBTC ICD - 1087), (TEOS), (ATC; IC  
 D - 1133)

ATC MBTC MBTC 7 %  
 350 가  
 , MBTC  
 가 0.8 1.0 % 400 / 720 / 4.8  
 53,257 (station) 3.3mm  
 1200 1220 , 가

, MBTC TEP  
 MBTC TEP 3 % 0.8  
 1.0 % 2  
 , TEP MBTC  
 1

, TFA MBTC MBTC TFA 12 % 0.  
 8 1.0 % 3

3.3mm 3 1750  
 1 , 450 650 - , 3400 - 2  
 0.8% 가 . 0.44 , 48% 가 , 0.18  
 (18) 3%

2

1  
TC 1.4 % (0.5 0.8 %) , . TEOS , 2  
MBTC 0.8 1.0 % TEOS MB  
MBTC TEOS 1.2

3.3mm 1750 1 , 450 650  
, 3400 - 가 .

0.44 , 48% 가 , 0.18 1.5%  
가 .

3  
- , 4 CVD  
- . ( CVD 1  
, MSVD)

[ 1 ]

		MBTC	%	%	SLM <sup>1</sup>	%	mm	/
1	1000	0.5	0.5	55	115	4	50	
2	1200	0.5	0.5	55	115	4	50	
4	1200	0.5	0	55	115	4	50	
6	1200	0.1	0.5	55	115	4	50	
8	1200	0.1	0	55	115	4	50	
9	1000	0.5	1	55	115	4	50	
10	1000	1	0.5	55	115	4	50	
11	1000	1	1	55	115	4	50	
1 L/								

(MBTC) 5 %

MBTC 20 % , 1150 (621 ) 가  
가 . 4 5

4 , 4(S4) 8(S8) 가 NIR  
가 . , 2(S2) 6(S6) , 550nm  
(PPG)

Industries, Inc.) (Solex<sup>R</sup>) (Solargreen<sup>R</sup>)  
10(S10) NIR 가 , 9(S9) 11(S11) UV , 1(S1)  
.

(annealed) (tempered) , 가 가

가

2  
4 1200 (649 )

H

샘플	평균 필름 두께	홀 이동도(Hall mobility)	홀 운반체 농도	홀 표면 저항	가중되지 않은 흡수치				
		MMR H-50 (cm <sup>2</sup> /Vs) AVG	MMR H-50(*E20 운반체/cm <sup>3</sup> ) <sup>1</sup> AVG	MMR H-50 (ohm/sq.) AVG	UV-Vis 300-700nm	근적외선 700-2500nm			
1	665	7.52	2.35	3.E+05	0.159	0.191			
2	795	0.72	1.49	7.E+03	0.307	0.298			
4	310	0.54	4.57	9.E+03	0.173	0.256			
8	153	0.54	4.95	2.E+04	0.142	0.211			
10	675	6.70	6.03	2.E+06	0.203	0.214			
11	879	4.90	9.48	6.E+05	0.254	0.224			
1H		1.02	1.07	3.E+05					
2H		0.47	2.23	8.E+03					
4H		0.42	4.89	1.E+04					
8H		0.35	4.84	2.E+04					
10H		0.04	3.41	2.E+05					
11H		8.35	1.92	2.E+05					
샘플	T	Tx	Ty	R1Y	R1x	R1y	R2Y	R2x	R2y
1	67.7	0.312	0.319	21.0	0.299	0.307	17.6	0.294	0.303
2	50.2	0.295	0.298	21.8	0.333	0.337	16.3	0.324	0.327
4	76.5	0.306	0.316	12.2	0.294	0.297	9.2	0.280	0.284
8	85.0	0.307	0.317	9.2	0.301	0.308	8.0	0.295	0.302
10	76.0	0.313	0.321	16.0	0.294	0.302	13.4	0.295	0.305
11	67.9	0.309	0.316	21.3	0.318	0.330	17.6	0.318	0.333
1H	70.1	0.312	0.320	19.2	0.298	0.306	16.6	0.293	0.303
2H	52.5	0.296	0.301	21.5	0.326	0.330	16.0	0.315	0.318
4H	76.7	0.306	0.316	12.2	0.294	0.297	9.2	0.280	0.284
8H	85.1	0.307	0.317	9.2	0.301	0.308	8.0	0.295	0.302
10H	72.1	0.312	0.320	18.3	0.295	0.304	16.1	0.291	0.302
11H	69.3	0.309	0.317	20.5	0.313	0.325	18.1	0.309	0.326
샘플	DE Delta T	DE Delta R1	DE Delta R2	Macadam T	Macadam R1	Macadam R2			
1	2.38	-1.78	-0.96	3.21	4.98	3.32			
2	2.25	-0.32	-0.3	3.79	5.16	6.56			
4	0.14	-0.02	0.01	0.26	0.1	0.19			
8	0.12	-0.07	-0.02	0.18	0.31	0.15			
10	-3.9	2.32	2.68	4.74	7.38	9.96			
11	1.34	-0.81	0.49	1.9	4.48	6.94			

<sup>1</sup> 10<sup>20</sup> 전자 운반체/cm<sup>3</sup>가 곱해진 지수(E)

R1은 코팅된 측면으로부터의 반사율인 반면 R2는 유리의 코팅되지 않은 측면으로부터의 반사율이고, T는 발광 투과율이다. 또한 DE는 색상 변화이다.

