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FIG.1

FIG.2

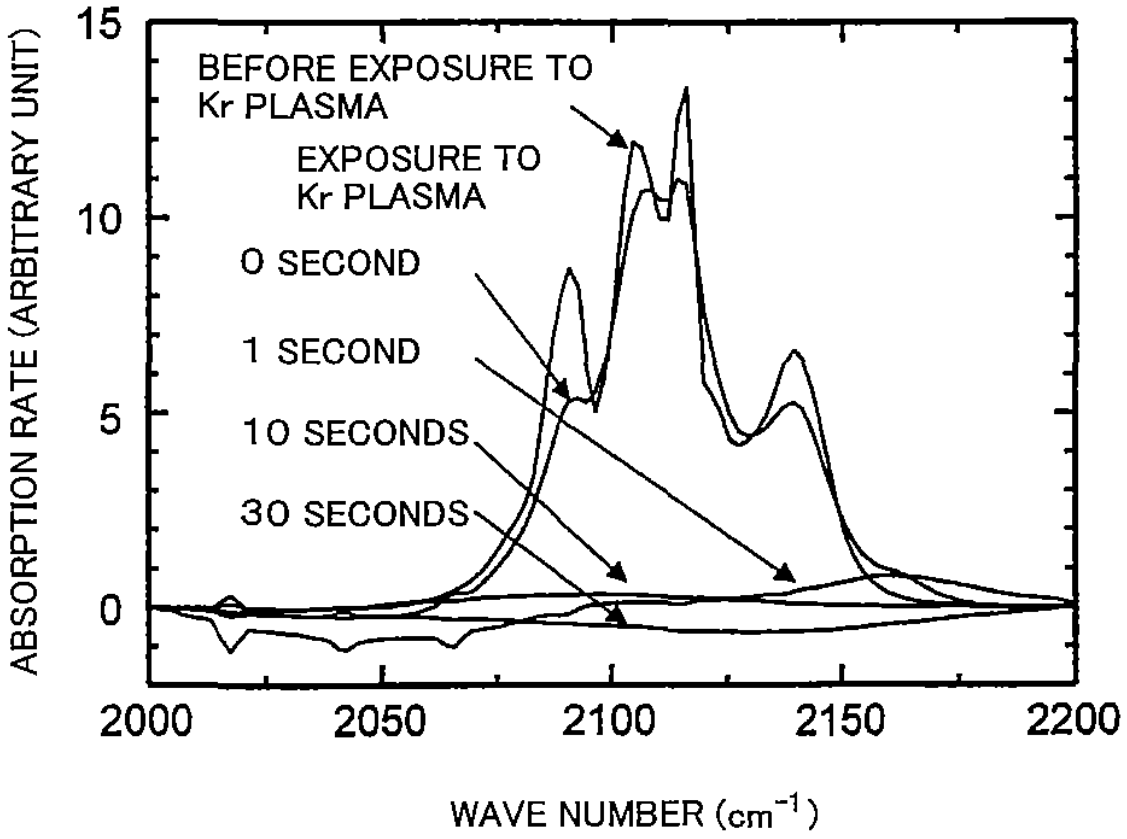

15
10
5
0
ABSORPTION RATE (ARBITRARY UNIT)
BEFORE EXPOSURE TO
Kr PLASMA
EXPOSURE TO
Kr PLASMA
0 SECOND
1 SECOND
10 SECONDS
30 SECONDS
2000
2050
2100
2150
2200
WAVE NUMBER (cm-1)

