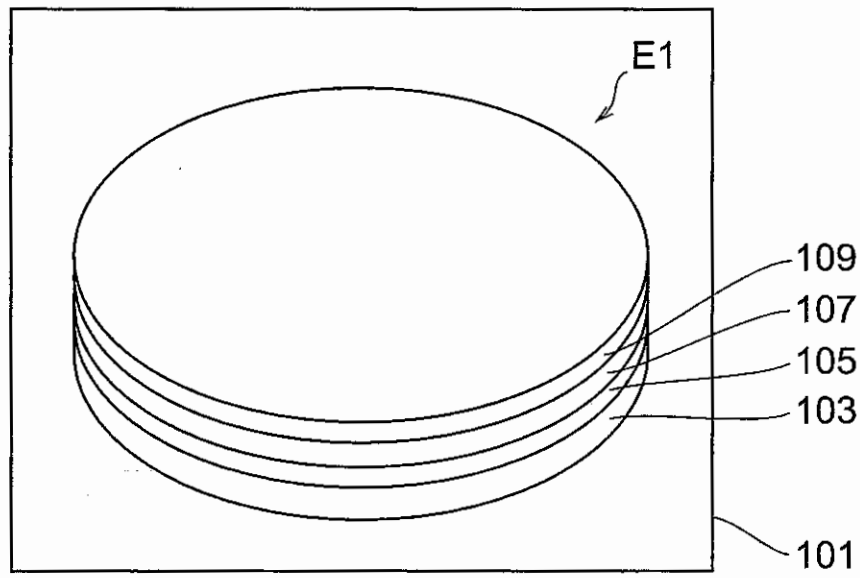
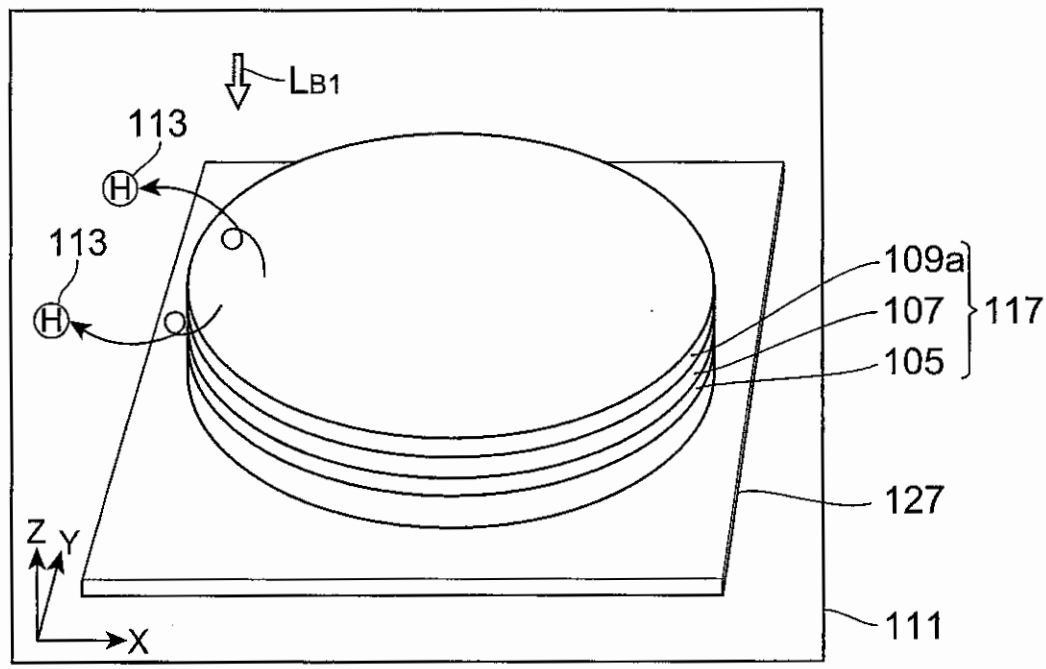
Fig.1


E1
109
107
105
103
101

(A)


LB1
113
H
113
H
109a
107
105
117
127
111
Z
Y
X

(B)

