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H01L 21/027

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(22)	1999 06 30	(43)	2000 02 25

(30)	1998 - 187626	1998 07 02	(JP)
	1999 - 081635	1999 03 25	(JP)

(73)	가 가	1 1 1
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(72)	가 가	8가 가
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가 가	8가 가
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가	8가 가
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(74)

:

(54) 가 , 가 가

가

가	(408) ,	(407) (404) ,	가 (402)	, (407) (408)	가 , (407) (406) 가

4

가 , , , , , 가

1 1 가

2 1

3 1 PEB

4 2 가

5 2 PAB 0

6 3 가

7 3 가

8 4 가

9 4 가

10 5 가

11 5 가

12 5 PEB

13 6 가

14 6 가

15 6 PEB

16 7 가

17 7 가

18 8 가

19 8 가

20 8 PAB

21 PEB
22 9
23
24 22
25 Tr 0
26 Tr
27 Tr 가
28 Tr/ T
29 Tr/ D
30 24
31 10
32
33 Tr

<

101, 401 :
102, 402, 604, 805 :
103, 403, 613, 806 : 0
104, 614, 712 : CCD
105, 405, 612, 816 :
106, 406, 606, 715, 811, 914 :
107, 407, 607, 716, 812, 915 :
108, 408, 609, 813 :
109, 611 :
404, 809, 907 :
601, 703, 801, 903 : 가

602, 704, 802, 808, 904, 906 :

603, 705, 804 :

605, 810 :

608, 814 :

610, 815 :

701, 901 :

707 :

710 : CCD

714, 913 : 가

803, 905 :

807 :

910 :

1001, 1103, 1301, 1403, 1601, 1703, 1801, 1903 : 가

1002, 1104, 1302, 1308, 1406, 1602, 1704, 1802, 1805, 1904, 1907, 1911 :

1003, 1105, 1303, 1405, 1603, 1614, 1705, 1706, 1803, 1808, 1905, 1906 :

1004, 1304, 1604, 1804 :

1005, 1605 : CCD

1006, 1606, 1809 :

1007, 1112, 1310, 1414, 1607, 1713, 1810, 1915 :

1008, 1113, 1311, 1415, 1608, 1714, 1811, 1916 :

1009, 1609 :

1010, 1312, 1610, 1812 :

1011, 1313, 1611, 1813 :

1012, 1314, 1612, 1814 :

1013, 1315, 1613, 1815 :

1014, 1101, 1401, 1616, 1701, 1901 :

1108, 1410, 1709, 1909 :

1111, 1413, 1712, 1914 : 가

1305 :

1306 : 0

1307, 1806:

1407, 1807, 1911;

1615 · CGD

10-275755, PEB (/),
PEB 가 . ,
,
, PEB . .

，
(隱逸) 가 . ，

, 가 , 가 .

, 가 가 , 가 , 가 가 . .

가 , 가 , 가 .

, 가

()

가 , 가 , 가 , 가 , 가 , 가 ,

가 , 가 , 가

(2) 가

(3) , , 가

(5) ,

(6) ,

(7) 가 , (積算) 가 가 .

(8) 가 , 가 . 가 가

(9) 가 . 가 가 가

(10) 가 , 가 가

1 2 , , D_{opt1}, D_{opt2} 1 1 2 , , 가
, 1 , Tr_1, Tr_2 2 , , Tr_1, Tr_2 , , 가
 Tr_2 , , , , , , 가
가 가

()

가 , . 가
가 , .

가 , , , , .

1

1 , 가 가 . ,
0 , . , , , , ,

, 가 0 가 가 , 가 ,
가 , 가 , 가 , 가 , 가 ,
가 , , , , , , , ,

2

PAB 0 , 5 . (pre assist bake : PAB) 140
. 0 가 , PAB 0 가

가

가

< 3

6,
0

가 가

, , , ,

가
가
(612),

(612)

가
(601)
(603)

470nm(5nm)

(602)

(603)

(604)

, 가

(607)

(607) 0 (613) (612) CCD (614)
 (607) (606) (611) 가 , (611)
 0 가 , 605 , 608 , 609 , 610
 . , (611) , 1 , , ,
 2 0.5μm