FIG.3

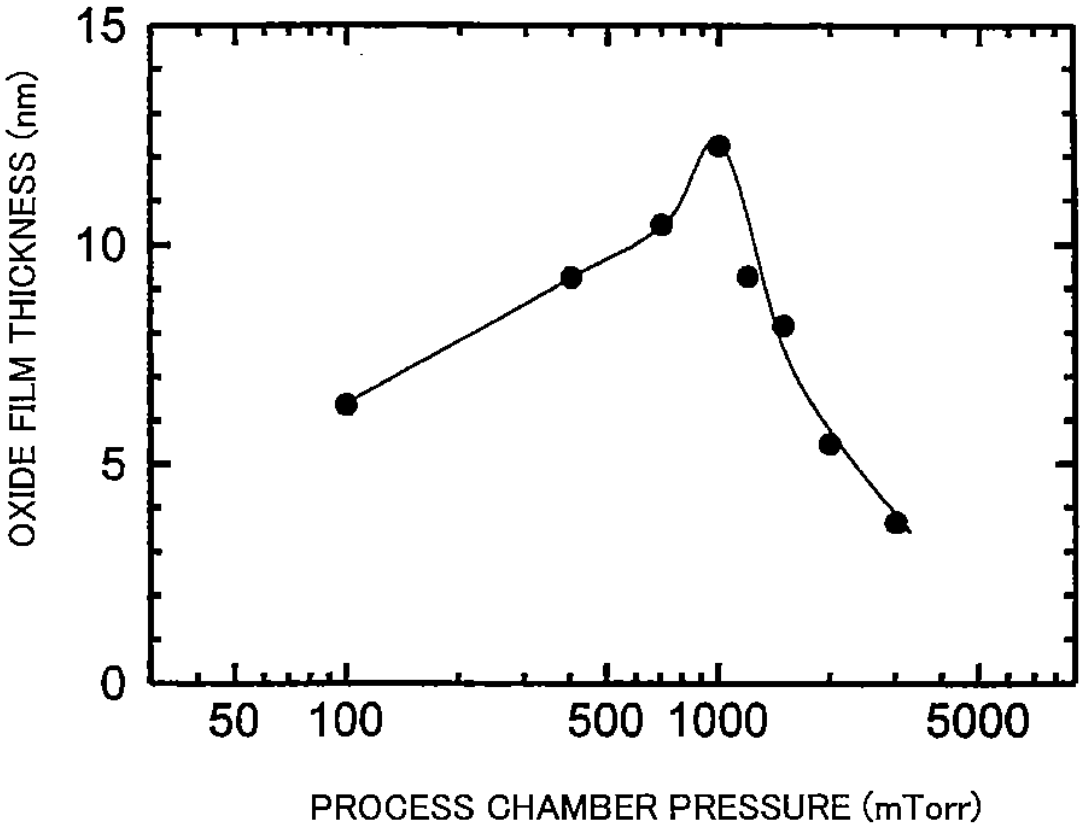

15
10
5
0
OXIDE FILM THICKNESS (nm)
50
100
500
1000
5000
PROCESS CHAMBER PRESSURE (mTorr)