[ 3a]

350.0 360.0370.0380.0390.04	1.89450 1.88140 1.86920 1.85800 1.84750	0.09050 0.07227 0.058840.049340.04301 0.
00.0 410.0 420.0430.0 440.04	1.83770 1.82850 1.81990 1.81180 1.80420	039290.037700.03783 0.03938 0.04209 0.04
50.0 460.0470.0480.0490.0 50	1.79700 1.79020 1.78370 1.77760 1.77170	573 0.05013 0.05514 0.06065 0.06655 0.07
0.0510.0 520.0530.0540.0 550.	1.76610 1.76070 1.75550 1.75060 1.74580	276 0.07922 0.08586 0.09265 0.09954 0.10
0 560.0 570.0 580.0590.0600.	1.74120 1.73670 1.73240 1.72020 1.72420	650 0.11351 0.12054 0.12759 0.134630.141
0 610.0 620.0 630.0 640.0 65	1.72020 1.71630 1.71250 1.70880 1.70520	65 0.14865 0.15563 0.16256 0.16947 0.176
0.0 660.0 670.0 680.0 690.0 7	1.70160 1.69810 1.69470 1.69120 1.68790	33 0.18315 0.18993 0.19667 0.20337 0.210
00.0	1.68460	03

[ 3b]

710.0 720.0730.0 740.0750.0 76	1.68130 1.67800 1.67480 1.67150 1.6683	0.21665 0.22323 0.22979 0.23631 0.24280
0.0770.0780.0790.0800.0 810.0	0 1.66520 1.66200 1.65880 1.65570 1.652	0.24926 0.25570 0.26212 0.26852 0.27491
820.0 830.0 840.0 850.0 860.0 8	60 1.64940 1.64630 1.64310 1.64000 1.63	0.28128 0.28764 0.293990.300330.30668 0.
70.0 880.0 890.0900.0 910.0920.	680 1.63370 1.63050 1.62730 1.62410 1.6	31302 0.31936 0.32571 0.33206 0.33842 0.
0 930.0940.0 950.0960.0970.0 9	2090 1.61770 1.61450 1.611201.607901.6	34480 0.351180.357590.364010.370450.37
80.0 990.01000.0 1010.0 1020.0	0460 1.60130 1.598001.594601.59120 1.5	6910 383390.38990 0.39644 0.40301 0.409
1030.01040.01050.0 1060.0 107	8780 1.58440 1.580901.577401.57390 1.5	61 0.41624 0.42290 0.42960 0.43634 0.443
0.0 1080.0 1090.0 1100.0 110.0	7040 1.566801.56320 1.55950 1.555801.5	110.449930.45679 0.46369 0.47064 0.4776
	5200 1.54840	3

[ 3c]

1120.0 1130.0 1140.0 1150.0 1160.	1.54460 1.540801.537001.53310 1.5292	0.48467 0.49175 0.49889 0.50608 0.513
0 1170.0 1180.0 1190.0 1200.0 121	0 1.52520 1.52120 1.51720 1.51310 1.50	32 0.52061 0.527960.535360.542820.55
0.0 1220.0 1230.0 1240.0 1250.0 12	900 1.50480 1.50070 1.49640 1.49220 1.	0330.55791 0.56554 0.57324 0.58099 0.
60.0 1270.0 1280.0 1290.0 1300.0 1	48790 1.48350 1.47910 1.47470 1.47020	58881 0.59669 0.60463 0.61264 0.62072
310.0 1320.0 1330.0 1340.0 1350.0	1.46570 1.46110 1.45650 1.45180 1.447	0.62886 0.63707 0.64534 0.65369 0.662
1360.0 1370.0 1380.0 1390.0 1400.	10 1.44240 1.43760 1.43280 1.42790 1.4	10 0.67058 0.67914 0.68777 0.69647 0.7
0 1410.0 1420.0 1430.0 1440.0 145	2300 1.41800 1.41300 1.40790 1.40280	0524 0.71408 0.72300 0.73200 0.74107
0.0 1460.0 1470.0 1480.01490.0150	1.39760 1.39240 1.38720 1.38190 1.376	0.750220.759440.76874 0.77812 0.7875
0.0 1510.0 1520.0 1530.0	50 1.37110 1.36560 1.36010 1.35460	8 0.79712 0.80674 0.81643 0.82621

[ 3d ]

1540.0 1550.0 1560.0 1570.0 1580.0	1.34900 1.34330 1.33760 1.33190 1.32	0.83607 0.84601 0.85604 0.86614 0.8763
1590.0 1600.0 1610.0 1620.0 1630.0 1	610 1.320201.31430 1.308301.30230 1.	3 0.88661 0.89697 0.90741 0.91794 0.928
640.0 1650.0 1660.0 1670.0 1680.0	296301.29020 1.28400 1.27780 1.2715	550.939260.950040.96092 0.97188 0.982
1690.0 1700.0 1710.0 1720.0 1730.	0 1.26520 1.25880 1.25230 1.24580 1.2	930.994071.00530 1.01660 1.02800 1.039
0 1740.0 1750.0 1760.0 1770.0 178	3930 1.23270 1.22600 1.21930 1.21260	50 1.05110 1.06280 1.07460 1.08640 1.09
0.0 1790.0 1800.0 1810.0 1820.0 18	1.20580 1.19890 1.19190 1.18500 1.17	840 1.11040 1.12260 1.13480 1.14720 1.1
30.0 1840.0 1850.0 1860.0 1870.0 1	7901.170801.16370 1.15650 1.14920 1.	5960 1.17210 1.18470 1.19740 1.21020 1.
880.0 1890.0	14190 1.13450 1.127001.11950	22310 1.23610

가 NIR 가 800 69% 가  
58% TSET  
가 700 3,000

" TFCalc"

4

가

UV 가  
" 1.9  
" 1.6 1.9

NIR

69% TSET 7

가 가 TSFT 가

(TSFT) 51% 가

가 가

0.35	52%	가	37%	TSET	5	-	6
0.45	37%	TSET	5	-	-	-	가

1800 , - 1800

TSET TiO<sub>2</sub>

51%

TiO<sub>2</sub>

가

TSET 32.5%

가

7

TFCalc

, 1.5

TFCalc

0.05

가

가

1.5

2.0

가

20

ASTM E 891 - 87

(Illuminant) C

2.0

10nm

1230nm

1.680

1.0

2166

1.42

m

3664

40.01%

1045nm

1500n

27.2%

가

12.80%

500nm

0.174

1230nm

0.