가 , 7 (701) 가 가 (714),
 (703), (703) (707), CCD (710) , 가
 (705) 가 , (704) , (705) 0
 . , CCD (712) , 715 , 716 , , ,

, PEB 140 PEB 0 1 , 3
 , PEB 0 가 0 , , ,
 , 0 가 , 가 (701) 가 (710) , , ,
 . , , , (707), CCD , , ,
 03), , , , (714), (7

가 , 0 , 1 , , ,
 , , , , , , ,
 가 , 1 , , ,
 , , , , , , ,
 가 , , , , , , ,

< 4

8,
0

가 가

, , , ,

가 , , 가 (816) 가 (801) 470nm (802) 5nm (803)
 , , (816) , (805) , , (812) (801) 0 (806) 0 (816) (808)
 (809) (802) (807) (808) , , , , , , , ,
 , 810 , 813 , 814 , 815

 가 , 9 (901) 가 , 가 , 가 (913),
 (903), (910) , , (904) , , (905) (903)
 가 , 0 , , , , , , , , , , , ,
 , , , , , , , , , , , , , ,

 , PEB 14 PEB 0 1 , 15 , 0
 , PEB 0 , , , , , , , , , , , ,
 , , , , , , , , , , , , , ,
 , , , , , , , , , , , , , ,

 , , , , , , , , , , , , , ,
 , , , , , , , , , , , , , ,
 , , , , , , , , , , , , , ,
 , , , , , , , , , , , , , ,

 < 5

 10 , , , , , , , , , , , ,
 0 , , , , , , , , , , , ,
 , , , , , , , , , , , , ,

 , , , , , , , , , , , , ,
 (1013) , , , , , , , , , , ,
 , , , , , , , , , , , , ,
 , , , , , , , , , , , , ,

 (1008) 0 (1013) (1009) CCD (1005) (1005) , , , , , , ,
 (1007) (1002) (1002) CCD , , , , , , , , ,
 , , , , , , , , , , , , ,
 (1009) , , 1 , , , , , , , , ,
 0.5μm

6

13 , 가 가 . , ,
0 , . , ,
,

(1315) 가 (1301) 470nm (5nm), 가 (1315) ,
(1303) (1302) (1304) (130)
5) , 가 (1311) .

(1311) (1310) 0 (1306) (1315) (1308) ,
(1309) 0 . , (1303)
(1302) (1308) ,
, (1307) ,
. , 1312 , 1313 , 1314 ,
.

413), 가 (1403), 05) 가 (1403), 0 , 14 (1401), (1403), 1405) 가 (1403), (1407), 1414 , 1415 (1407)

PEB , PEB 140 , PEB 90 . PEB 가 140 PEB
15 . . , PEB 가
15 . .
, 가
가 , 가 , 가 , 가 ,
(1401) 가 , 가 , (1413), (1403), (1410)
, 가 .

< 7 >

가 (1601) 470nm(5nm), 가 (1613) 2 (1603, 1614) (1602) (1603) 1603). (1613) . , (1604) , 가 (1608)

0 , (1613) CCD (1605) , (1609) 0 가
 (1607) (1609) , (1603) CCD (1605)
 , 2 (1609) 2 (1609)
 1 , 2 0.5μm

,	1606	,	1611	,	1610	,	1612	,	1616	.
가		17	.		(1701)	가		가	가	(1712),
(1703),		(1709)	.	가	.	.	(1703)	.	.	(17
가	,		(1704)	,		(1705, 1706)	.	.	.	1
05, 1706)					0					
713		,	1714	.						

PEB , PEB 140 , PEB 90 . PEB 가 140
12
가 , 2 12
. , PEB . 가 ,
가 .

가 가 , 가
(1701) 가 가 , (1712), PEB
가 . (1703), (1709)

< 8 >

18 , 가 가 . ,
0 , . ,

가 (1801) 470nm (5nm), 가 (1815) 2 (1803, 1808) (1802) 1803). (1815) (1804) 가 (1811) . .

(1811) (1810) 0 (1815) (1806)
(1805) , (1807) (1810) 0 가
(1803) (1802) (1805) ,

14

1809 , 1813 , 1812 , 18

가 19 (1901) 가 가 (1914),
 (1903), (1909) 가 . (1903)
 가 , (1904) , (1905, 1906) . (19
 05, 1906) (1911) ,
 0 . , 1915 , 1916 .