FIG.4

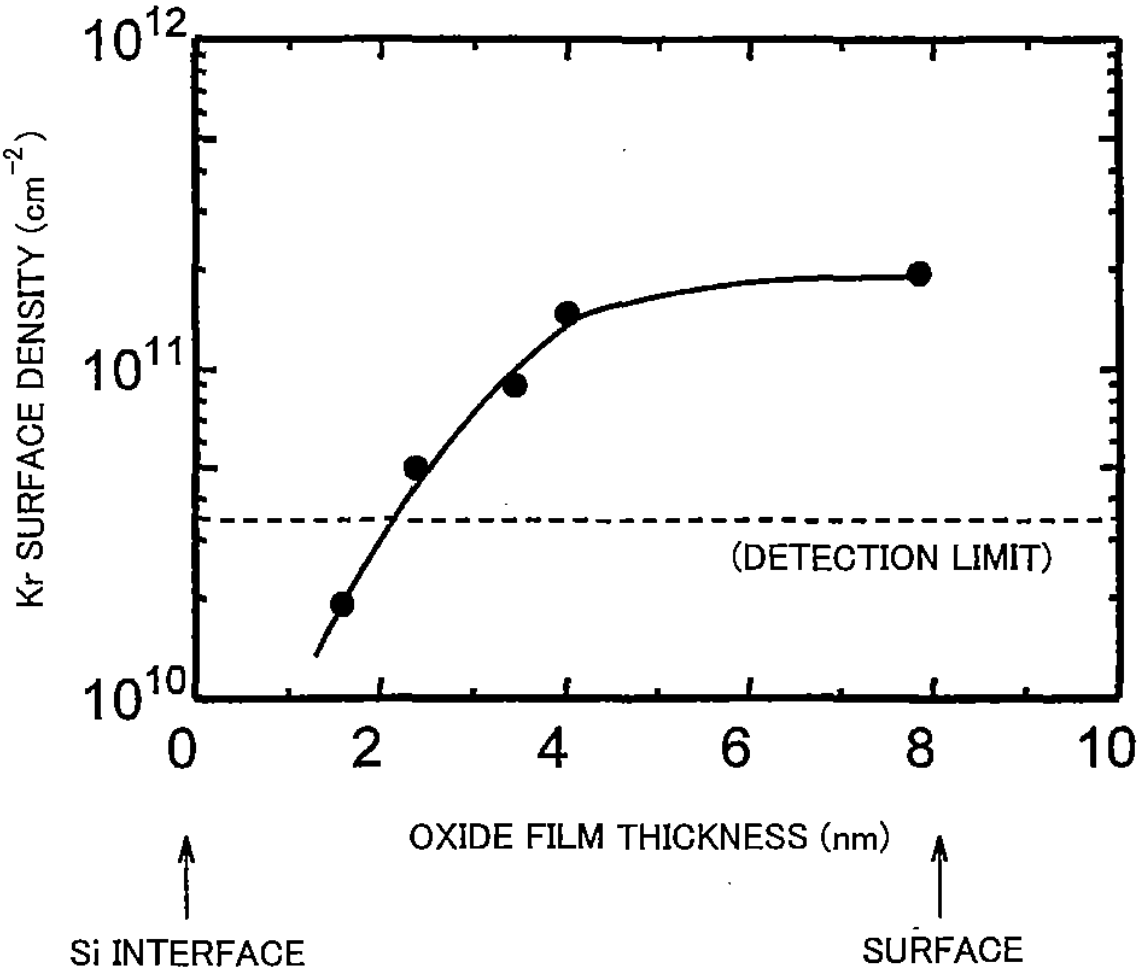

10^{12}
10^{11}
10^{10}
Kr SURFACE DENSITY (cm^{-2})
(DETECTION LIMIT)
0
2
4
6
8
10
OXIDE FILM THICKNESS (nm)
Si INTERFACE
SURFACE

FIG.5

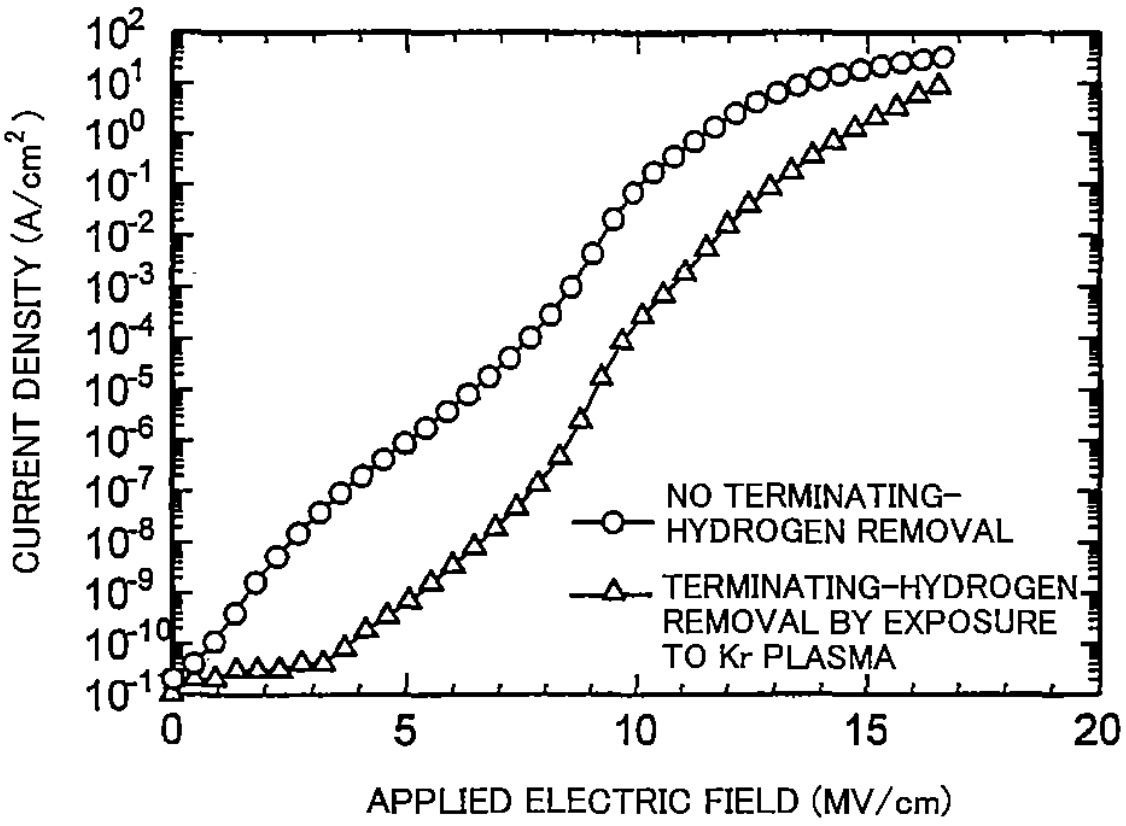

CURRENT DENSITY (A/cm^2)
10^{2}
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-8}
10^{-9}
10^{-10}
10^{-11}
0
5
10
15
20
APPLIED ELECTRIC FIELD (MV/cm)
NO TERMINATING-HYDROGEN REMOVAL
TERMINATING-HYDROGEN-REMOVAL BY EXPOSURE TO Kr PLASMA

