FIG. 1A

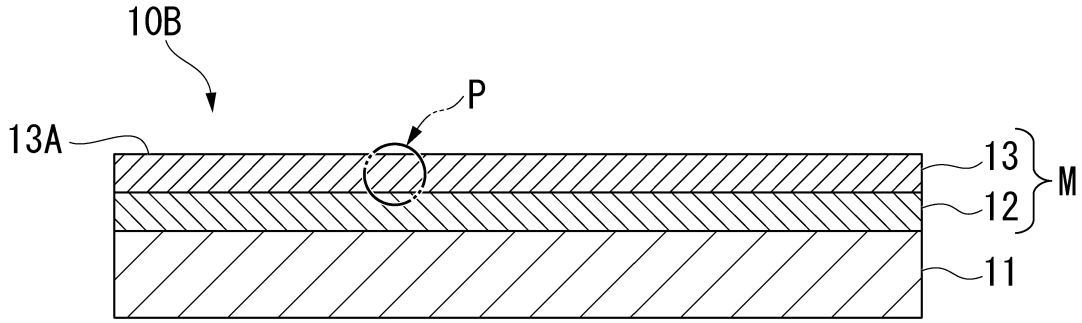


FIG. 1B

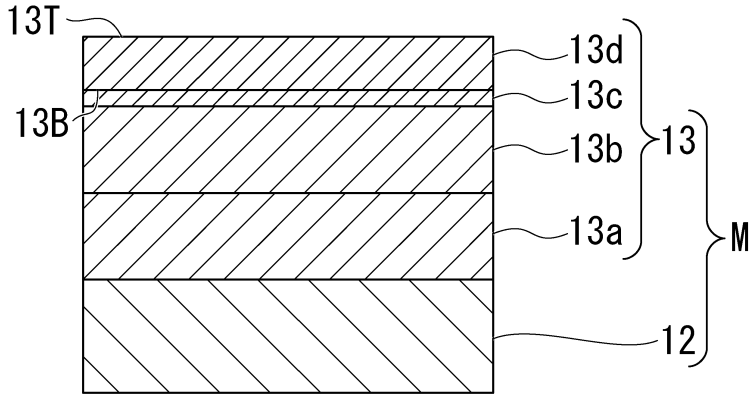


FIG. 2

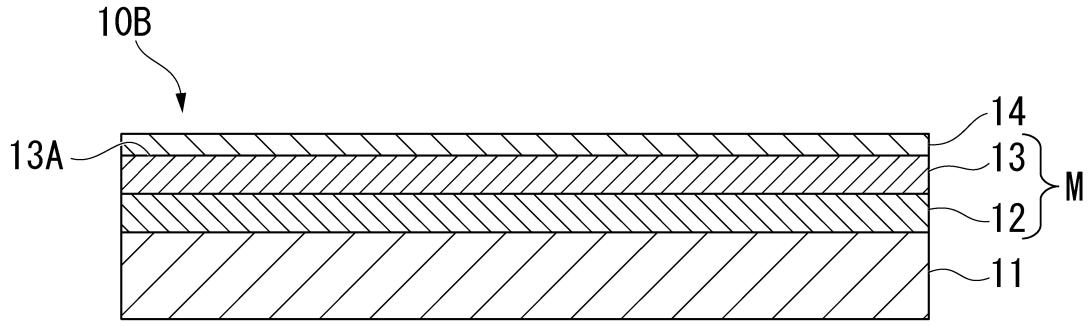


FIG. 3

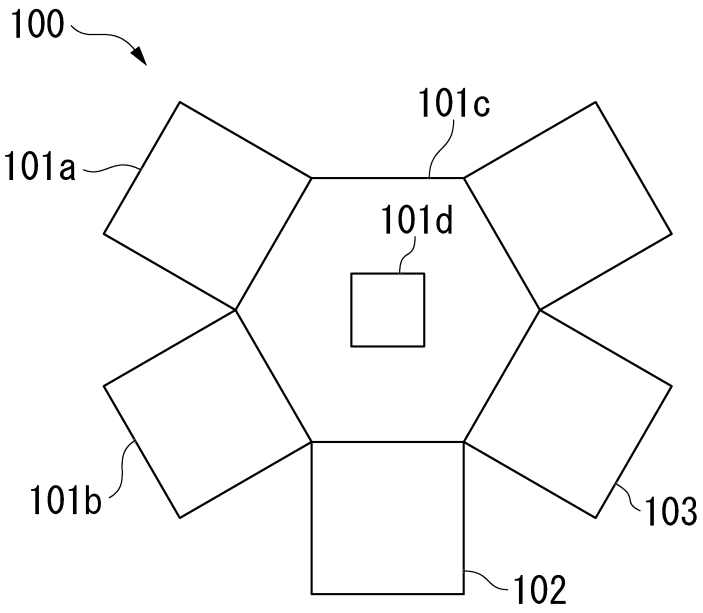

100
101c
101a
101d
101b
103
102

FIG. 4

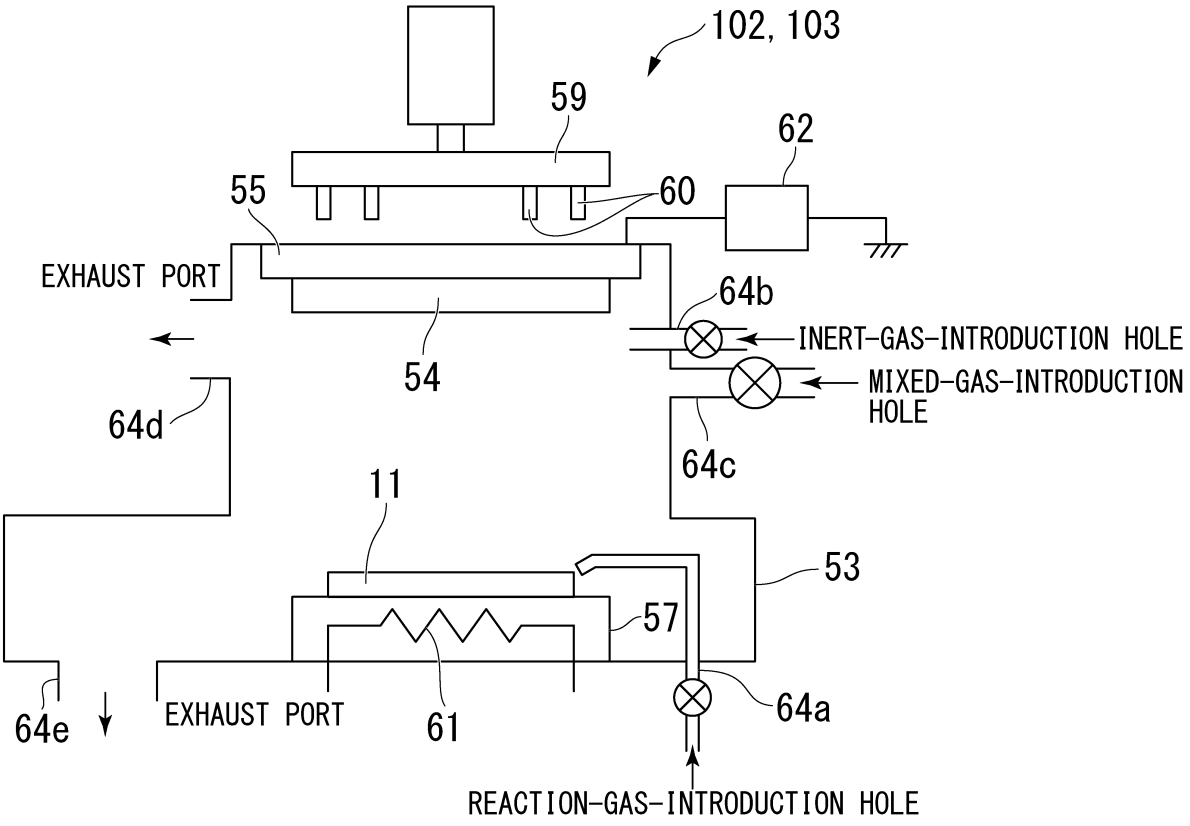

102, 103
59
62
55
60
EXHAUST PORT
64b
INERT-GAS-INTRODUCTION HOLE
54
MIXED-GAS-INTRODUCTION HOLE
64d
64c
11
53
57
64e
EXHAUST PORT
61
64a
REACTION-GAS-INTRODUCTION HOLE