, 가 0 가 가 가 . , 6
0 , 가 0 가 .
가 , .
가 , .
가 , .

< 9 >

PEB(Post Exposure Bake)

B , , , (, . ,) , PE 가 가

22 , (,)
. (2200) , 7

, (2200) (2200) INT
가 .

가 WS CAR . CAR

COT1, HP1,
COT2, HP2가
가 HP3
CAR, CAR, DEV가
CAR, .

WS	()	CAR
COT1		,	CAR
HP1			COT1
HP1	,	190	, 60
			60nm

,
,
40 , 90
400nm

INT (2200) CAR
 HP3 PEB(Post Exposure Bake)
 24 24a HP3
 24b (2401) 3 (2402, 2403, 2404)
 4) (2405)

PEB (2402 2404) 140 . HP3 140 , 90
WS . ,

$$\text{Tr} = (\quad) - (\quad)$$

, 5mm² 25 CCD 0 CCD, | Tr . , Tr 26 . ,

26	Tr 가	27	Tr 가	27	Tr 가
	Tr 가		, 13.5mJ/cm ² , 90		
	A Tr 가 (140)	B T 0.4	A Tr 139.6	B 25.0nm, 26.2nm 140.4	A 가 27

PEB 가 가 , 13.5mJ/cm² , Tr , Tr/ T Tr/ D ()

CCD CCD Tr
Tr

0 CCD ,
(nanometroics) (nanospec) 210

3 30 (3001) 가
30a 30b 30a A - A'

Tr , 가
Tr , 1

HP3

() DEV 90

PEB, 1, 180nm
12.1nm(3) 7.2nm

, PEB 가 , , , PEB T
, 가 . , , (P), (I), (D)

< 10 >

, 가 9 , .

WS		CAR		COT1				
	,	CAR		HP1		, 190	, 60	
		60nm			,			
COT2			,		HP2		, 140	, 90
	가		,	400nm				

31 (3101)
 (3102) (3103) (3104)
 (3103, 3104) (3103)
 51.9%, (3104) 23.1% 가

26.0mJ/cm²
 5mm² 32 (3201) 5mm
 (3202) x, y 10mm
 가, 1 (3203) 13.5mJ/cm² 2 (3204)
 6.0mJ/cm² 가

INT (2200) CAR
 HP3 PEB HP3 9
 () , 140 , 90 PEB
 , WS
 , 5mm² 2 (3203, 3204)

Tr_{13.5} = [] - [1 (3203)],

Tr_{6.0} = [] - [2 (3204)]

9 가, 0 CCD
 (x, y) Tr_{13.5}, Tr_{6.0}, Tr
 2 (13.5mJ/cm², 6.0mJ/cm²)

Tr 가,

Tr

1

$$\Delta Tr = F(D) + \Delta D \times \frac{\partial \Delta Tr}{\partial D} (D + \Delta D) + \Delta T \times \frac{\partial \Delta Tr}{\partial T} (D + \Delta D)$$

, F(D) (140) 가, D, D, T
 , D 33

1 1 D, T가 0 , 2
 Tr , 3 Tr

, Tr/ D · (D), Tr/ T · (D) d , D가 28, 29

Tr/ D · (D) = A_D,

Tr/ T · (D) = B_D

, [1] 2 Tr ,

2

$$\Delta \text{Tr}(D_1', T') = F(D_1) + \Delta D \times A_{D1} + \Delta T \times B_{D1}$$

3

$$\Delta \text{Tr}(D_2', T') = F(D_2) + \Delta D \times A_{D2} + \Delta T \times B_{D2}$$

(D' = D + ΔD, T' = T + ΔT)

, A_{D1}, B_{D1}, A_{D2}, A_{D2} , [2], [3] , , Tr_{13.5} 24.4nm,
 D, T Tr_{6.0} 12.8nm가 A_{D1}, B_{D1}, A_{D2}, A_{D2} , ,

$$D = +0.14 \text{mJ/cm}^2, T = -0.75$$

D T

, 2 Tr , Tr , Tr , 가 가

PEB 가

, , D가 , D
 - D
 , T가 , T , , T
 - T
 , , 1 150nm
 14.1nm(3) , 5.2nm

2 6. 0 13. 5mJ/cm²

0 CCD ,
,
,
(nanometRICS) (nanospec) 210

CCD, Tr, Tr, CCD, Tr, Tr, ,

PEB 가 , , , PEB , Tr
가 , , , (P), (I), (D)

Tr ,
가 , 가

2 Tr , D T
가 가 .

(57)

1.