FIG.6

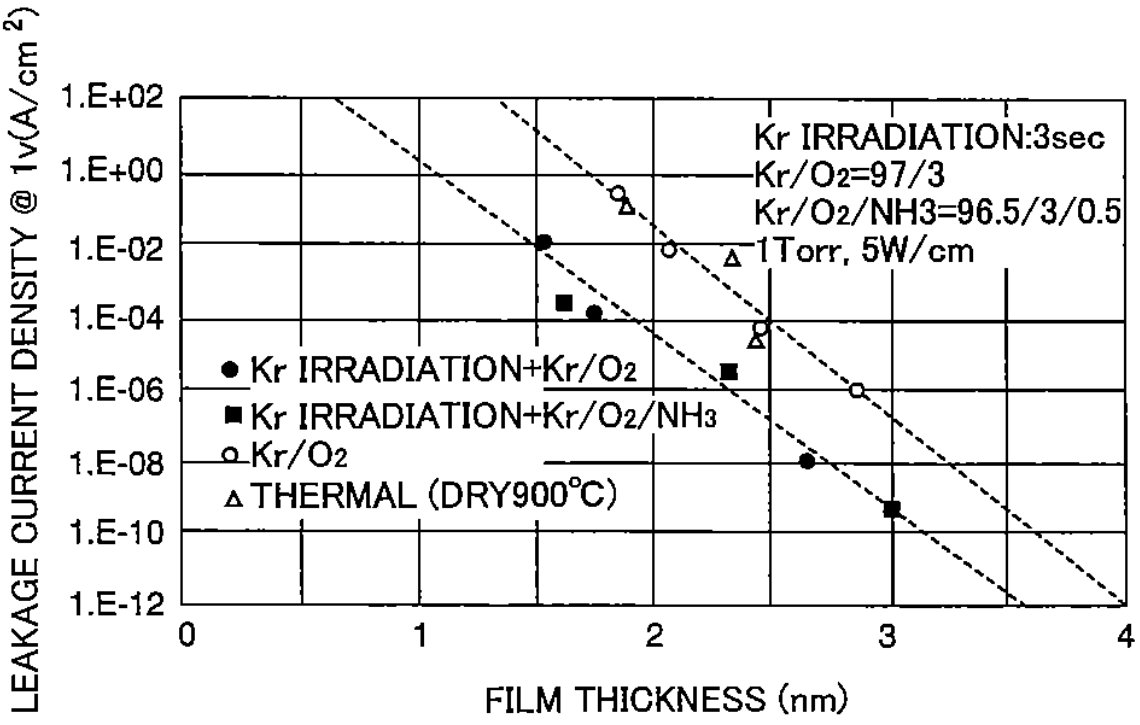

LEAKAGE CURRENT DENSITY @ 1v(A/cm 2)
1.E+02
1.E+00
1.E-02
1.E-04
1.E-06
1.E-08
1.E-10
1.E-12
0
1
2
3
4
FILM THICKNESS (nm)
Kr IRRADIATION:3sec
Kr/O2=97/3
Kr/O2/NH3=96.5/3/0.5
1Torr, 5W/cm
● Kr IRRADIATION+Kr/O2
■ Kr IRRADIATION+Kr/O2/NH3
○ Kr/O2
△ THERMAL (DRY900°C)