FIG. 5

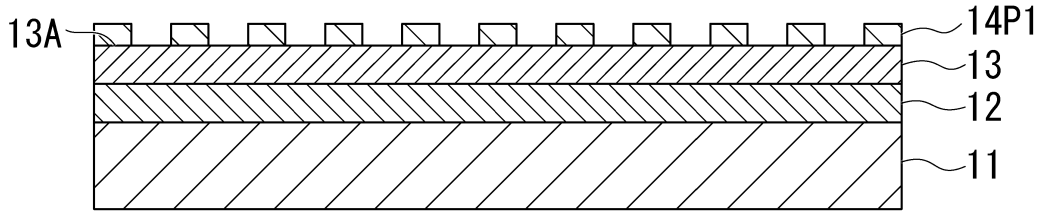


FIG. 6

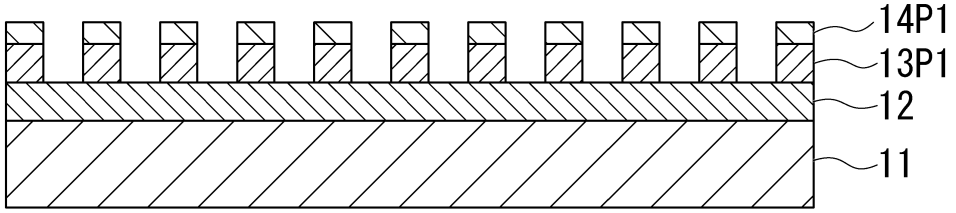


FIG. 7

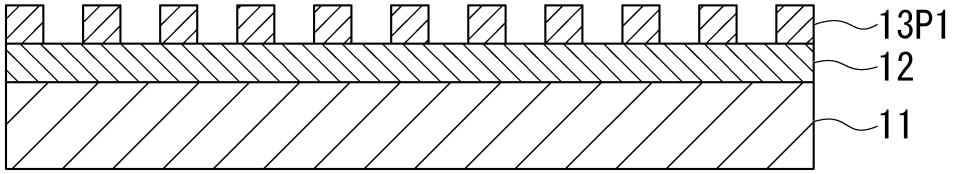


FIG. 8

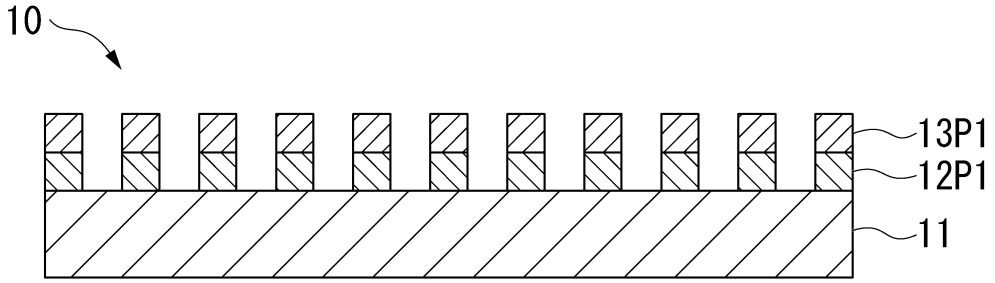


FIG. 9

LAYER	LIGHT-SHIELDING LAYER				INTERMEDIATE LAYER			SURFACE LAYER			
FILM FORMATION CONDITIONS	Power (kW)	Ar (sccm)	N_2 (sccm)	CO_2 (sccm)	Power (kW)	Ar (sccm)	N_2 (sccm)	Power (kW)	Ar (sccm)	CH_4 (sccm)	NO (sccm)
EXPERIMENTAL EXAMPLE 1	1.0	15	10	0	1.5	10	10	1.0	20	2	20
EXPERIMENTAL EXAMPLE 2	1.0	30	10	7	1.5	15	10	1.0	20	2	20
EXPERIMENTAL EXAMPLE 3	1.0	30	10	10	1.5	15	10	1.0	20	2	20

FIG. 10

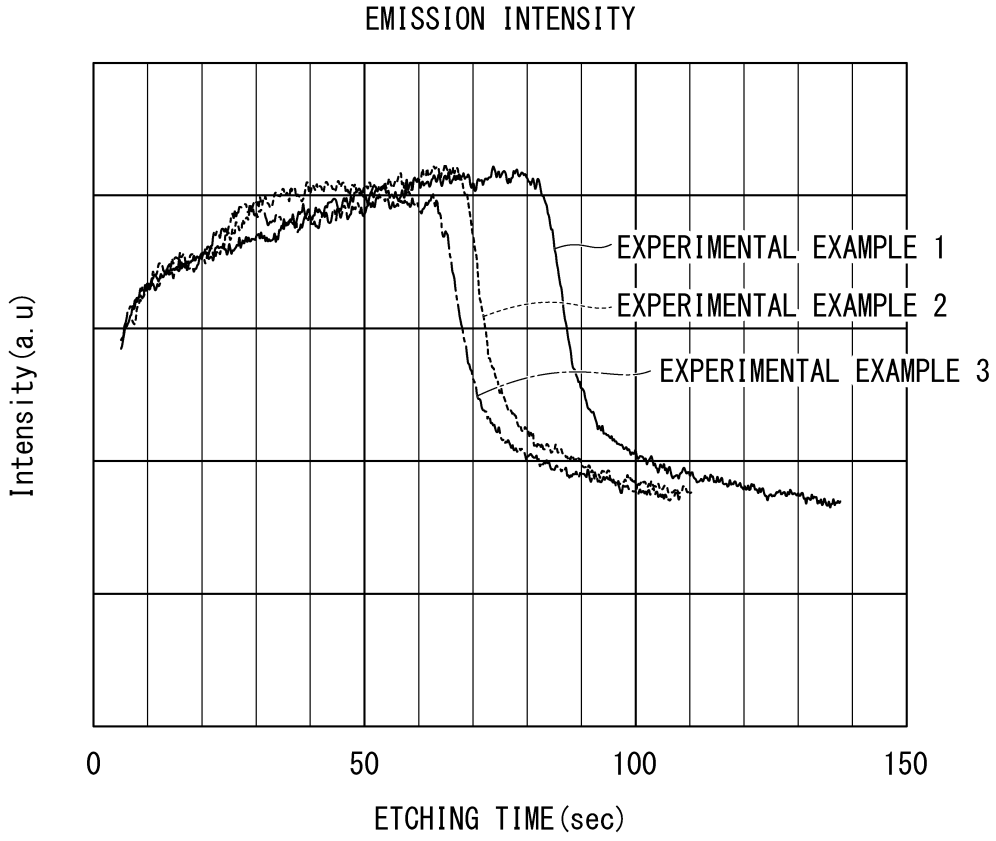


FIG. 11

FILM TYPE	EXPERIMENTAL EXAMPLE 1	EXPERIMENTAL EXAMPLE 2	EXPERIMENTAL EXAMPLE 3
SHORTENING RATE OF ETCHING TIME	-	17.7%	21.4%