Fig.2

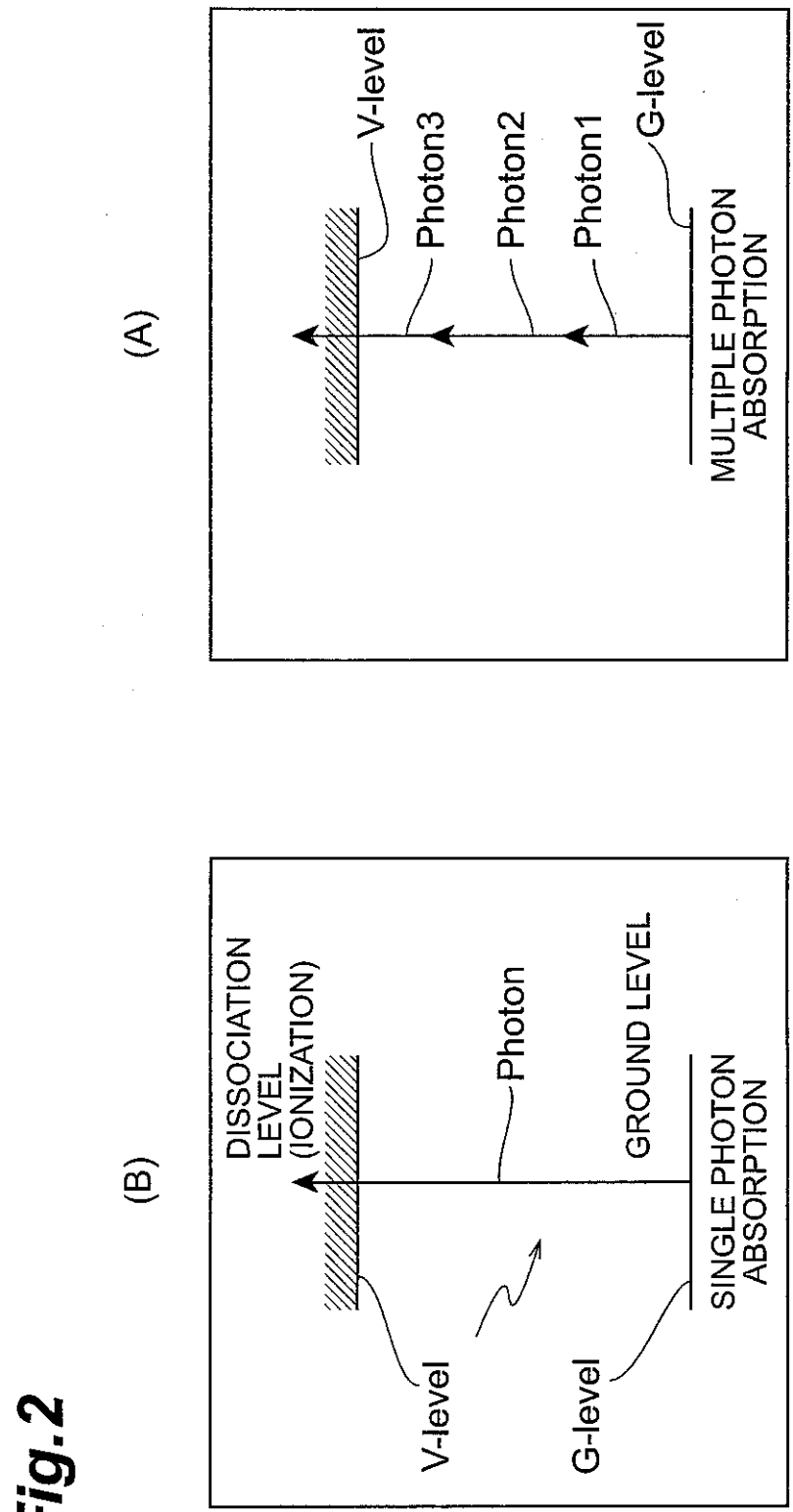

(A)
V-level
Photon3
Photon2
Photon1
G-level
MULTIPLE PHOTON ABSORPTION
(B)
DISSOCIATION LEVEL (IONIZATION)
Photon
GROUND LEVEL