FIG.7

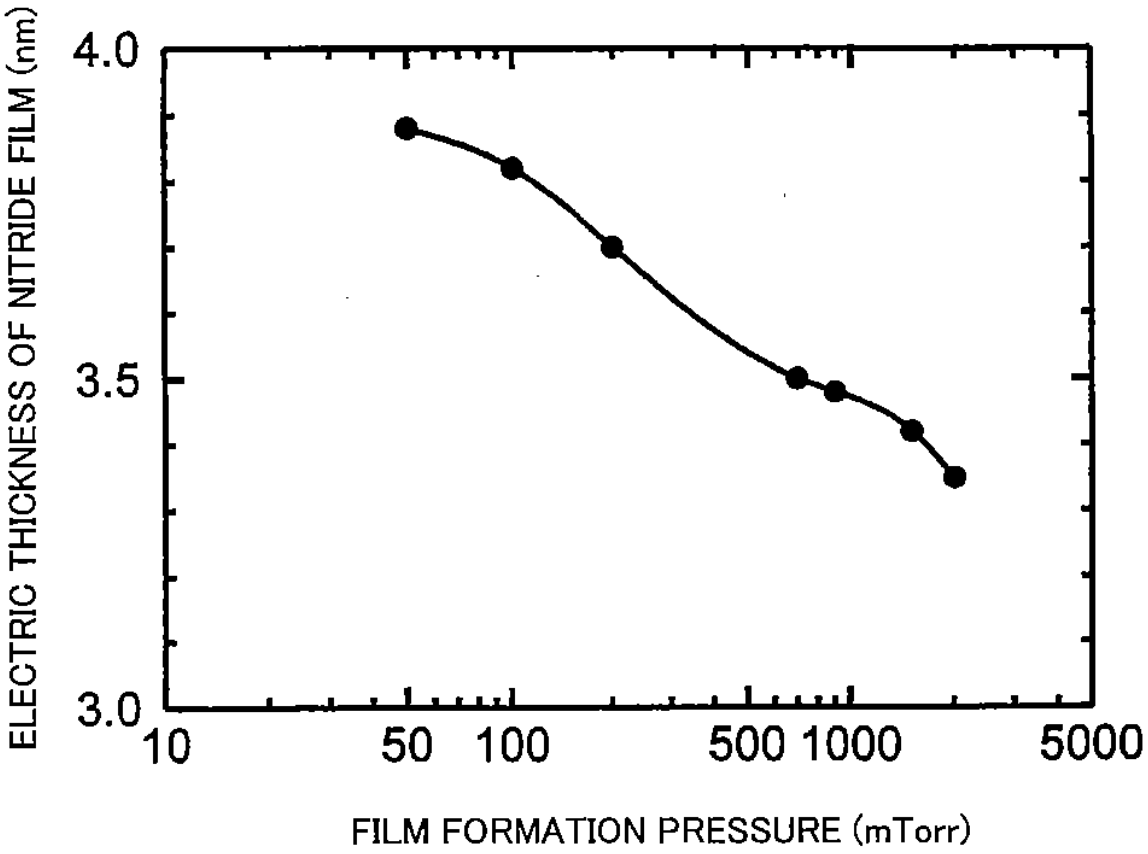

ELECTRIC THICKNESS OF NITRIDE FILM (nm)
4.0
3.5
3.0
10
50
100
500
1000
5000
FILM FORMATION PRESSURE (mTorr)

FIG.8

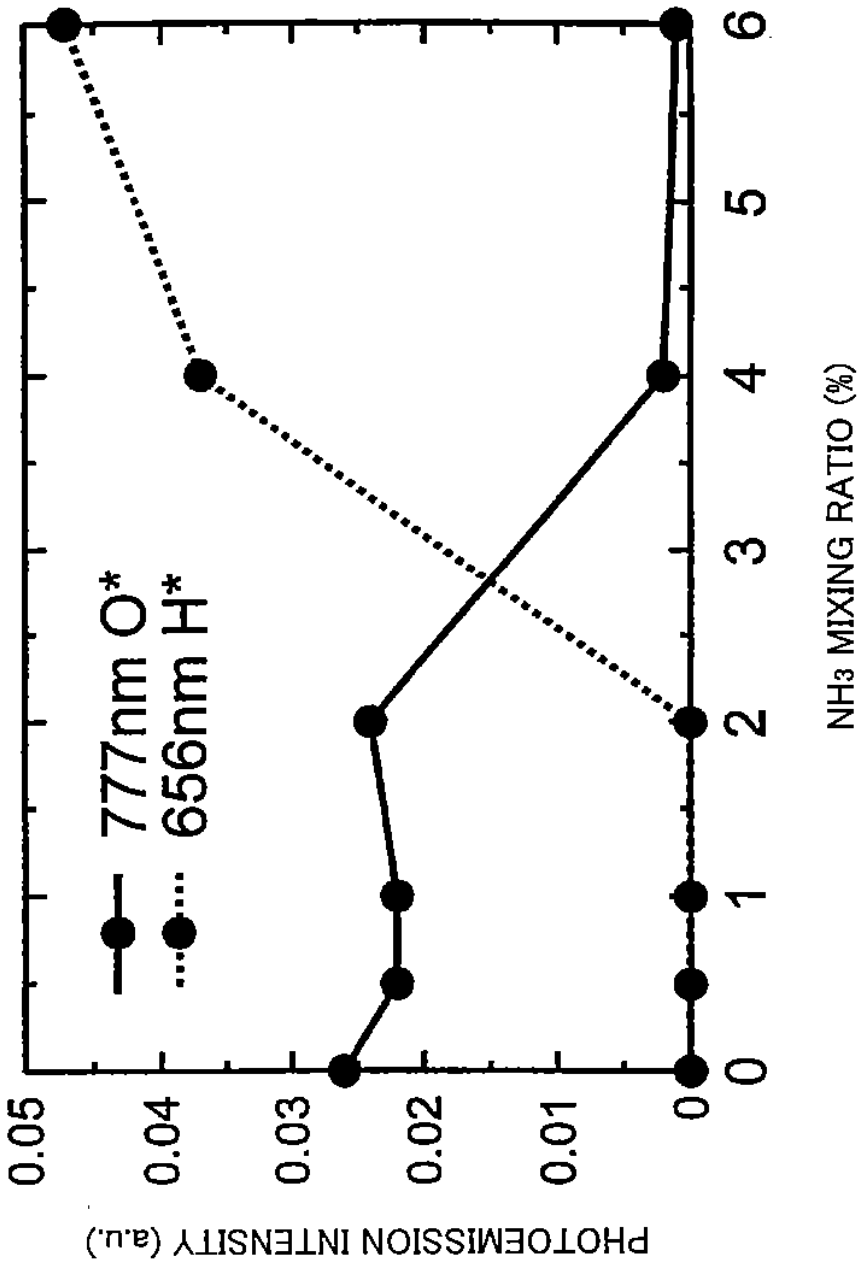

777nm O*
656nm H*
PHOTOEMISSION INTENSITY (a.u.)
0.05
0.04
0.03
0.02
0.01
0
0
1
2
3
4
5
6
NH3 MIXING RATIO (%)