2.

3.

4.

1 2 . 가 가

5.

1 2 , 가
가 .

6.

1 2 , 가 가

7.

1 2 , 가 (積算) 가
 가 , 가
 가 .

8.

3 , 가
 , 가
 , 가
 , .

9.

가 , D_{opt} ,
가 , Tr , (未)
가 , Tr ,
가 , Tr ,
가 .

10.

9

D_{opt} ,

11.

12.

,
D_{opt},
가, 가, , Tr, ,
, Tr, Tr, 가,
가, 가, ,

가 가

가 ,

가

13.

가

D_{opt}

가 ,

,

가

Tr ,

Tr, Tr 가

,

가 가 가

14.

12 13 ,

$$D_{opt}$$

15.

,

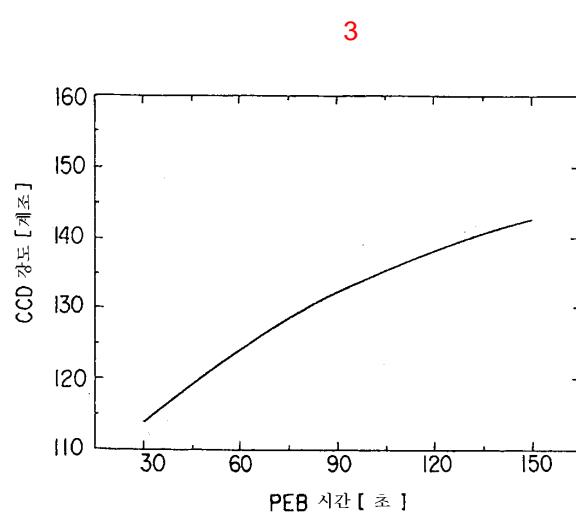
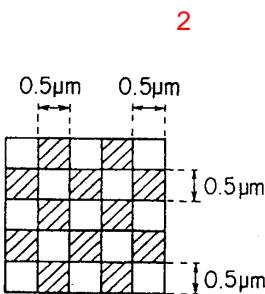
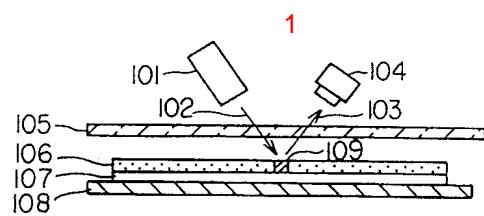
16.

가

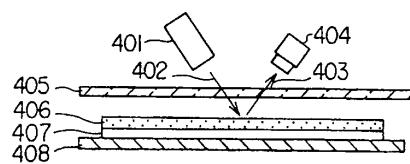
가 가

$$, \quad \quad \quad 1 \quad \quad \quad 2 \\ D_{opt1} \quad , \quad D_{opt2} \quad \quad 1 \quad \quad \quad , \quad \quad \quad ,$$