FIG. 12

LAYER	LIGHT-SHIELDING LAYER				INTERMEDIATE LAYER			SURFACE LAYER					UPPERMOST LAYER
FILM FORMATION CONDITIONS	Power (kW)	Ar (sccm)	N_2 (sccm)	CO_2 (sccm)	Power (kW)	Ar (sccm)	N_2 (sccm)	Power (kW)	Ar (sccm)	CH_4 (sccm)	NO (sccm)	CO_2 (sccm)	OXYGEN-NITROGEN COMPOSITIONAL RATIO O/(O+N)
EXPERIMENTAL EXAMPLE 3	1.0	30	10	10	1.5	15	10	1.0	20	2	20	0	0.862
EXPERIMENTAL EXAMPLE 4	1.0	30	10	10	1.5	15	10	1.0	20	2	0	15	0.988
EXPERIMENTAL EXAMPLE 5	1.0	30	10	10	1.5	15	10	1.0	20	2	5	10	0.939
EXPERIMENTAL EXAMPLE 6	1.0	30	10	10	1.5	15	10	1.0	20	2	2	13	0.970

FIG. 13

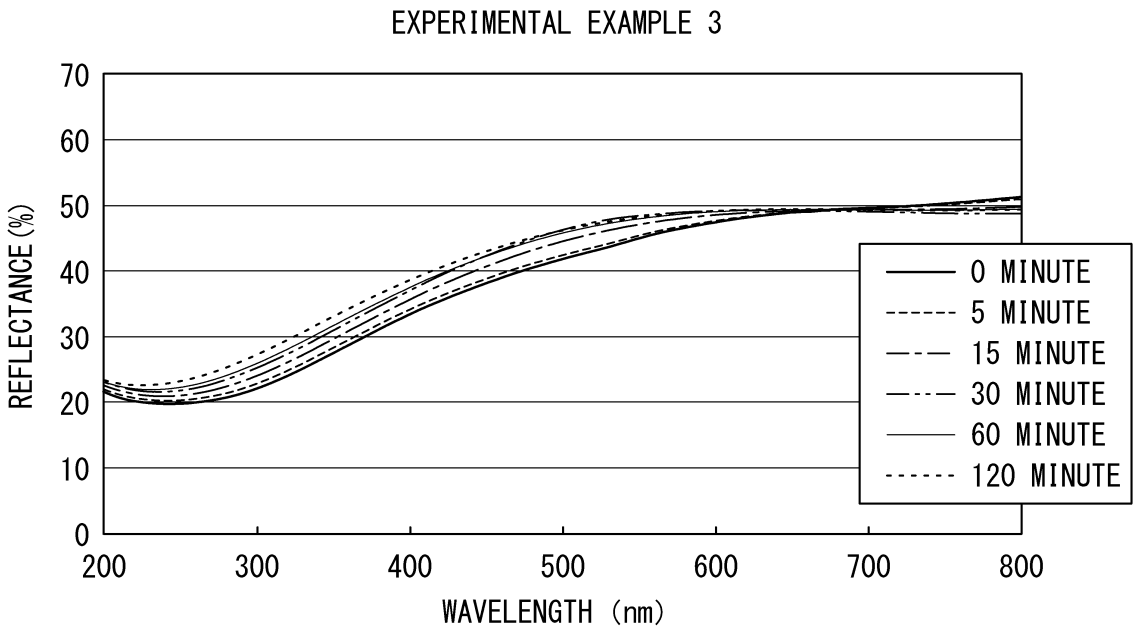

EXPERIMENTAL EXAMPLE 3
REFLECTANCE (%)
70
60
50
40
30
20
10
0
200
300
400
500
600
700
800
WAVELENGTH (nm)
0 MINUTE
5 MINUTE
15 MINUTE
30 MINUTE
60 MINUTE
120 MINUTE

FIG. 14

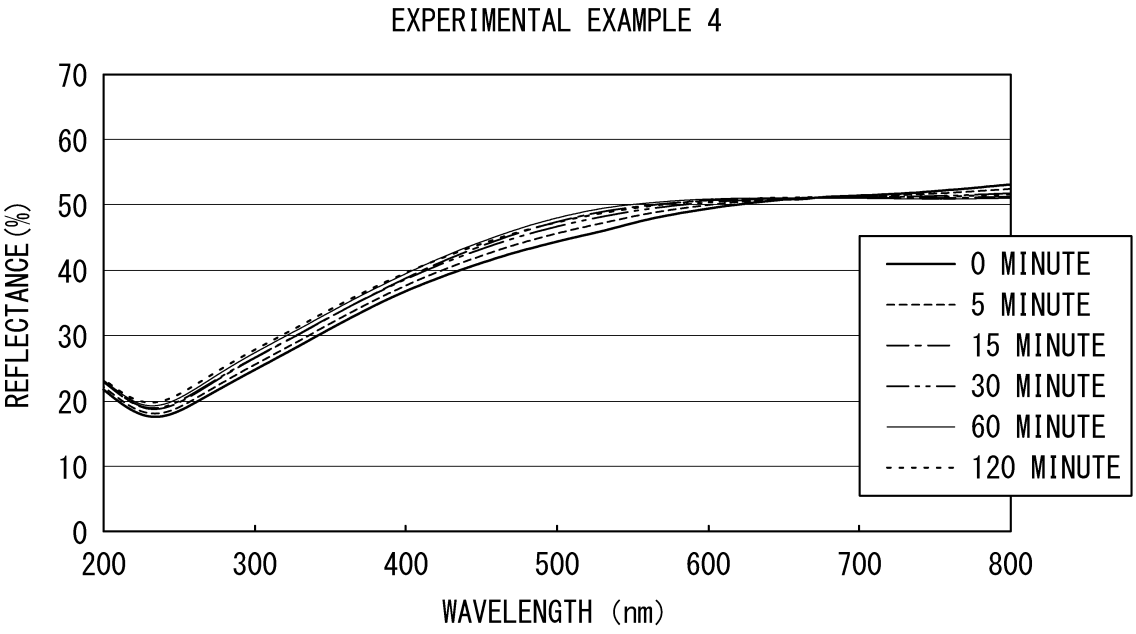

EXPERIMENTAL EXAMPLE 4
REFLECTANCE (%)
70
60
50
40
30
20
10
0
200
300
400
500
600
700
800
WAVELENGTH (nm)
0 MINUTE
5 MINUTE
15 MINUTE
30 MINUTE
60 MINUTE
120 MINUTE