260

5

4

550nm

2.0

10

nm

가

2.0

가

1.826

2.0

가

1539

702

300nm

1160nm

2.0

1.0

가

62.28%,

49.54%

가

12.75%

500nm

0.174

1230nm

0.260

6

900 1500 1200

2300 3600

900 1500 1200

가

가

5,356,718

8

$x=0.333$   $y=0.333$

8 1931 CIE; 2 ;  
 : CIE - C; : ; : 0.00 ° ; x 0.338, 0.3  
 21 ; y 0.371, 0.323 ; 14.24, 60.  
 18 ; 569nm, 585nm ; 450nm,  
 484nm ; (excitation purity) 0.223, 0.047 8 10  
 TFCalc

9  
 가 1 가 985

2 1200 3600 1  $x=$   
 0.3,  $y=0.34$   $x=0.34$ ,  $y=0.32$

10  $\pm 75$

9 10

8 ( 6 , x 0.305(0.325); y 0.342(0.325); 11.06(57.92); 539nm(584nm); (483nm); 0. 057(0.065) 7 , x 0.333(0.322); y 0.326(0.328); 10.55(56.63); 589nm(578nm); 486nm(478nm); 0.086(0.064)

(57)

1.

1 ;

2 ;

1 2 (break  
 r layer)

2.

1 ,

1 2 ,

3.

1 ,

1 2

4.

1 ,

5.

1 ,

6.

1 ;

1 2 ;

1 2 (epitaxial growth)

7.

6 ,

1 ,

8.

6 ,

1 ,

9.

6 ,

1 1000 2300 .

10.

6 ,

1 2 (a) Zn, Fe, Mn, Al, Ti, In, Zr, Ce, Sn, Si, Cr, Sb, Co  
, (b) Sn, Sb, F, In

11.

6 ,

2 2000 5000 .

12.

6 ,

13.

6 ,

14.

6 ,

100 1000 .

15.

6 ,

16.

- 1200 2300 1 ;

- 3000 3600 , 1

2 ;

1 2 1 2

17.

16

100

1000

,

18.

;

1

;

2

;

1

2

,

19.

18

,

1

2

,

20.

18

,

1

21.

20

,

1

가

22.

18

,

2

23.

22

,

2

가

24.

18

,

25.

18

,

26.

;

1 ;

1

;

2

,

1

2

27.

26

,

,

28.

26

,

1

29.

26

,

1

Zn, Fe, Mn, Al, Ti, In, Zr, Ce, Sn, Si, Cr, Sb, Co  
, Sn, Sb, F, In

30.

26

,

1

1200 2300

31.

26

,

32.

26

,

100            1000

33.

26

,

34.

26

,

35.

26

,

2

36.

35

,

2

Zn, Fe, Mn, Al, Ti, In, Zr, Ce, Sn, Si, Cr, Sb, Co  
, Sn, Sb, F, In

37.

26

,

1

가    8.0            12.0

-

38.

35

,

2

가    5            %

-

39.

33

0.001      0.10

40.

34

0.005      0.050

41.

;

1    ;

1

1

42.

;

가    50            3000            ;

가    700            3000

1

43.

42

,

(strata)

44.

42

,

1

2

2

,      2      0      3000  
          2      1      가    1

45.

;

900

1500

-

;

1200

3600

,

, 1

가 985

2

가 214

46.

;

1 ;

1

2

,

1

2

47.

46

,

1

-

48.

47

,

2

-

,

-

49.

;

;

1 ;

1

2 ;

1

2

1

2

50.

49

,

51.

49

,

52.

49

,

1

-

53.

49

,

2

-

54.

;

1

1

;

1

,

,

1

2

1

2

;

2

2

3

55.

54

,

1

,

2

3

56.

54

,

1

2

가

57.

54

,

1

58.

54

,

1

, 2

59.

1

;

1

;

2

,

1

2

,

60.

1

;

1

,

1

,

61.

;

가 50 3000

;

가 700 3000

-

1

;