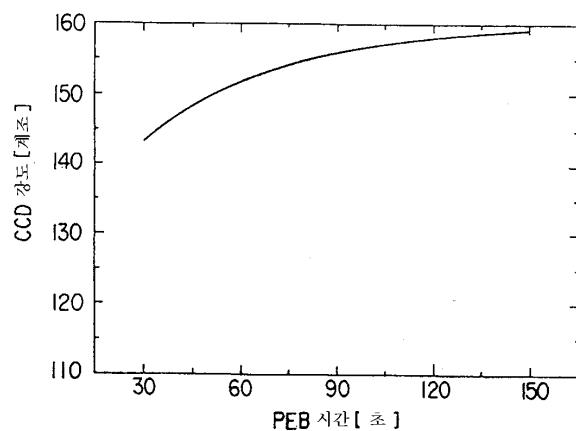
가 ,
1 , 1 2 ,
Tr₁, Tr₂ ,
,



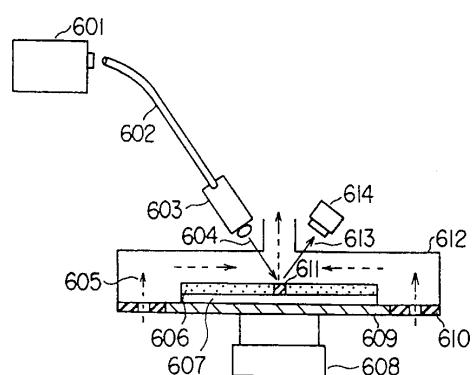
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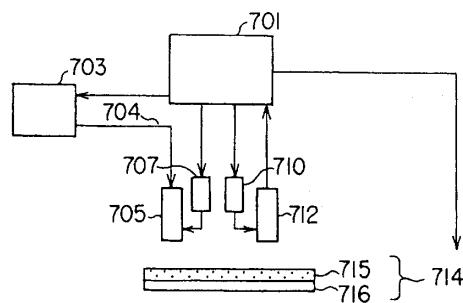
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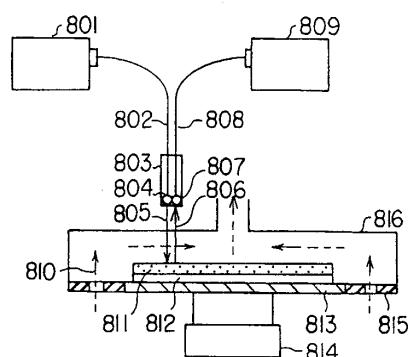
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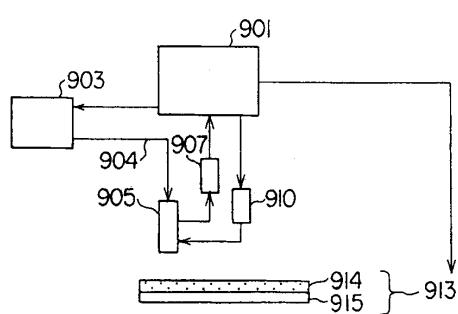
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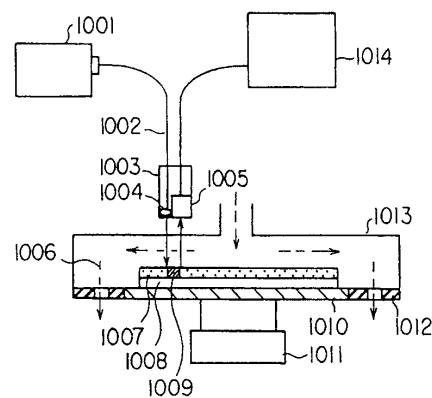
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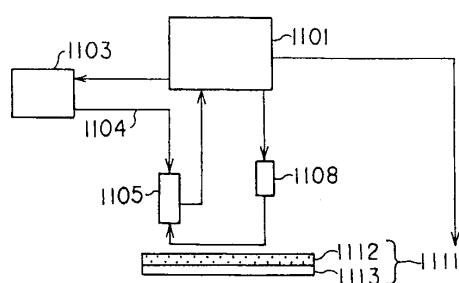
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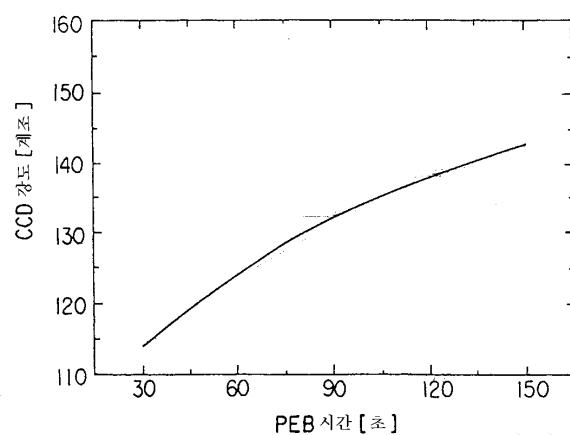