FIG. 15

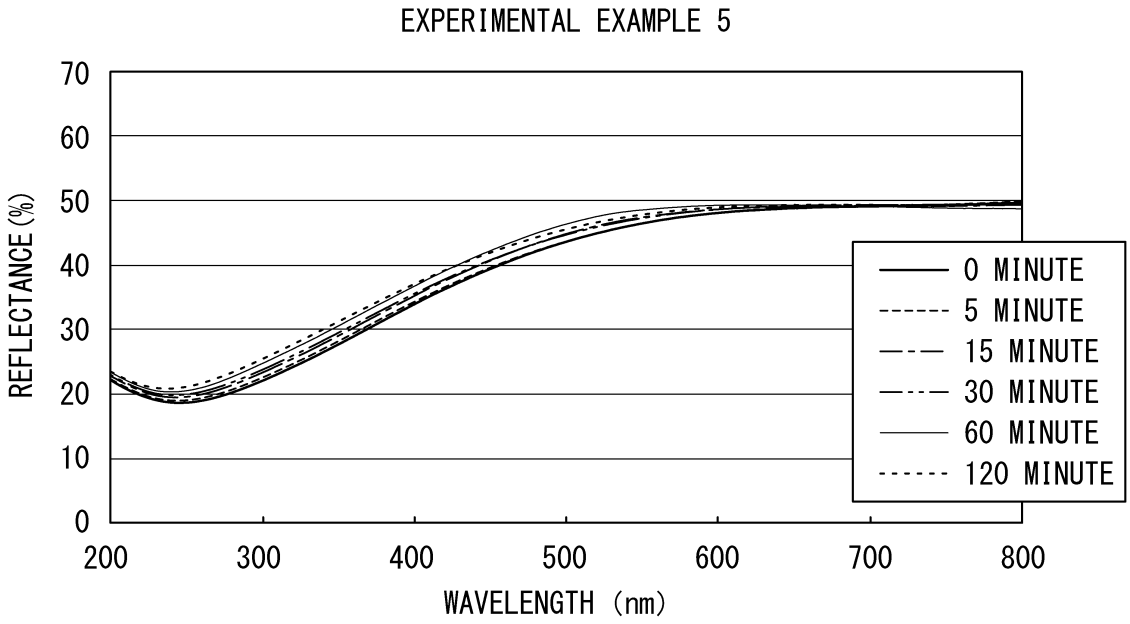

EXPERIMENTAL EXAMPLE 5
REFLECTANCE (%)
70
60
50
40
30
20
10
0
200
300
400
500
600
700
800
WAVELENGTH (nm)
0 MINUTE
5 MINUTE
15 MINUTE
30 MINUTE
60 MINUTE
120 MINUTE

FIG. 16

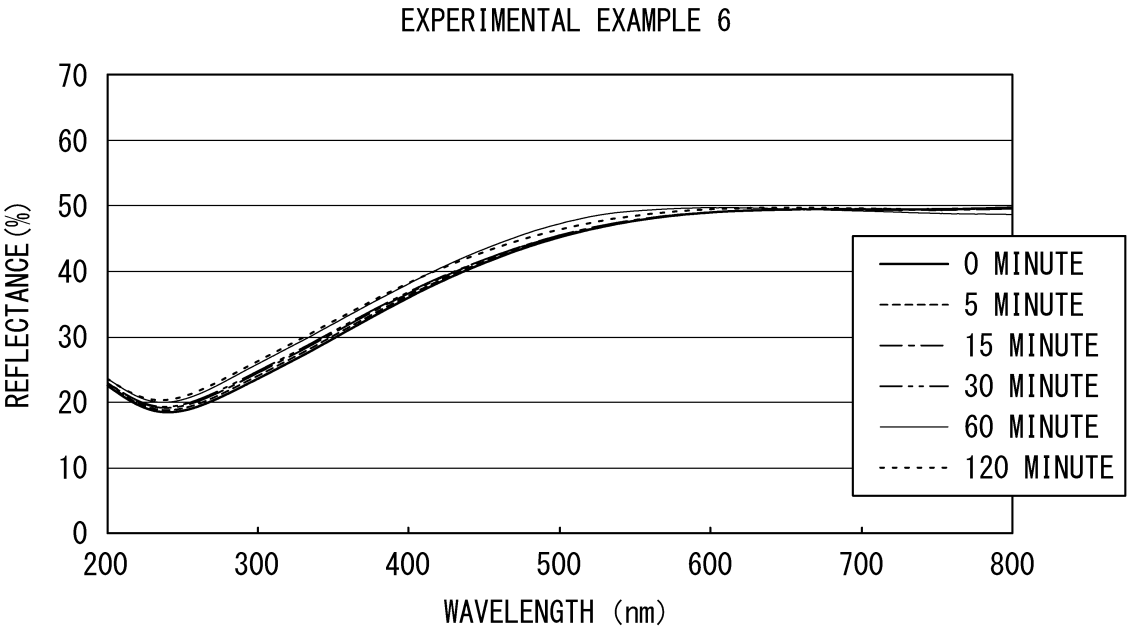

EXPERIMENTAL EXAMPLE 6
REFLECTANCE (%)
70
60
50
40
30
20
10
0
200
300
400
500
600
700
800
WAVELENGTH (nm)
0 MINUTE
5 MINUTE
15 MINUTE
30 MINUTE
60 MINUTE
120 MINUTE