FIG.9

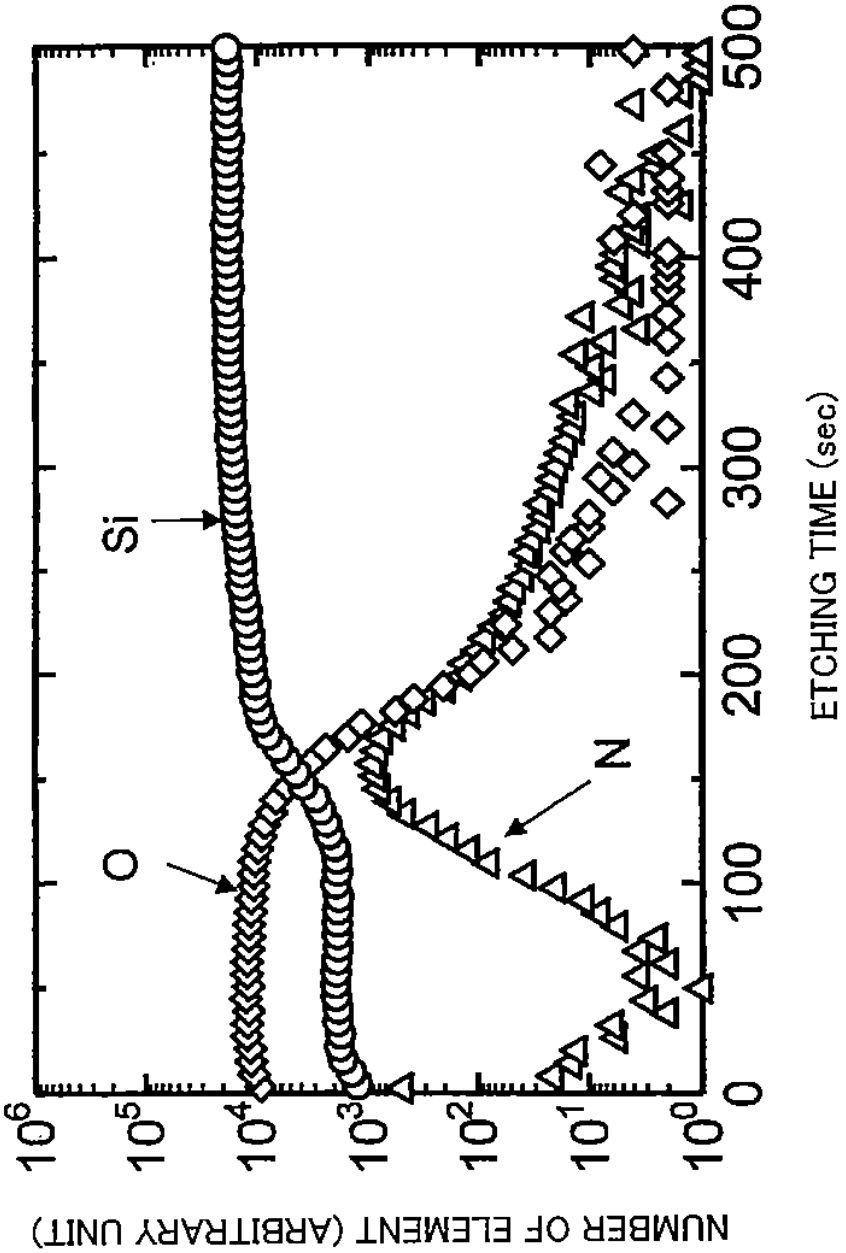
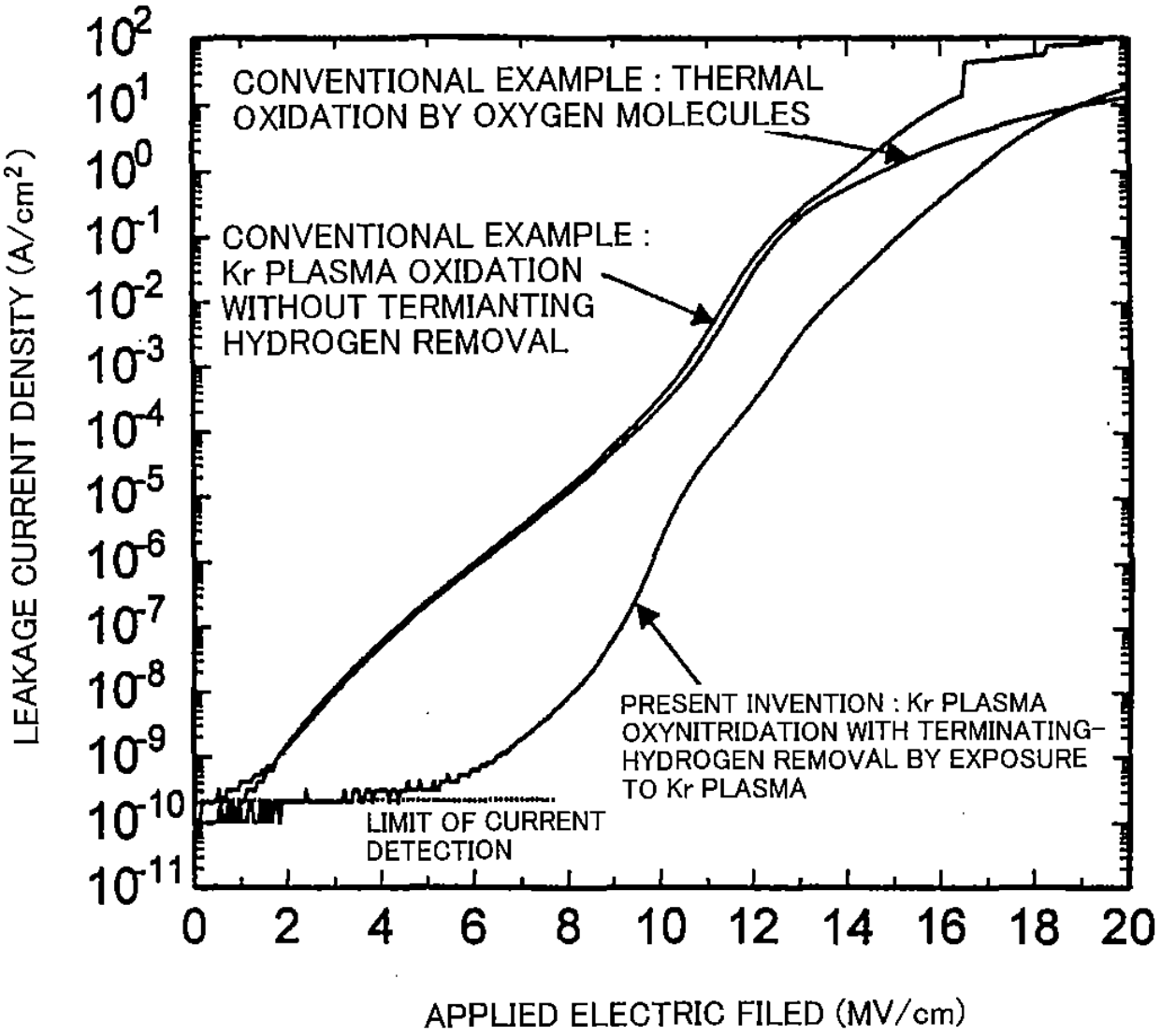