V-level
G-level
SINGLE PHOTON ABSORPTION

Fig.3

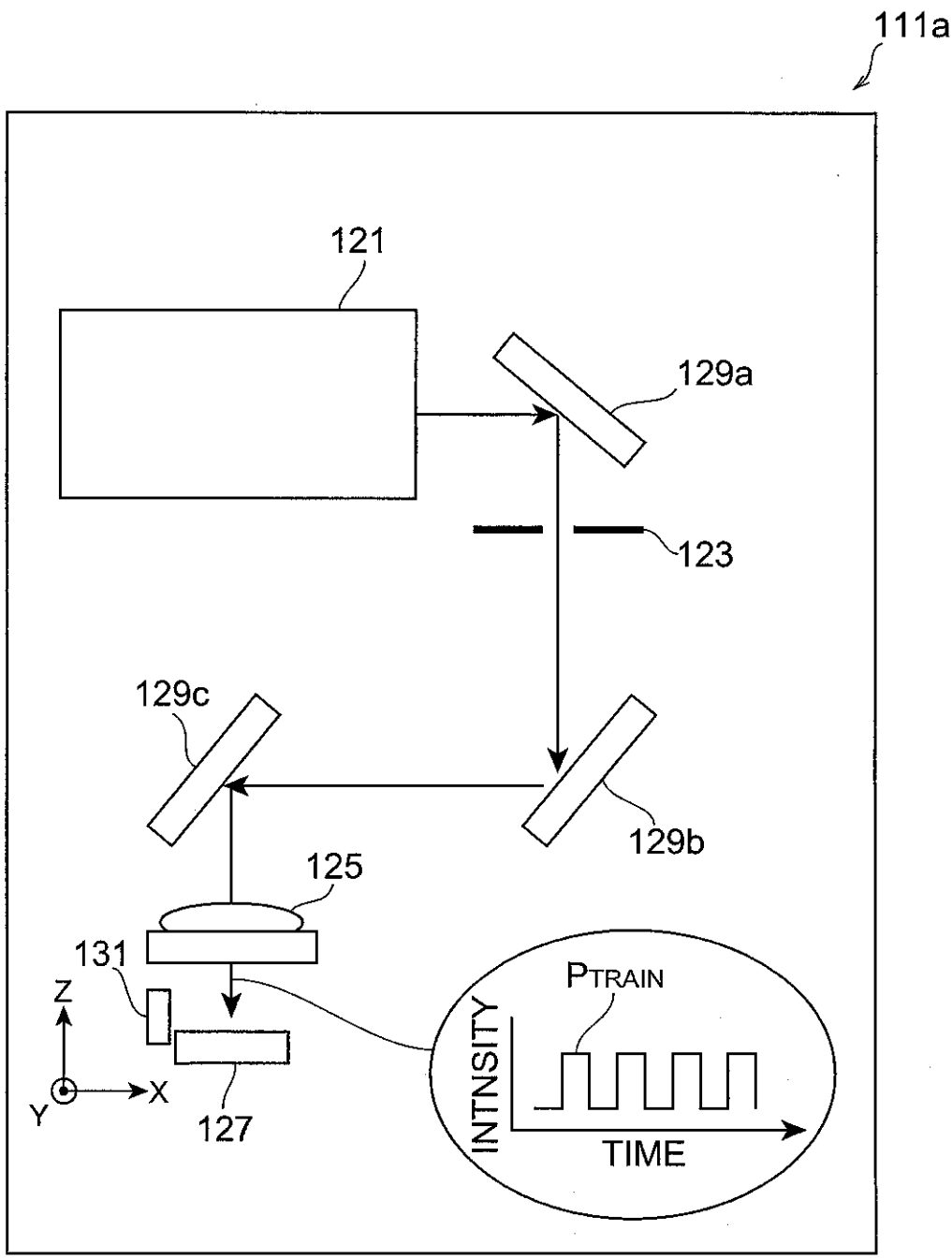
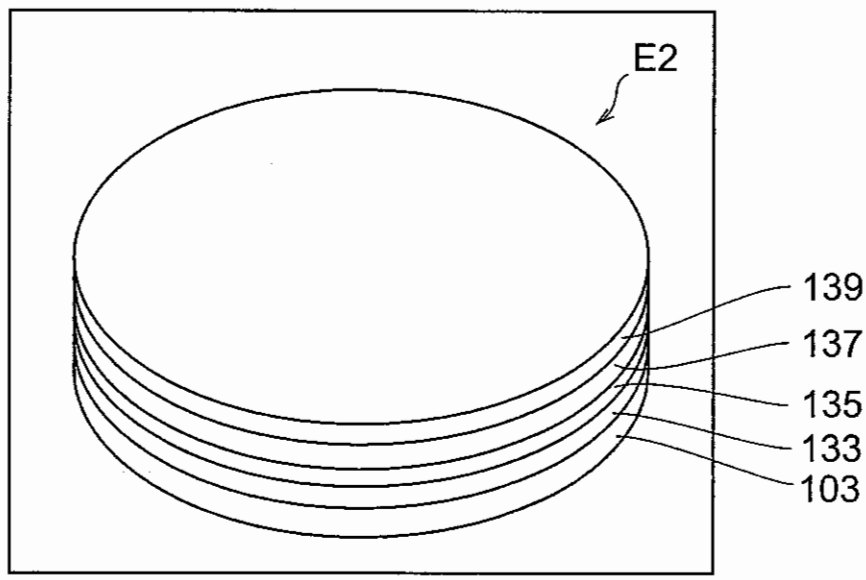
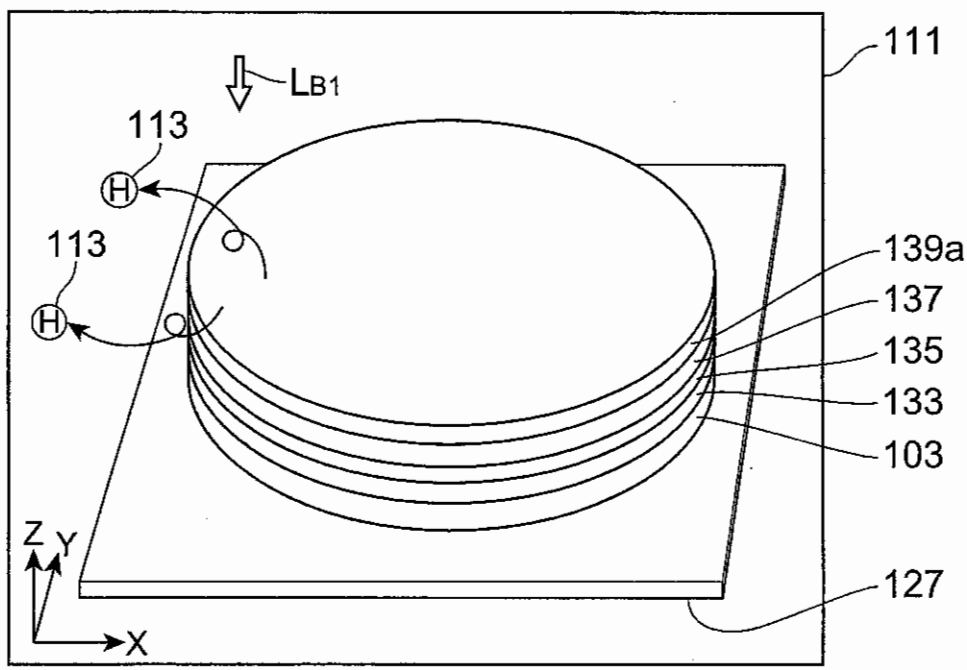