FIG. 17

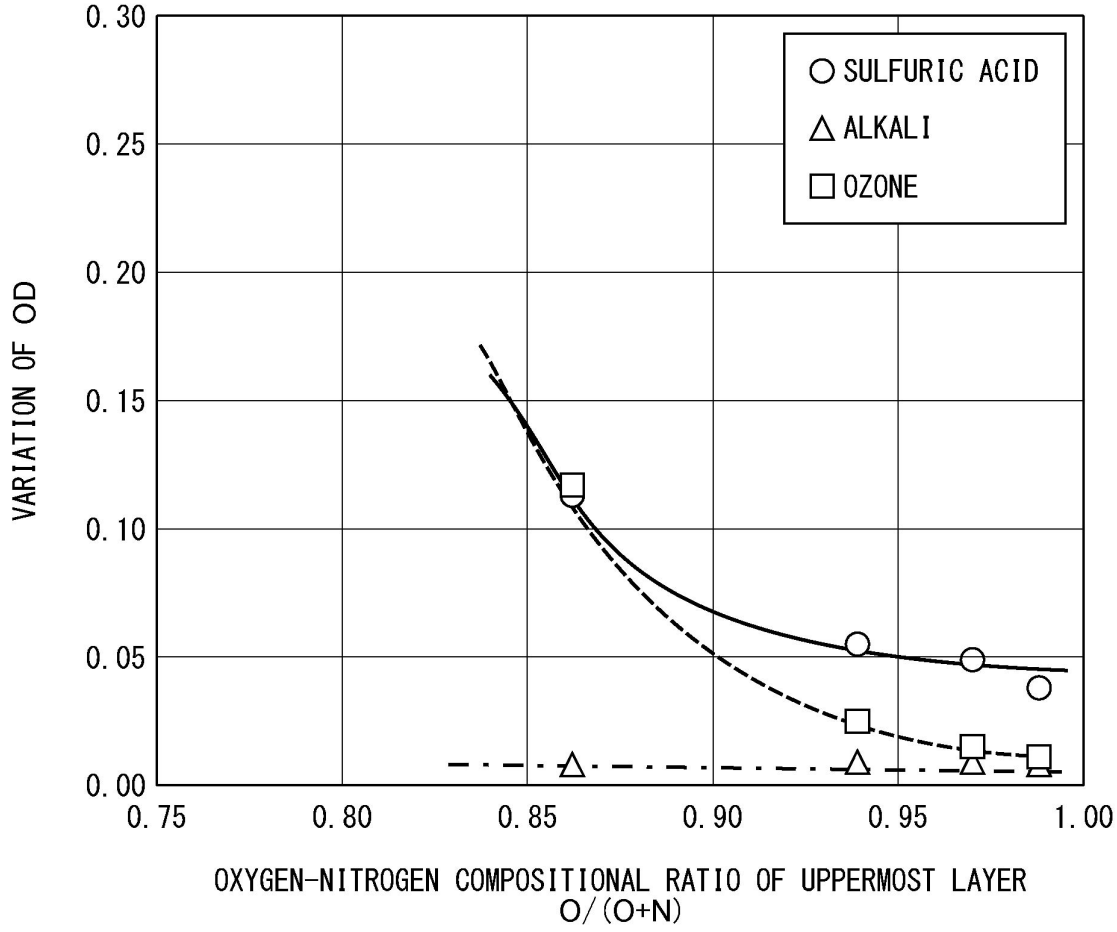

0.30
0.25
0.20
0.15
0.10
0.05
0.00
VARIATION OF OD
SULFURIC ACID
ALKALI
OZONE
0.75
0.80
0.85
0.90
0.95
1.00
OXYGEN-NITROGEN COMPOSITIONAL RATIO OF UPPERMOST LAYER
O/(O+N)

FIG. 18

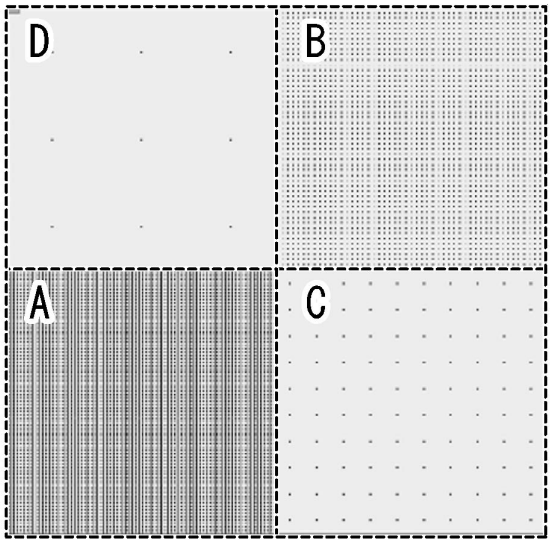

D
B
A
C

FIG. 19

AREA	A	B	C	D
Pitch $\alpha:\beta$	2:1	3:1	15:1	50:1
PATTERN DENSITY %	25	11.1	0.4	0.04

FIG. 20

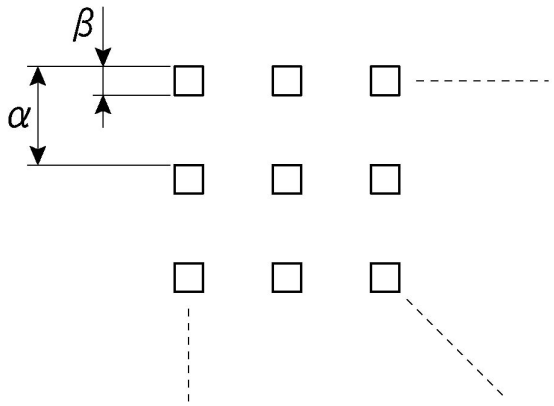
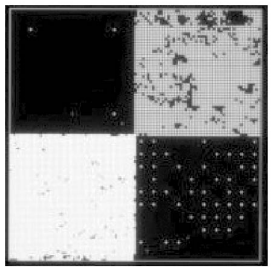
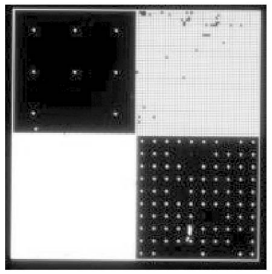


FIG. 21



EXPERIMENTAL EXAMPLE 4

FIG. 22



EXPERIMENTAL EXAMPLE 6

FIG. 23

	EXPERIMENTAL EXAMPLE 4	EXPERIMENTAL EXAMPLE 6	EXPERIMENTAL EXAMPLE 5	EXPERIMENTAL EXAMPLE 3
OXYGEN-NITROGEN COMPOSITIONAL RATIO OF UPPERMOST LAYER O/(O+N)	0.988	0.970	0.939	0.862
PATTERN RESIDUAL RATE	0.65	0.92	0.98	0.95
DETERMINATION OF ADHESION	NG	OK	OK	OK