NUMBER OF ELEMENT (ARBITRARY UNIT)
10^6
10^5
10^4
10^3
10^2
10^1
10^0
0
100
200
300
400
500
ETCHING TIME (sec)
Si
O
N

FIG.10



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FIG.11A

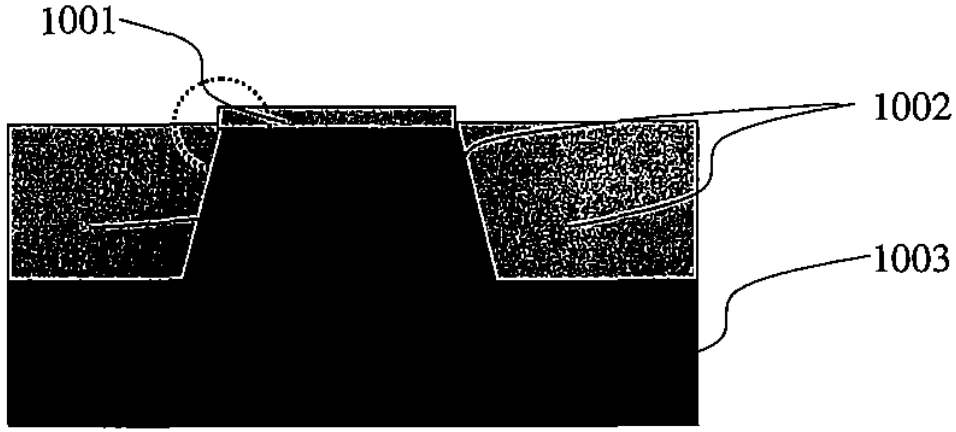
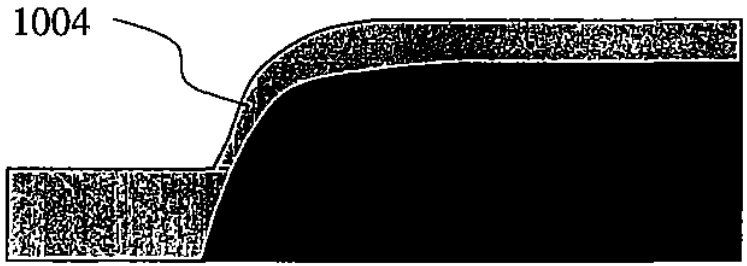
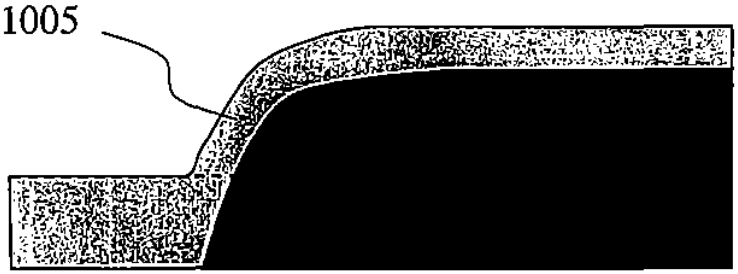