1 가 0 3000

-

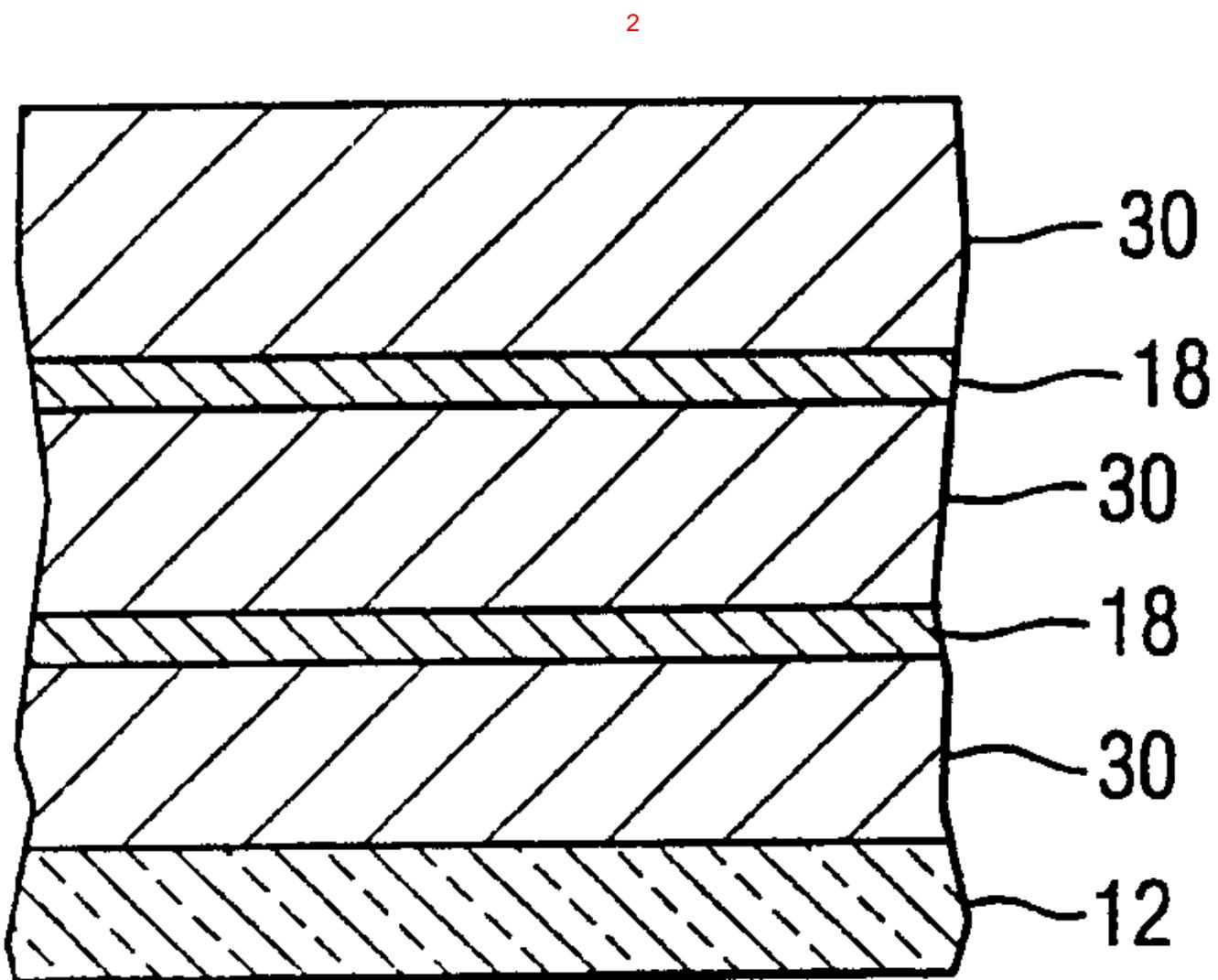
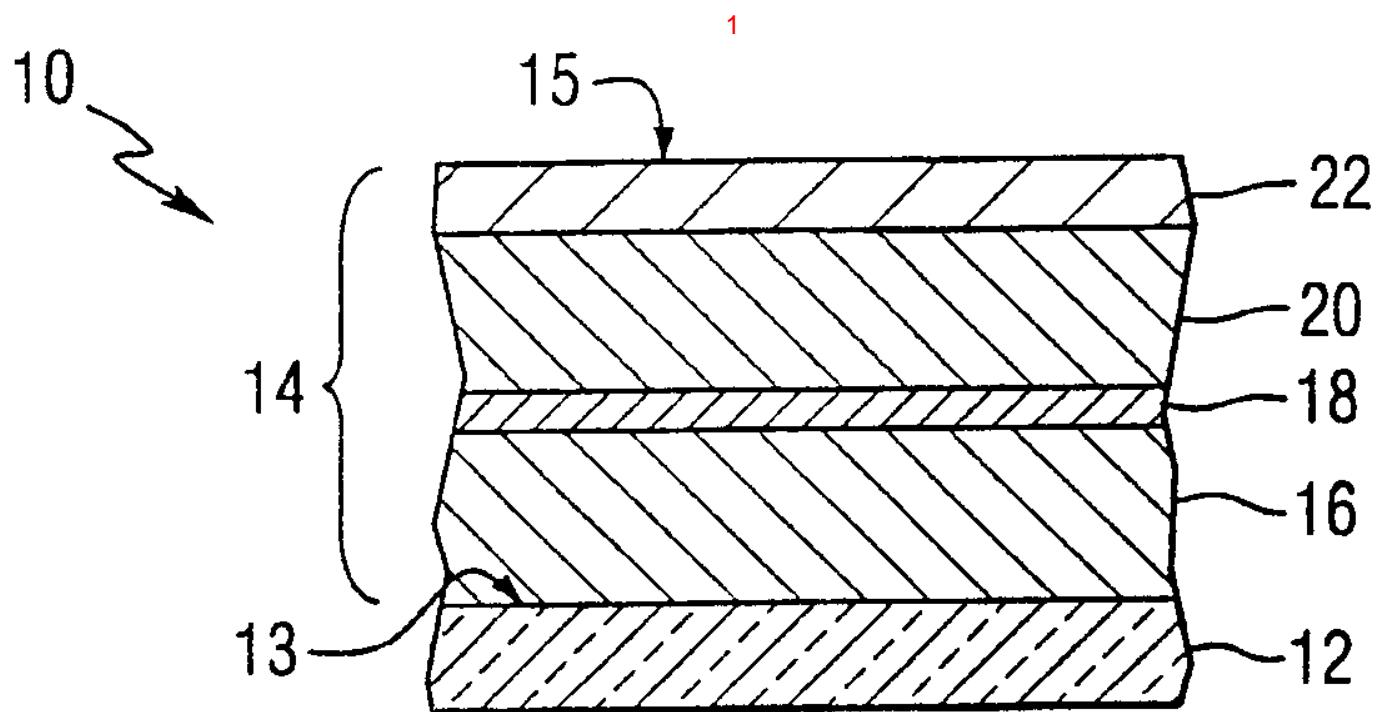
2