FIG. 24

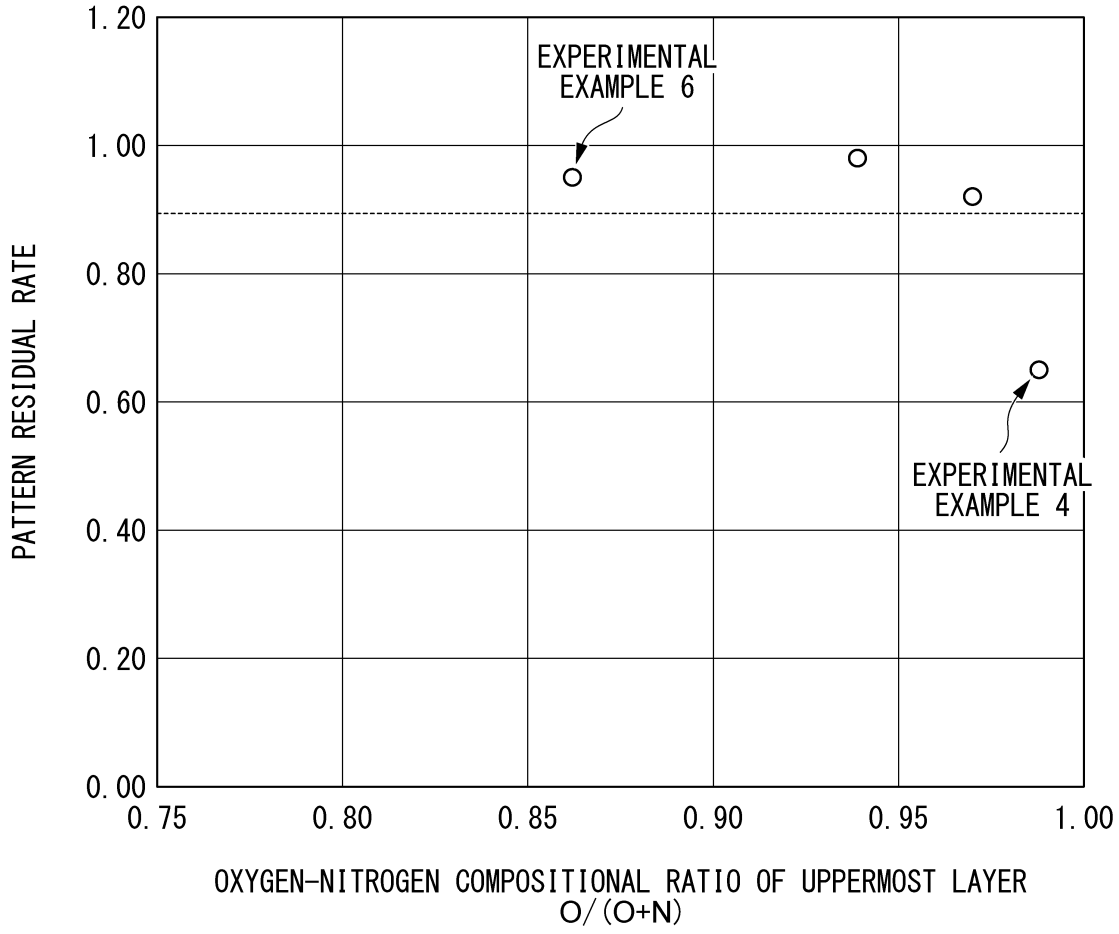


FIG. 25

LAYER	LIGHT-SHIELDING LAYER				INTERMEDIATE LAYER			UPPER-MEDIUM LAYER				SURFACE LAYER				
FILM FORMATION CONDITIONS	Power (kW)	Ar (sccm)	N_2 (sccm)	CO_2 (sccm)	Power (kW)	Ar (sccm)	N_2 (sccm)	Power (kW)	Ar (sccm)	CH_4 (sccm)	NO (sccm)	Power (kW)	Ar (sccm)	CH_4 (sccm)	NO (sccm)	CO_2 (sccm)
EXPERIMENTAL EXAMPLE 3	1.0	30	10	10	1.5	15	10	–	–	–	–	1.0	20	2	20	0
EXPERIMENTAL EXAMPLE 4	1.0	30	10	10	1.5	15	10	–	–	–	–	1.0	20	2	0	15
EXPERIMENTAL EXAMPLE 6	1.0	30	10	10	1.5	15	10	–	–	–	–	1.0	20	2	2	13
EXPERIMENTAL EXAMPLE 7	1.0	30	10	10	1.5	15	10	1.0	10	2	2	1.0	20	2	2	13

FIG. 26

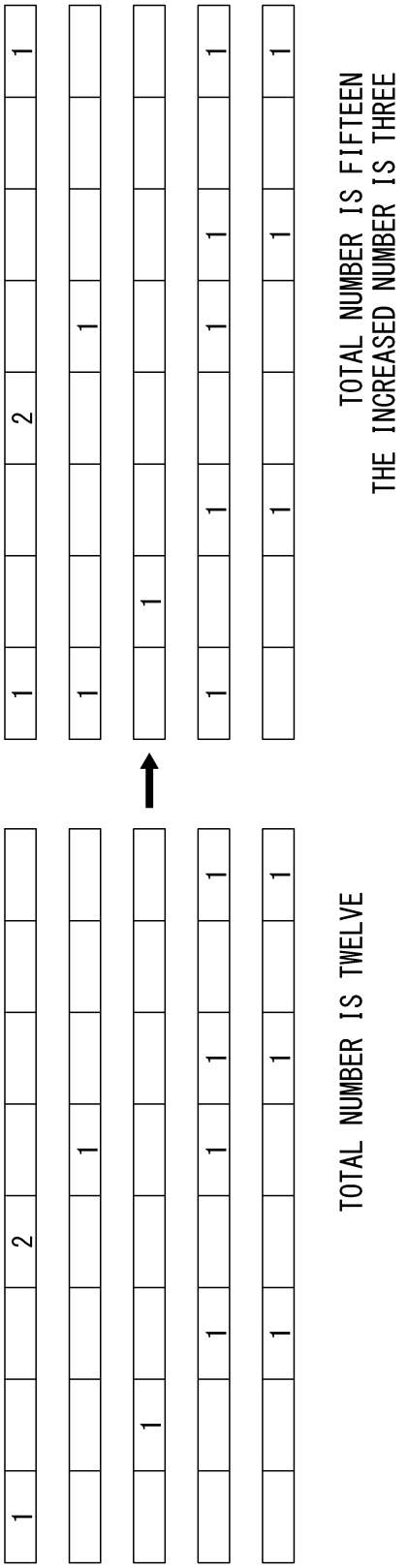

EXPERIMENTAL EXAMPLE 7
INITIAL
AFTER FRICTION
TOTAL NUMBER IS TWELVE
TOTAL NUMBER IS FIFTEEN
THE INCREASED NUMBER IS THREE