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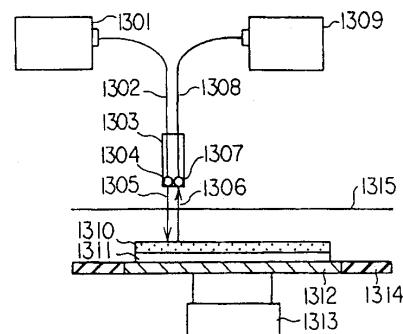
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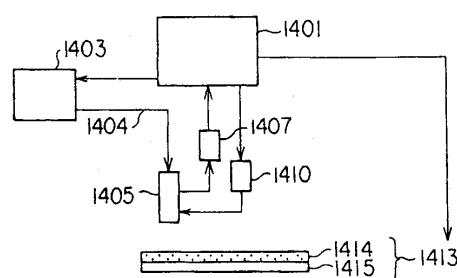
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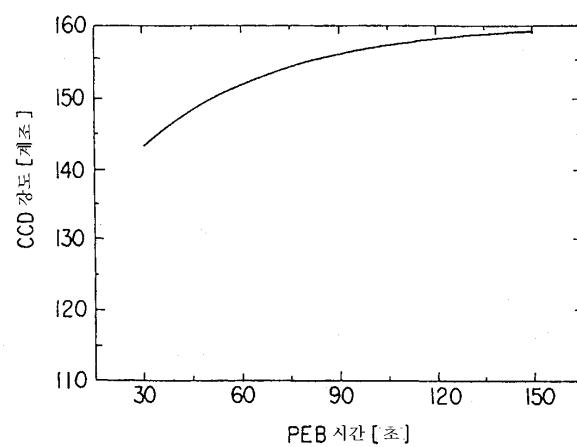
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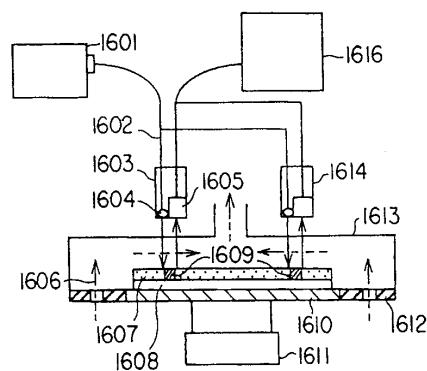
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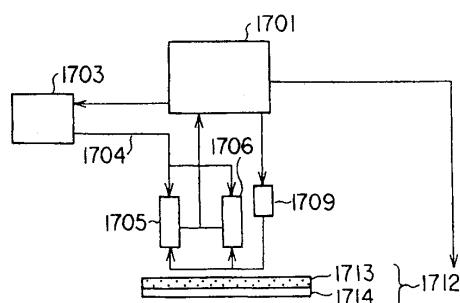
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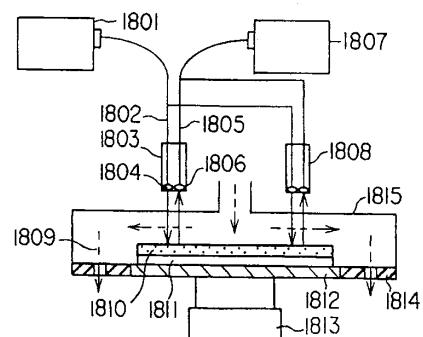
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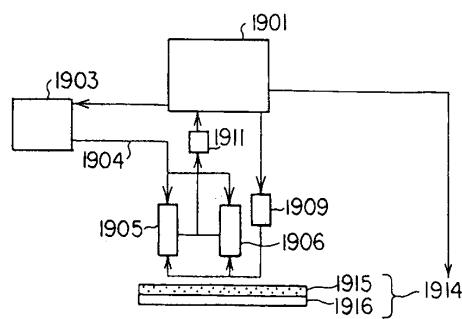