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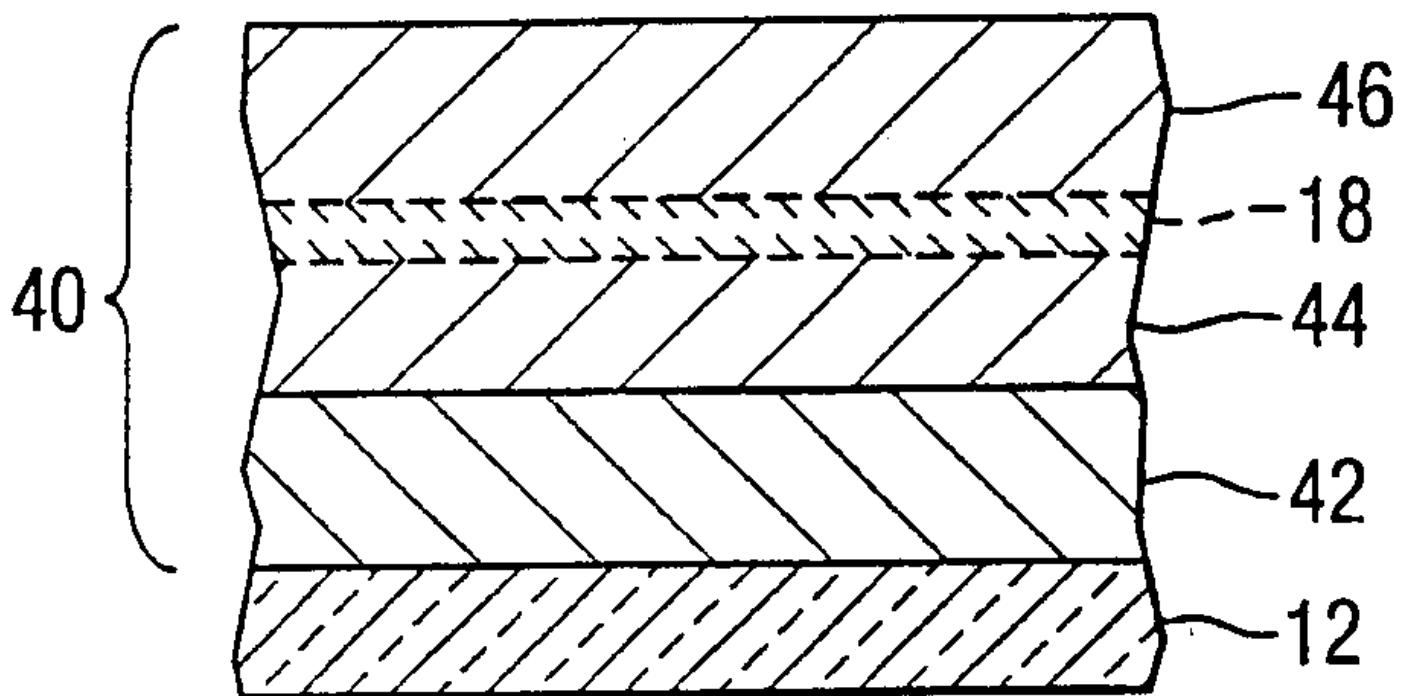
2