111a
121
129a
123
129c
129b
125
131
127
Z
X
Y
PTRAIN
INTNSITY
TIME

Fig.4


E2
139
137
135
133
103

(A)


111
LB1
113
H
113
H
139a
137
135
133
103
127
Z
Y
X

(B)

Fig.5

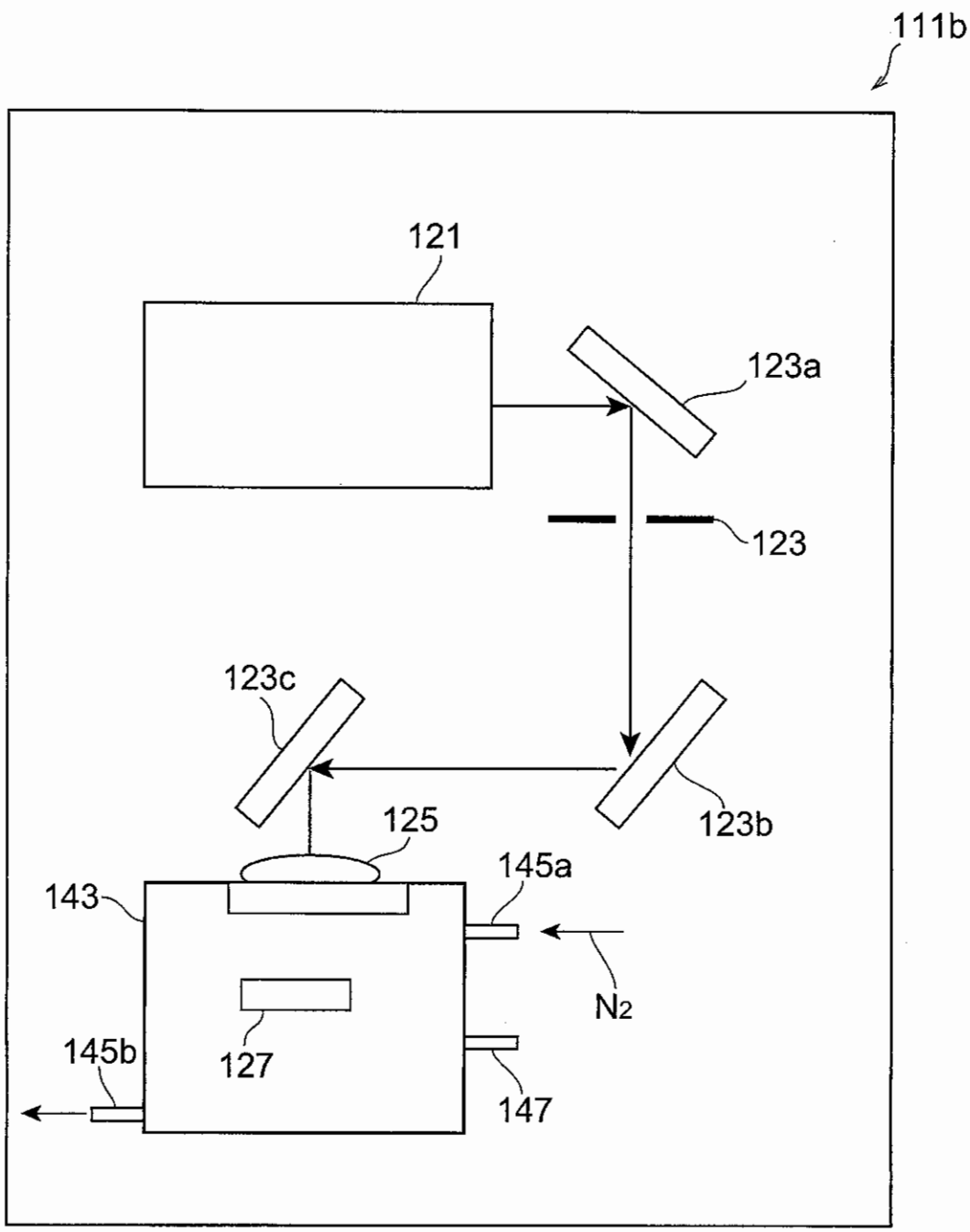


Fig.6

TREATMENT	TYPE OF CARRIER	HYDROGEN CONCENTRATION (cm^{-3})	MAGNESIUM CONCENTRATION (cm^{-3})	CARRIER CONCENTRATION (cm^{-3})
NO ACTIVATION	—	5.1×10^{19}	5.5×10^{19}	6×10^{16}
THERMAL ANNELAL	P	2.3×10^{19}	5.7×10^{19}	5.1×10^{17}
PRESENT EMBODIMENT	P	1.2×10^{19}	5.4×10^{19}	6.3×10^{17}

Fig.7

(A)

CONDITION	PULSE WIDTH	SURFACE TEMPERATURE	ATMOSPHERE
1	500ns	520℃	IN AIR
2	100ns	500℃	IN VACUUM
3	100000fs	200℃	IN AIR
4	10000fs	55℃	IN AIR
5	500fs	42℃	IN AIR
6	200fs	34℃	IN N_2
7	80fs	32℃	IN VACUUM
8	30fs	27℃	IN O_2
THERMAL ANNEAL	—	700℃(1 MIN.)	

(B)

CONDITION	TYPE OF CARRIER	CARRIER CONCENTRATION (cm^{-3})	RESISTIVITY ($\Omega \cdot cm$)
1	p	8.10×10^{16}	6.6
2	p	4.86×10^{17}	1.4
3	p	1.9×10^{18}	0.76
4	p	4.2×10^{18}	0.60
5	p	1.4×10^{19}	0.10
6	p	4.0×10^{19}	0.07
7	p	7.5×10^{19}	0.04
8	p	8.2×10^{19}	0.03
THERMAL ANNEAL	p	1.81×10^{18}	0.86