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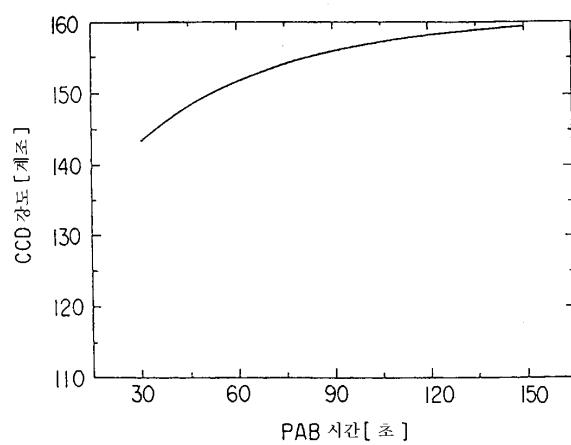
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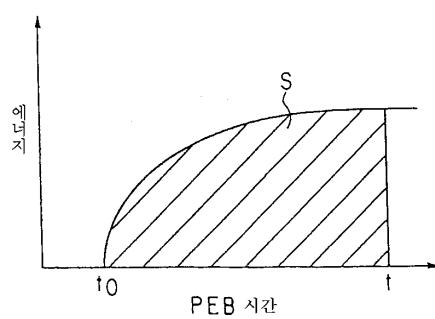
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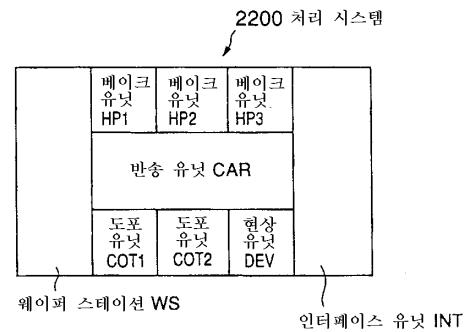
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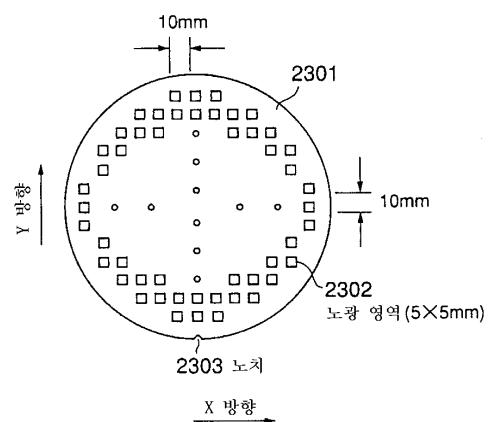
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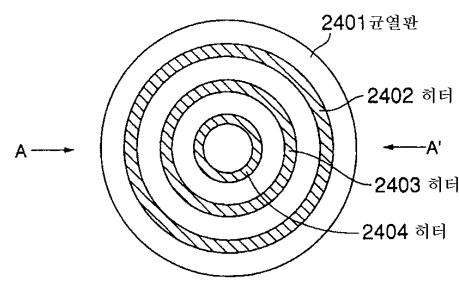
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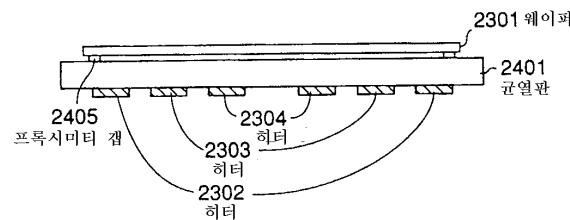
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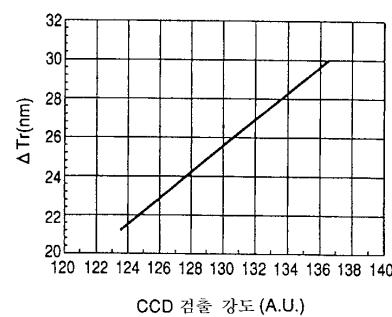