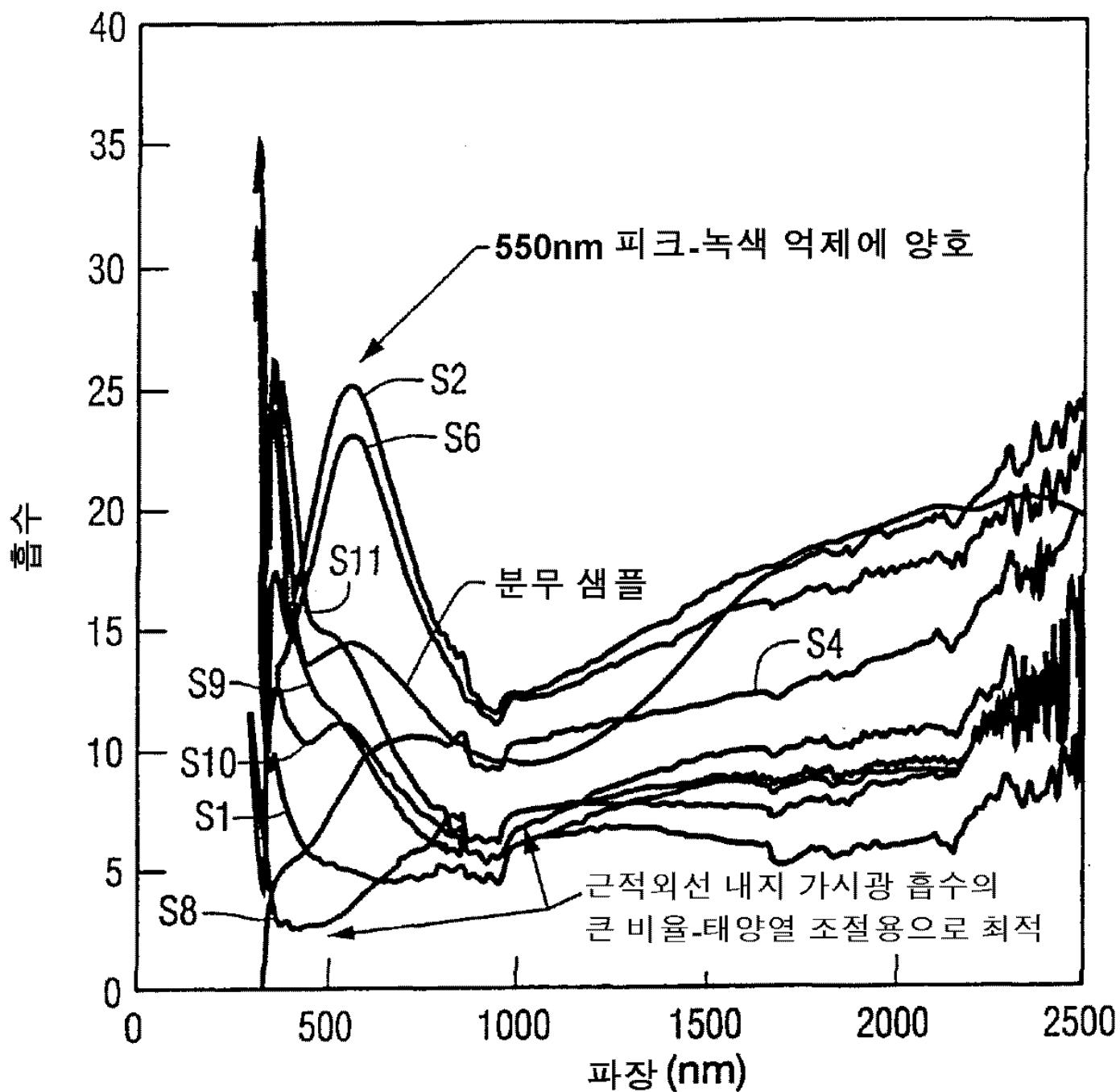
가 1

,



3

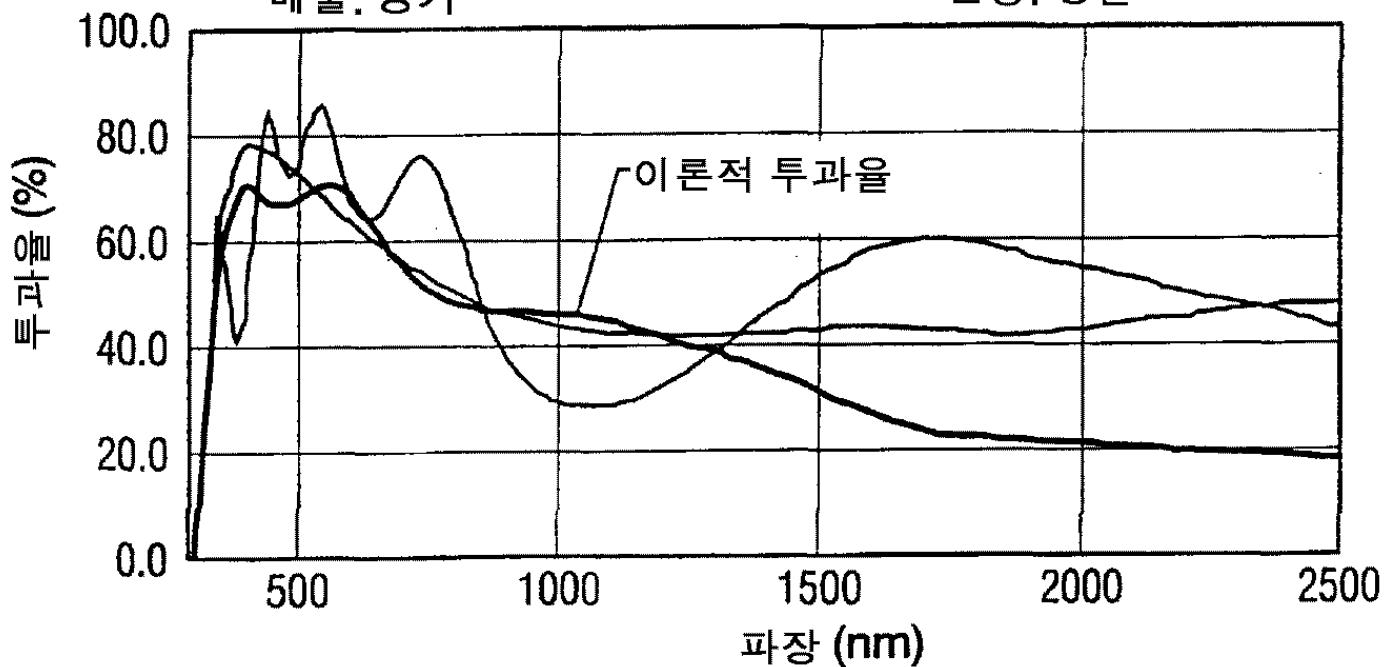




5

광원: 백색  
매질: 공기  
기판: 투명 유리  
배출: 공기

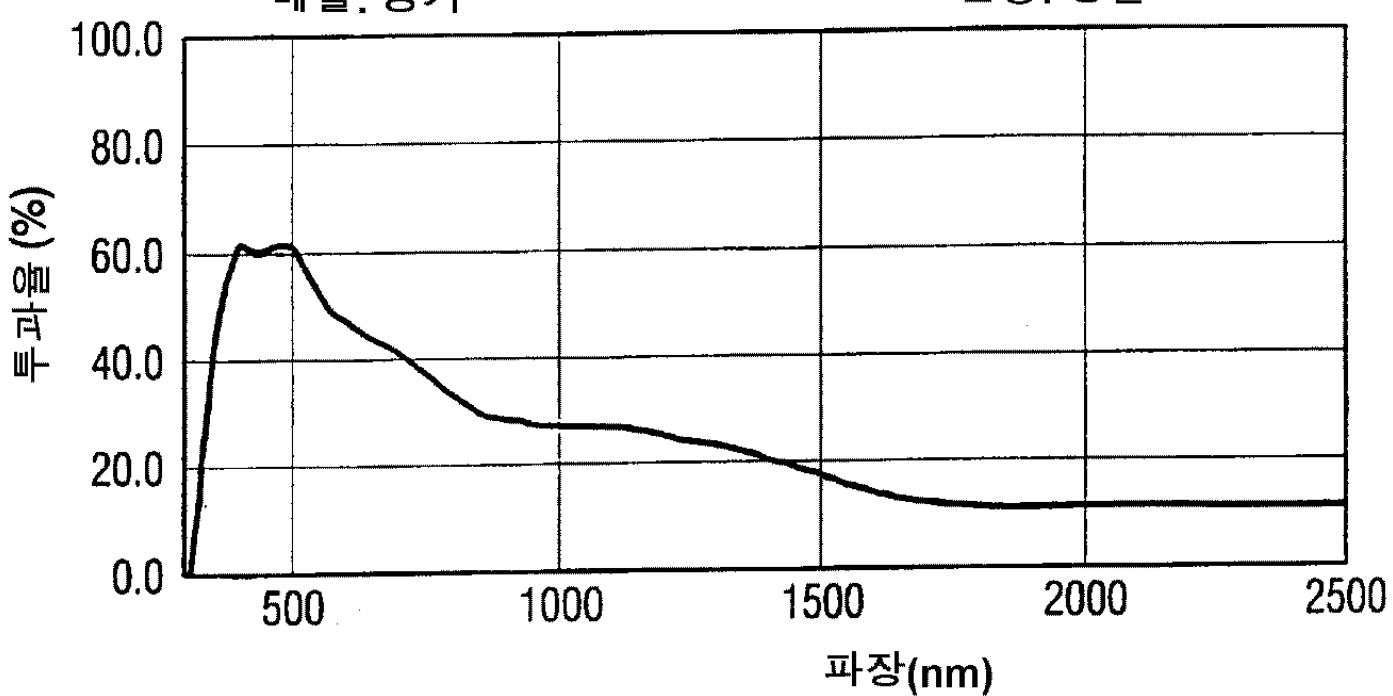
검출기: 이상적인 것  
각도: 0.0(도)  
기준: 1000.0(nm)  
편광: 평균 —