Fig.8

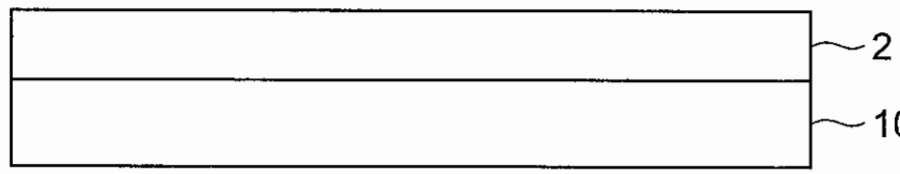


Fig.9

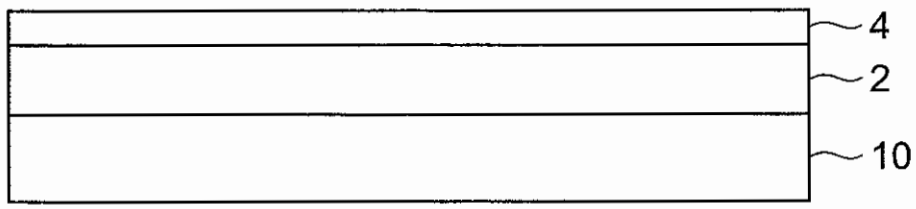


Fig.10

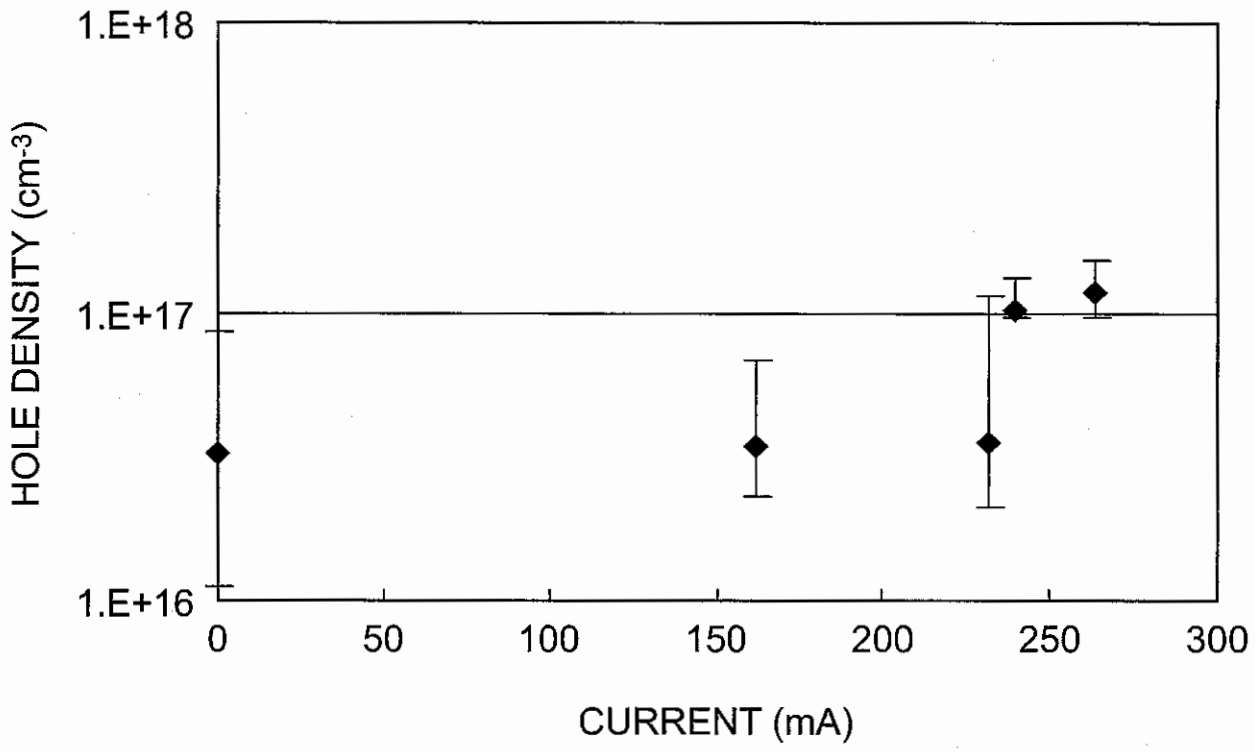

1.E+18
1.E+17
1.E+16
HOLE DENSITY (cm-3)
0
50
100
150
200
250
300
CURRENT (mA)

Fig.11

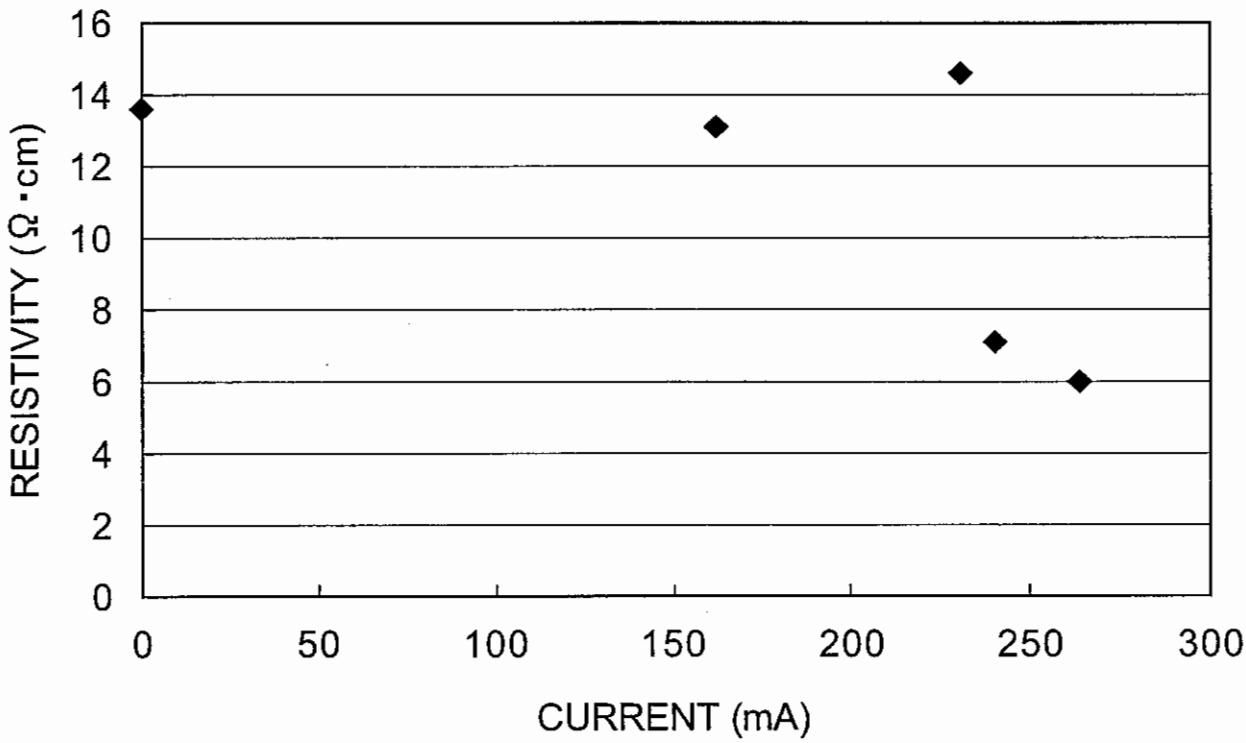

16
14
12
10
8
6
4
2
0
RESISTIVITY (Ω·cm)
0
50
100
150
200
250
300
CURRENT (mA)