(a)

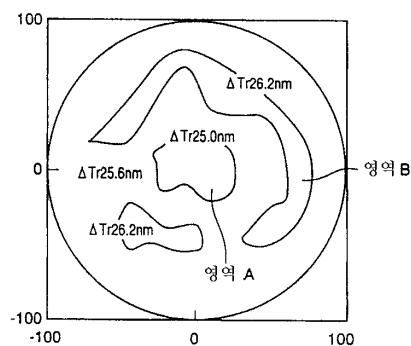


(b)

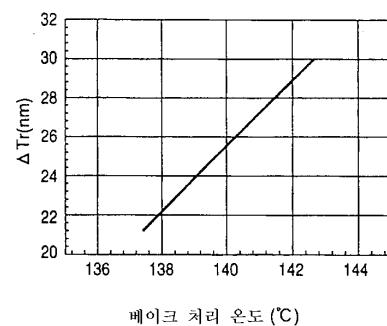
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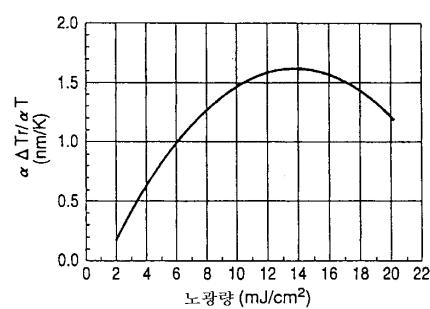
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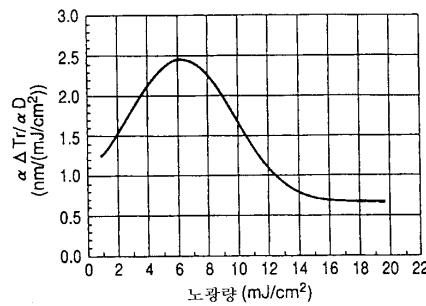
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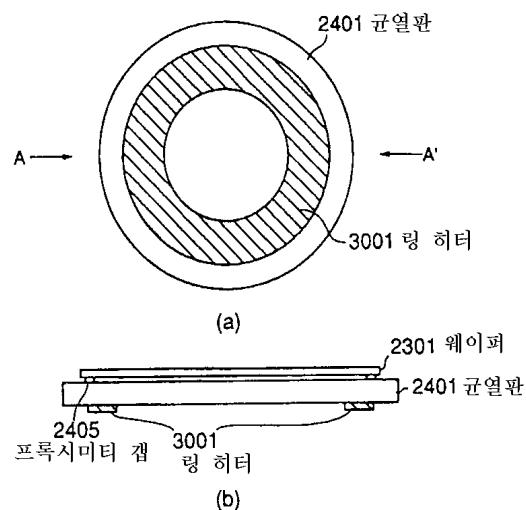
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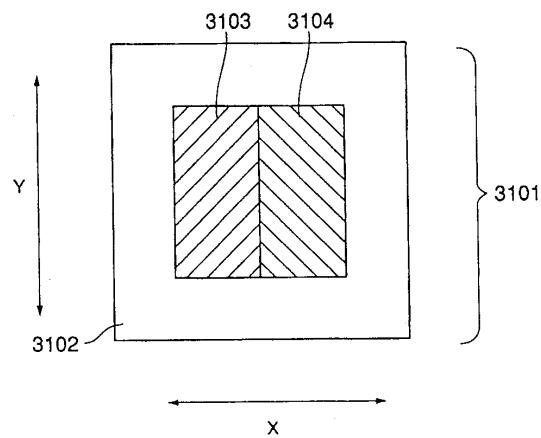
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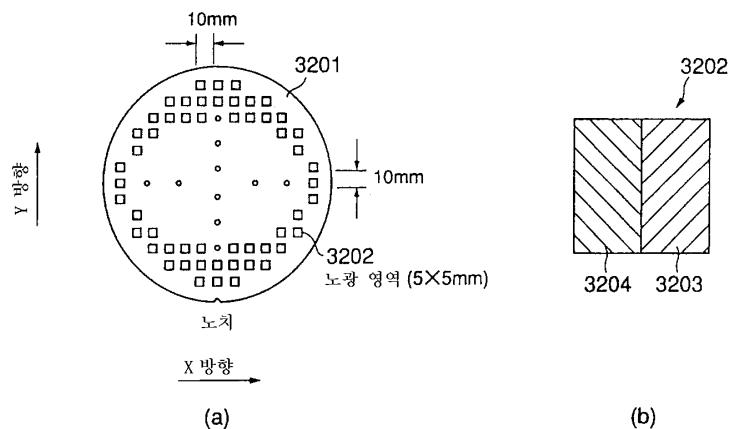
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31



32



33