6

광원: 백색  
매질: 공기  
기판: 투명 유리  
배출: 공기

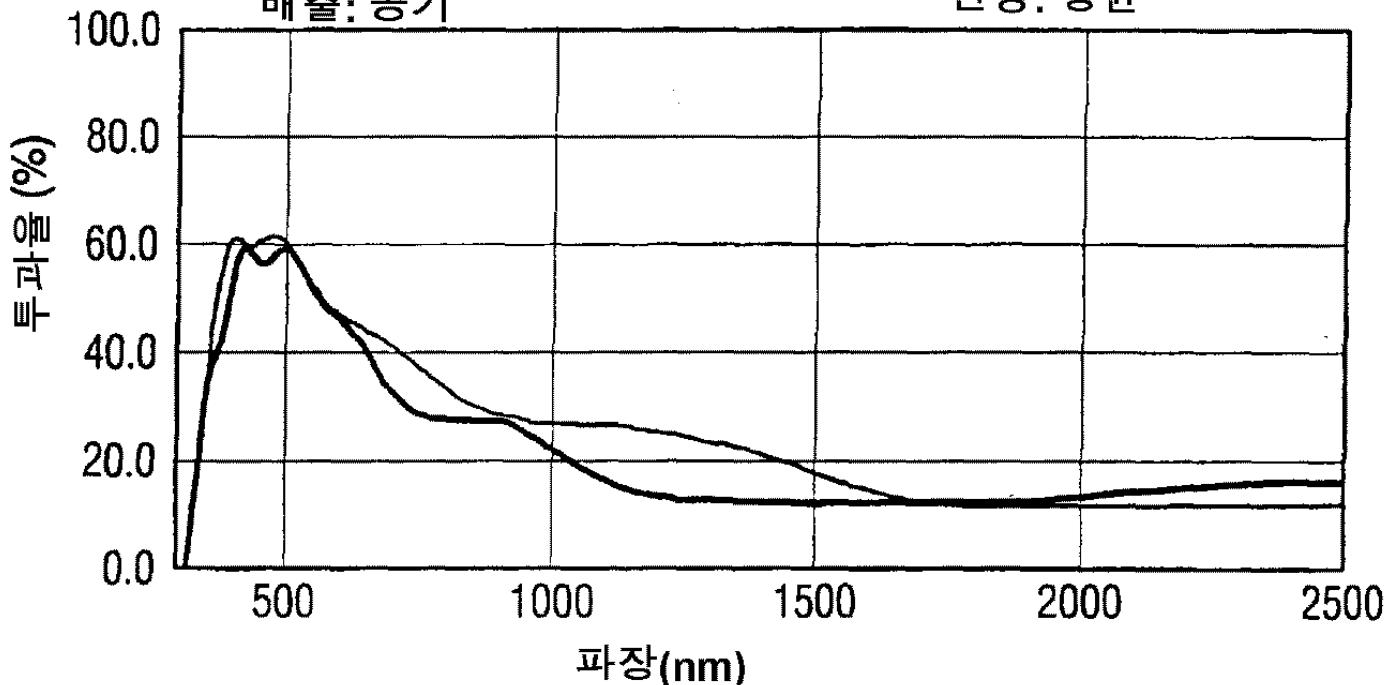
검출기: 이상적인 것  
각도: 0.0(도)  
기준: 1000.0(nm)  
편광: 평균 —