Fig.12

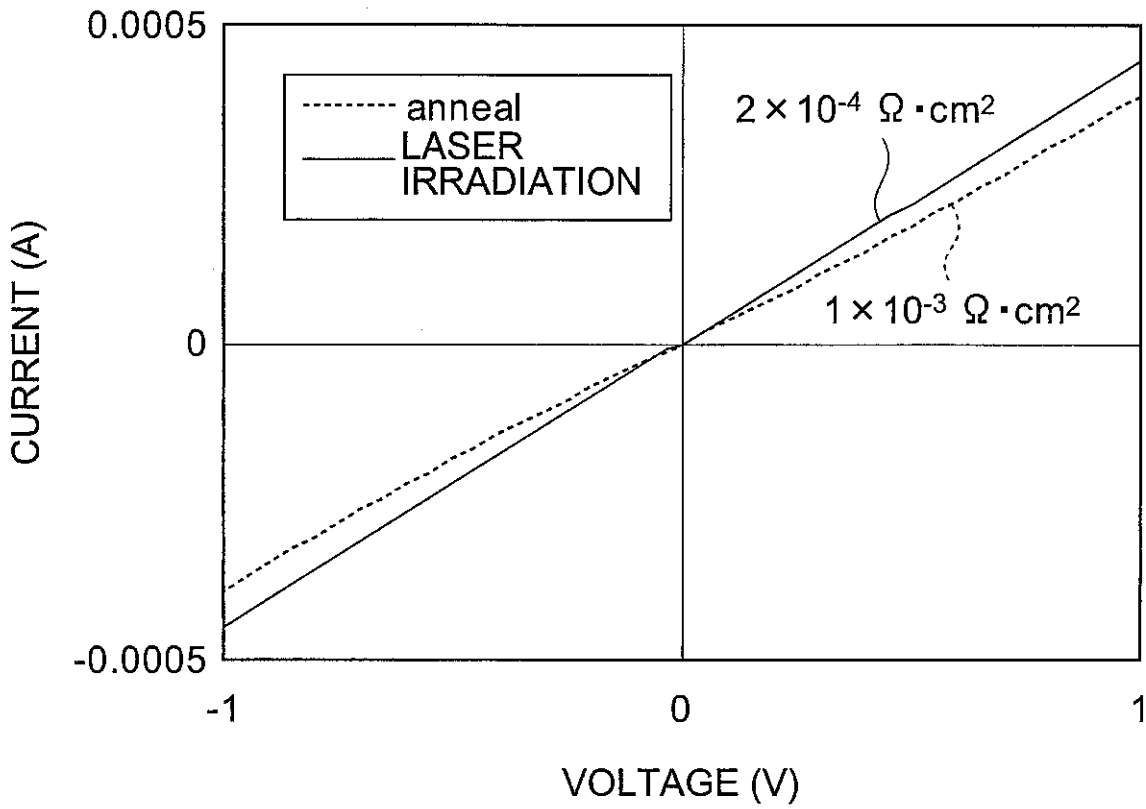

0.0005
0
-0.0005
-1
0
1
CURRENT (A)
VOLTAGE (V)
anneal
LASER IRRADIATION
2 × 10-4 Ω・cm2
1 × 10-3 Ω・cm2

Fig.13

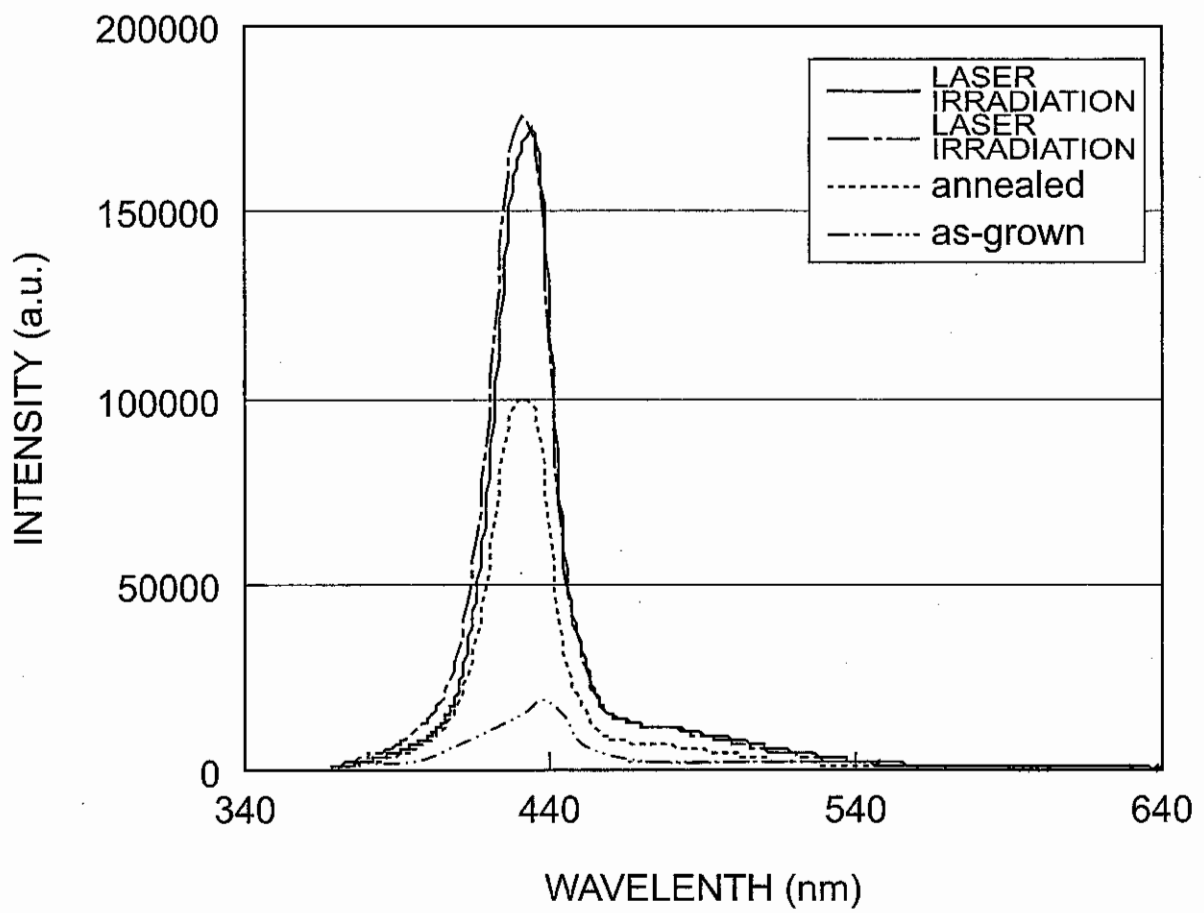
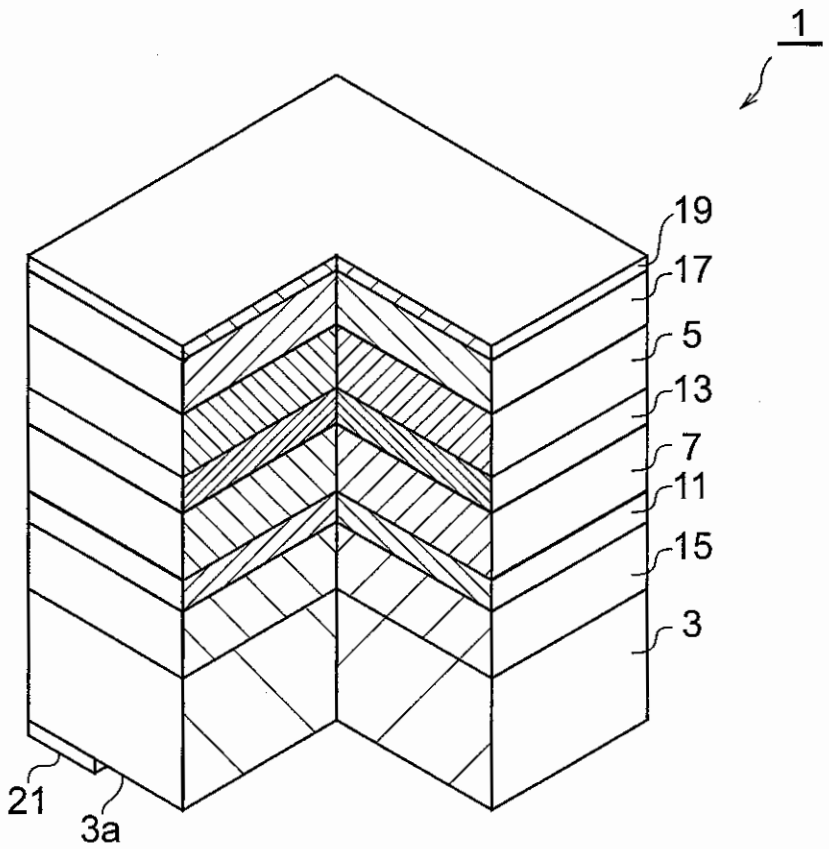