FIG. 27

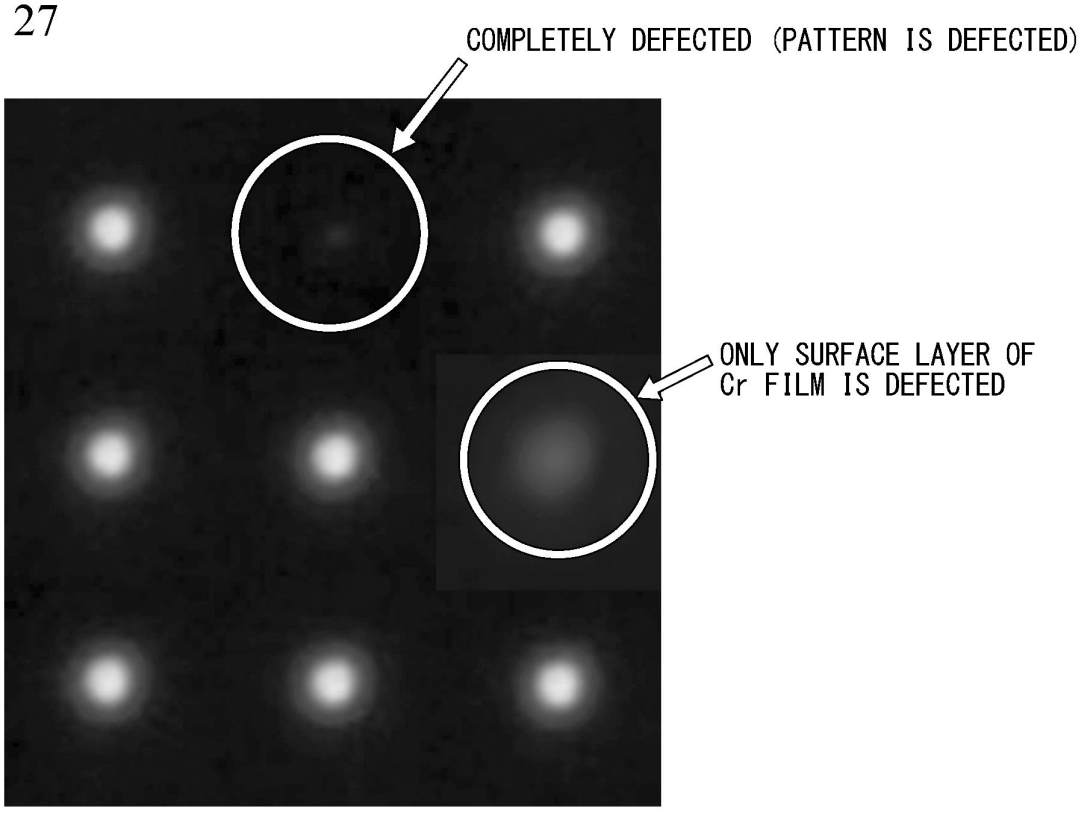

COMPLETELY DEFECTED (PATTERN IS DEFECTED)
ONLY SURFACE LAYER OF
Cr FILM IS DEFECTED

FIG. 28

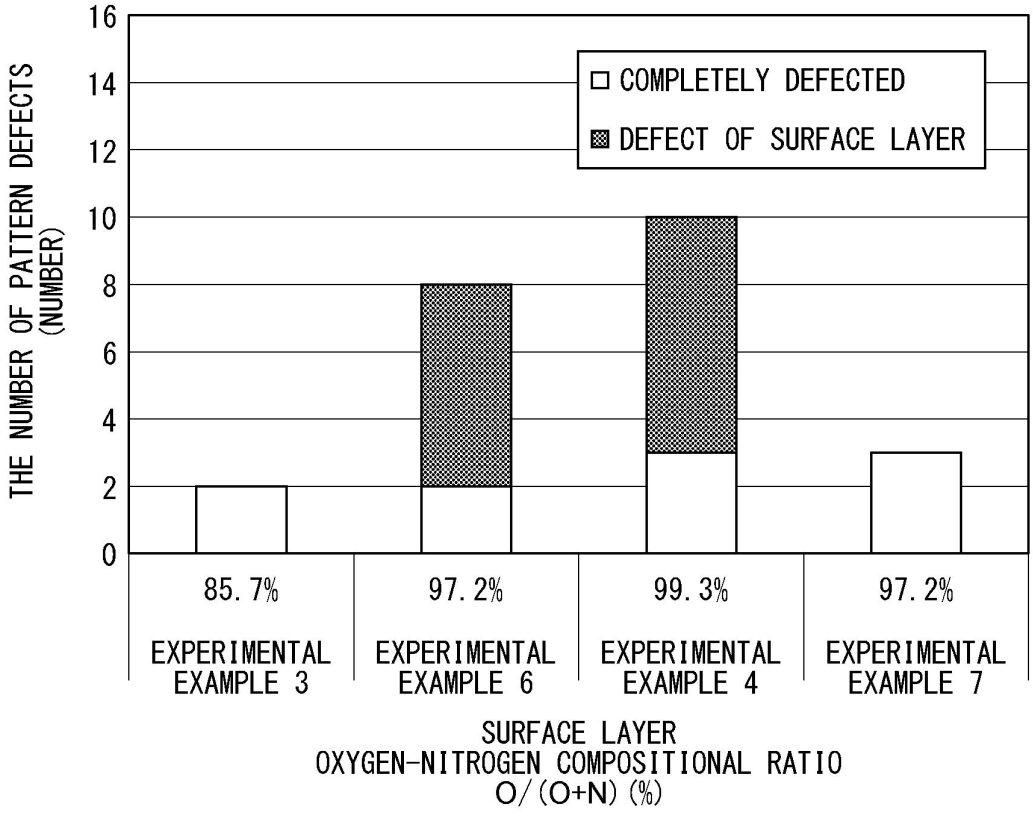

THE NUMBER OF PATTERN DEFECTS
(NUMBER)
16
14
12
10
8
6
4
2
0
COMPLETELY DEFECTED
DEFECT OF SURFACE LAYER
85.7%
97.2%
99.3%
97.2%
EXPERIMENTAL EXAMPLE 3
EXPERIMENTAL EXAMPLE 6
EXPERIMENTAL EXAMPLE 4
EXPERIMENTAL EXAMPLE 7
SURFACE LAYER
OXYGEN-NITROGEN COMPOSITIONAL RATIO
O/(O+N) (%)

FIG. 29

LAYER	LIGHT-SHIELDING LAYER				INTERMEDIATE LAYER				UPPER-MEDIUM LAYER				SURFACE LAYER			
CHEMICAL ELEMENT	Cr	O	N	C	Cr	O	N	C	Cr	O	N	C	Cr	O	N	C
EXPERIMENTAL EXAMPLE 3	35	30	19	16	50	15	25	10	–	–	–	–	25	60	10	5
EXPERIMENTAL EXAMPLE 4	35	30	19	16	50	15	25	10	–	–	–	–	23	71	0	6
EXPERIMENTAL EXAMPLE 6	35	30	19	16	50	15	25	10	–	–	–	–	23	70	2	5
EXPERIMENTAL EXAMPLE 7	35	30	19	16	50	15	25	10	50	20	20	10	23	70	2	5

FIG. 30

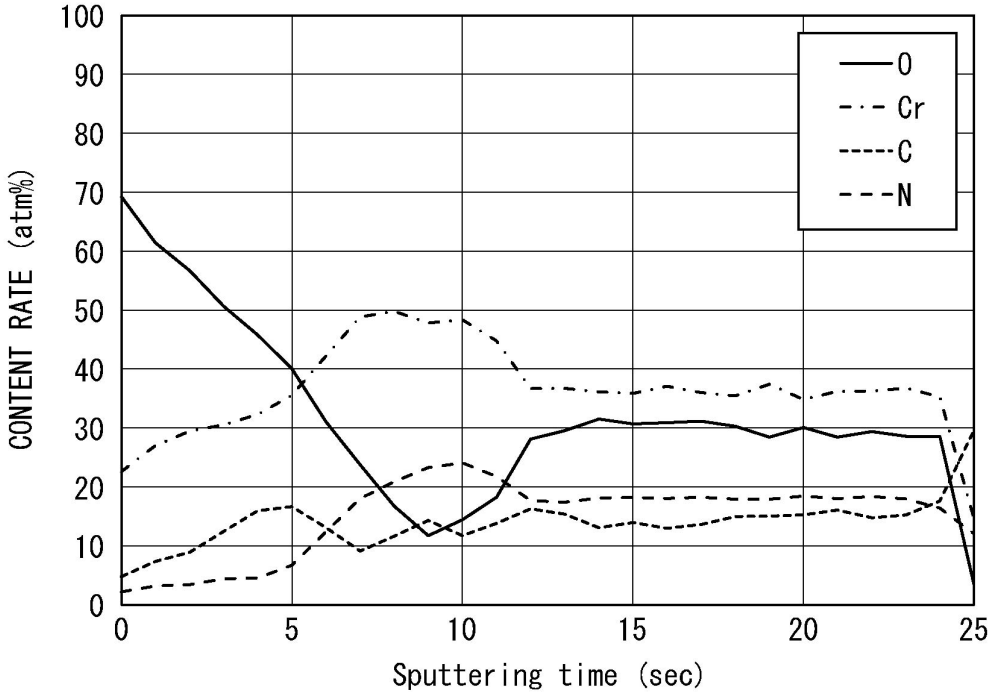
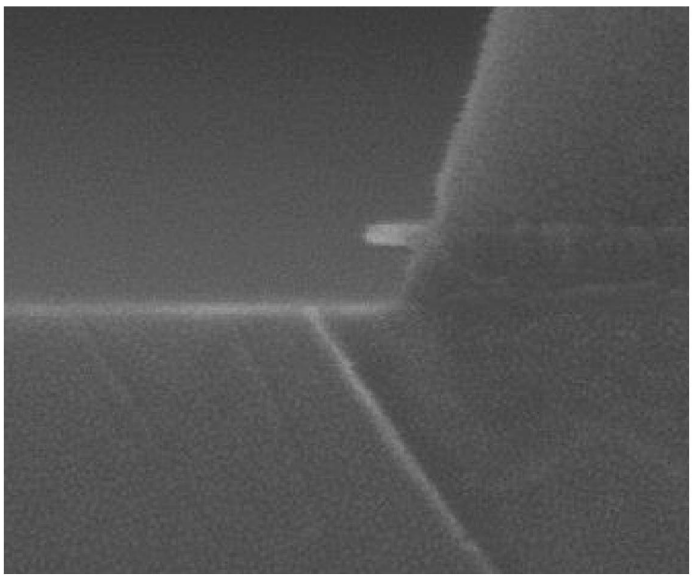