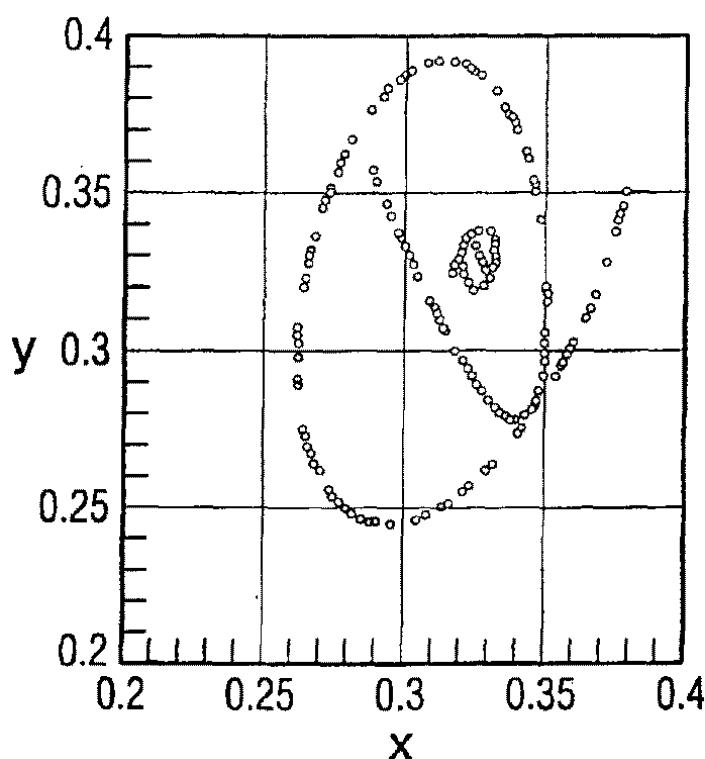
7

광원: 백색  
매질: 공기  
기판: 투명 유리  
배출: 공기

검출기: 이상적인 것  
각도: 0.0(도)  
기준: 1000.0(nm)  
편광: 평균 —

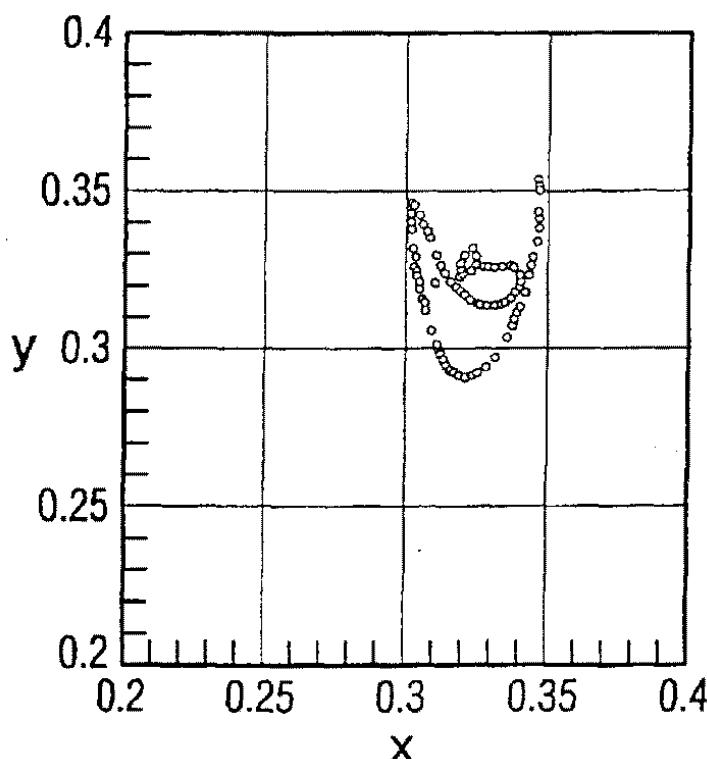


8



색상 표준:	1931 CIE
시야:	2°
편광:	평균
기준 백색:	CIE-C
광원:	백색
입사각(도):	0.00
	반사 투과
x 좌표:	0.338 0.321
y 좌표:	0.371 0.323
광도(%)	14.24 60.18
주요 파장(nm)	569 585
보색 파장(nm)	450 484
여기 순도	0.223 0.047

9



색상 표준:

1931 CIE

시야:

2°

편광:

평균

기준 백색:

CIE-C

광원:

백색

입사각(도):

0.00

x 좌표:

반사 0.305 투과 0.325

y 좌표:

0.341 0.325

광도(%)

11.06 57.92

주요 파장(nm)

539 584

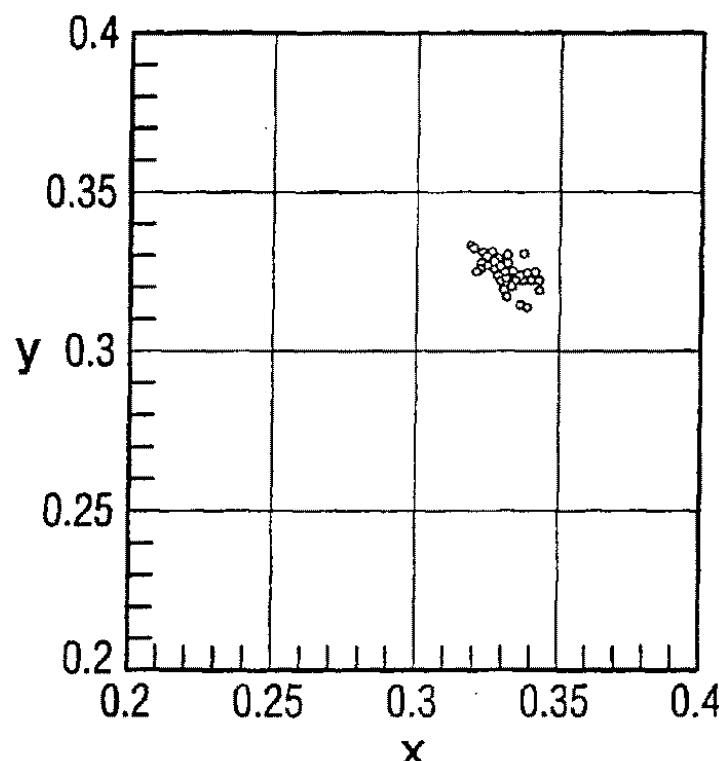
보색 파장(nm)

N/A 483

여기 순도

0.057 0.065

10



색상 표준:

1931 CIE

시야:

2°

편광:

평균

기준 백색:

CIE-C

광원:

백색

입사각(도):

0.00

x 좌표:

반사 0.333 투과 0.322

y 좌표:

0.326 0.328

광도(%)

10.55 56.63

주요 파장(nm)

589 578

보색 파장(nm)

486 478

여기 순도

0.086 0.064