200000
150000
100000
50000
0
INTENSITY (a.u.)
340
440
540
640
WAVELENTH (nm)
LASER IRRADIATION
LASER IRRADIATION
annealed
as-grown

Fig.14

(A)


1
19
17
5
13
7
11
15
3
21
3a

(B)

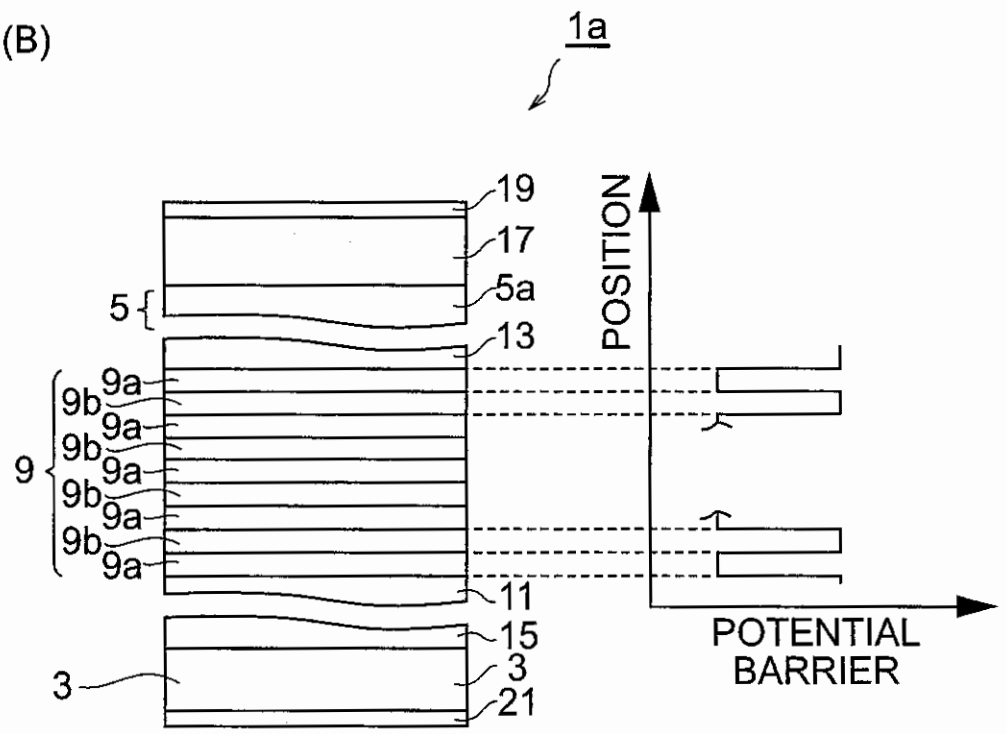
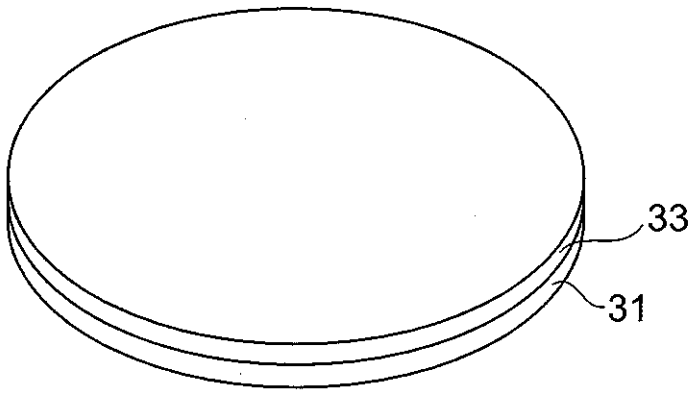
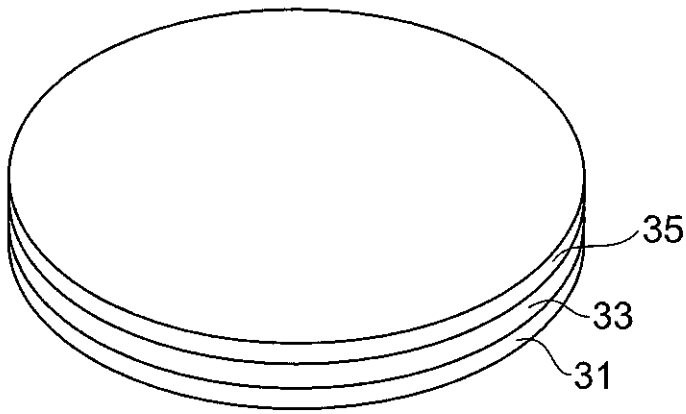

1a
19
17
5
5a
13
9
9a
9b
11
15
3
21
POSITION
POTENTIAL
BARRIER

Fig.15

(A)


33
31

(B)


35
33
31

(C)