FIG. 31

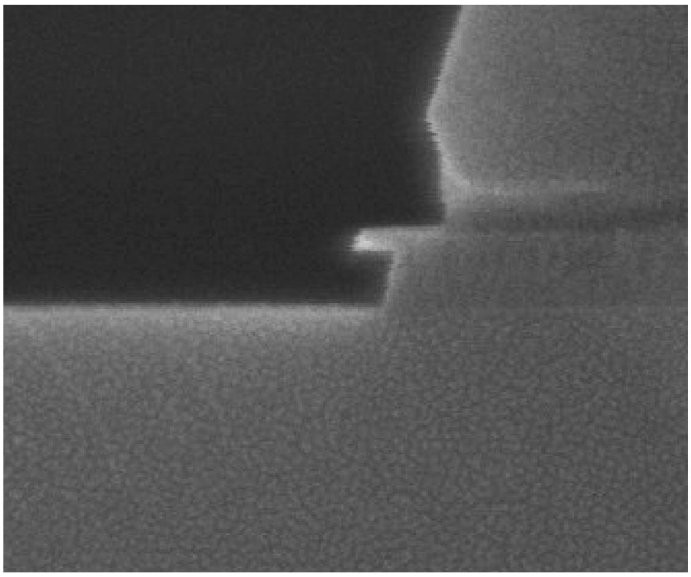
EXPERIMENTAL EXAMPLE 3



SEM×150k

FIG. 32

EXPERIMENTAL EXAMPLE 7



SEM × 150k

FIG. 33

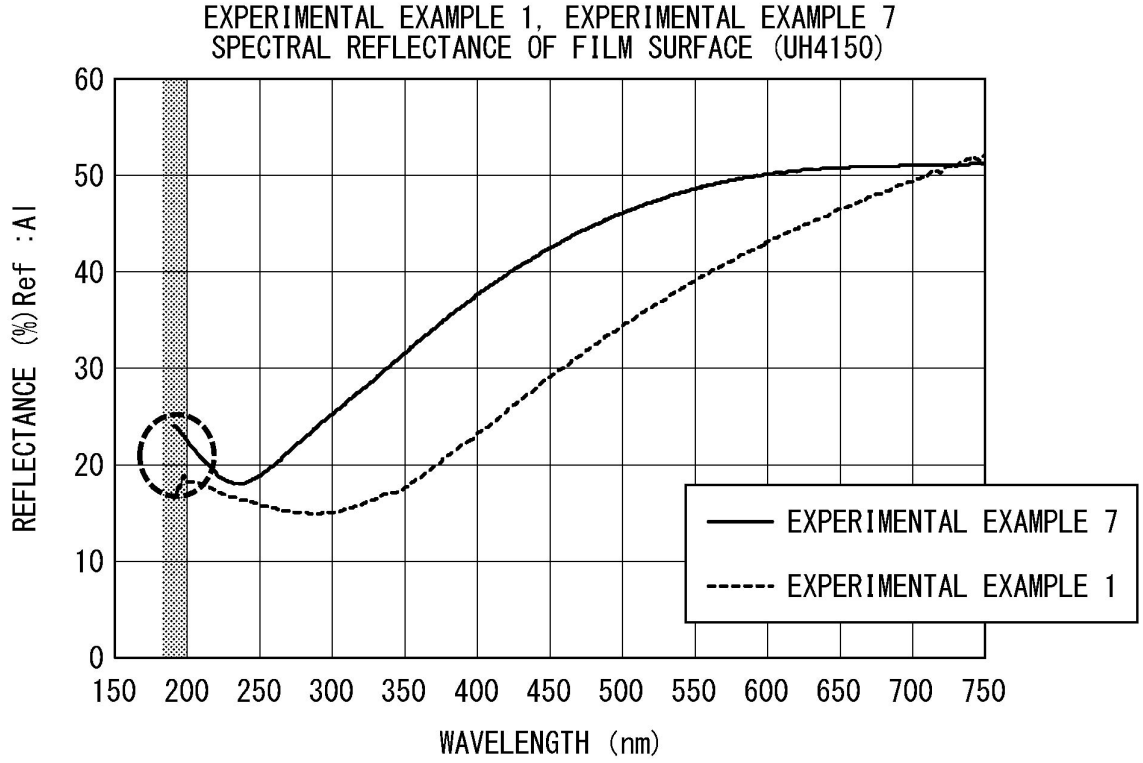
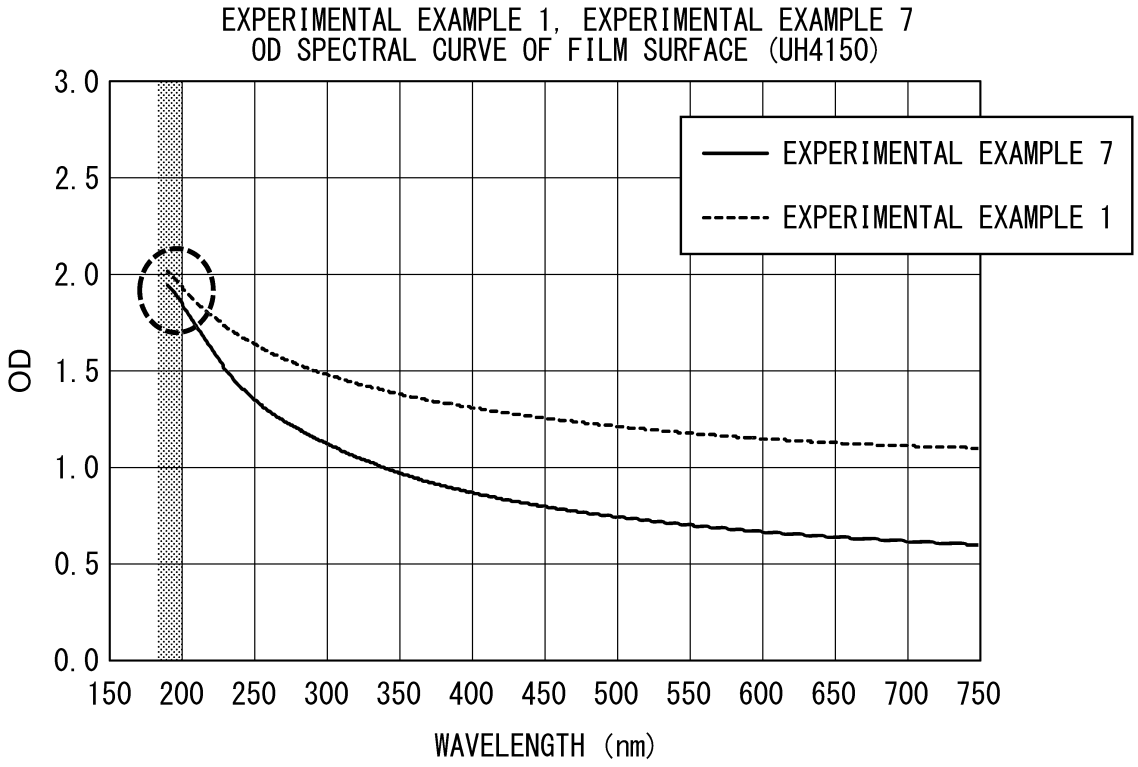


FIG. 34


EXPERIMENTAL EXAMPLE 1, EXPERIMENTAL EXAMPLE 7
OD SPECTRAL CURVE OF FILM SURFACE (UH4150)
EXPERIMENTAL EXAMPLE 7
EXPERIMENTAL EXAMPLE 1
OD
3.0
2.5
2.0
1.5
1.0
0.5
0.0
150
200
250
300
350
400
450
500
550
600
650
700
750
WAVELENGTH (nm)