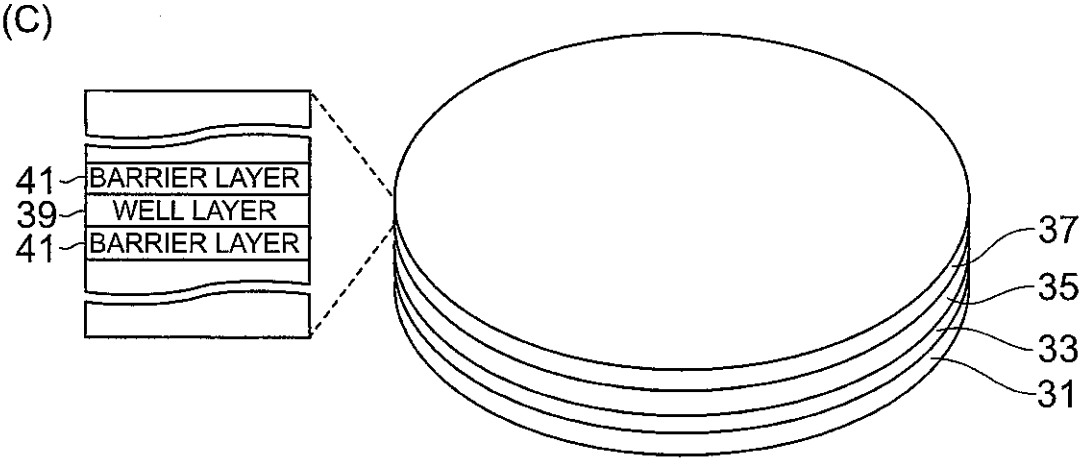
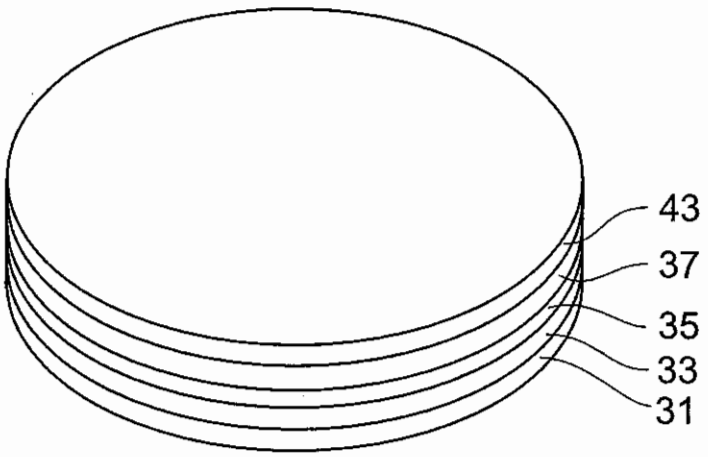
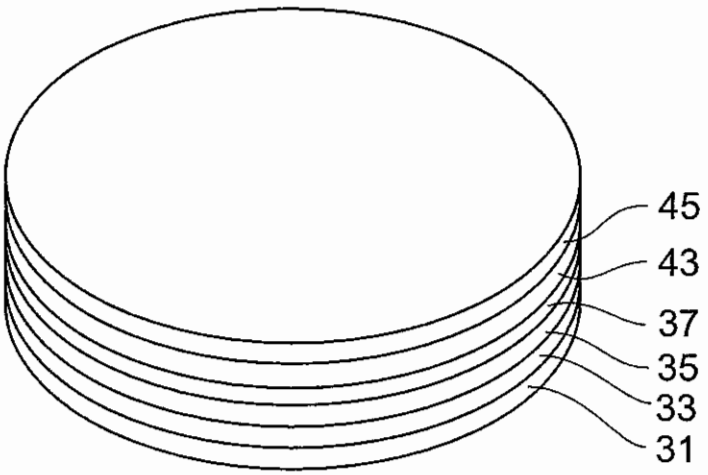

41
BARRIER LAYER
39
WELL LAYER
41
BARRIER LAYER
37
35
33
31

Fig.16

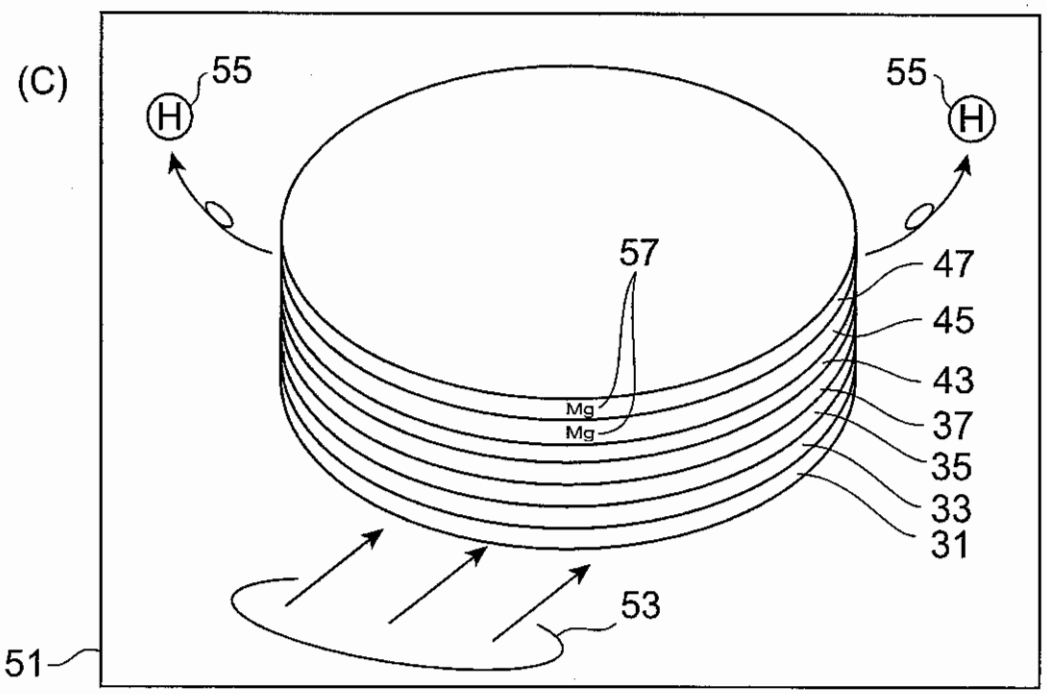
(A)


43
37
35
33
31

(B)


45
43
37
35
33
31

(C)


55
H
55
H
57
47
45
43
Mg
Mg
37
35
33
31
53
51