FIG.11B



CONVENTIONAL EXAMPLE

FIG.11C



PRESENT INVENTION

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FIG.12

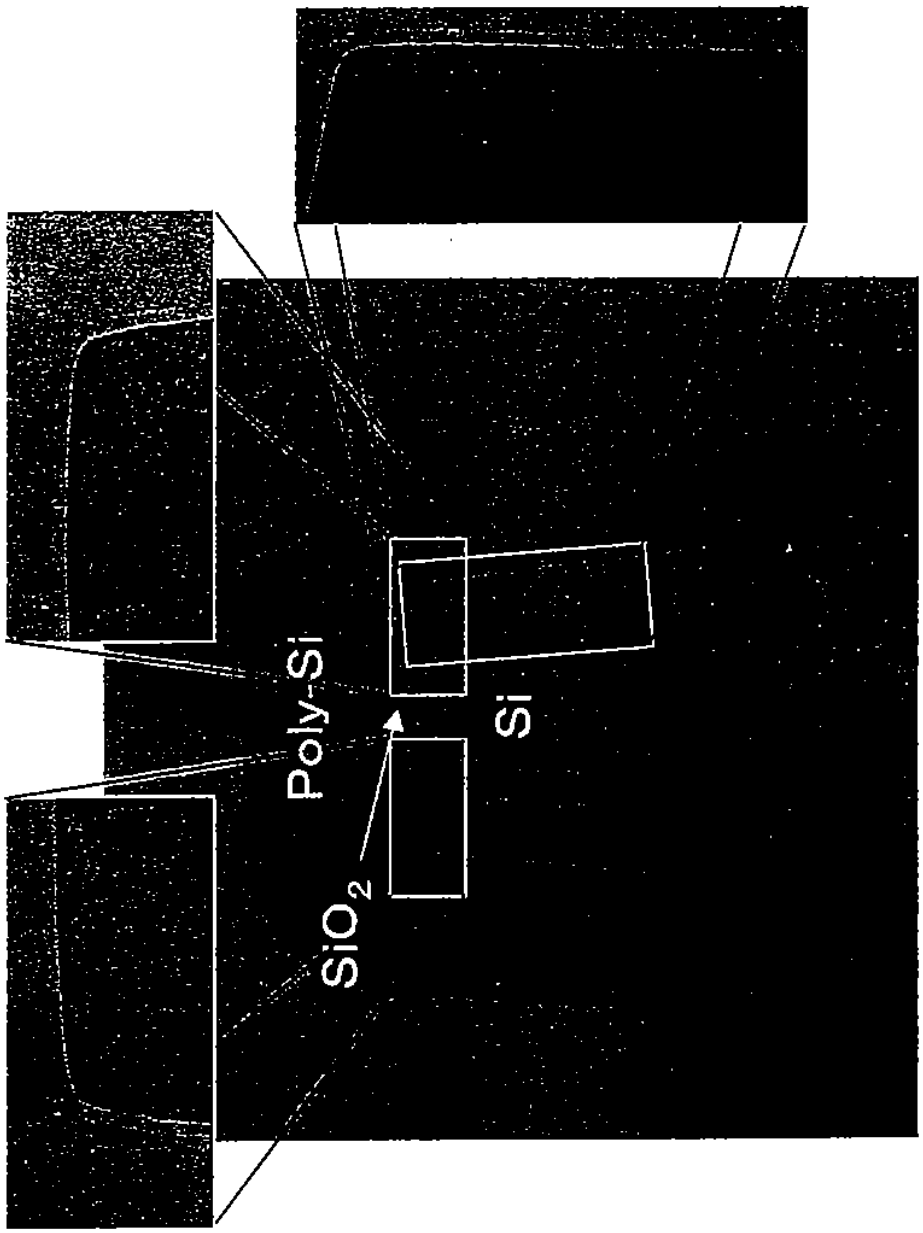


FIG.13

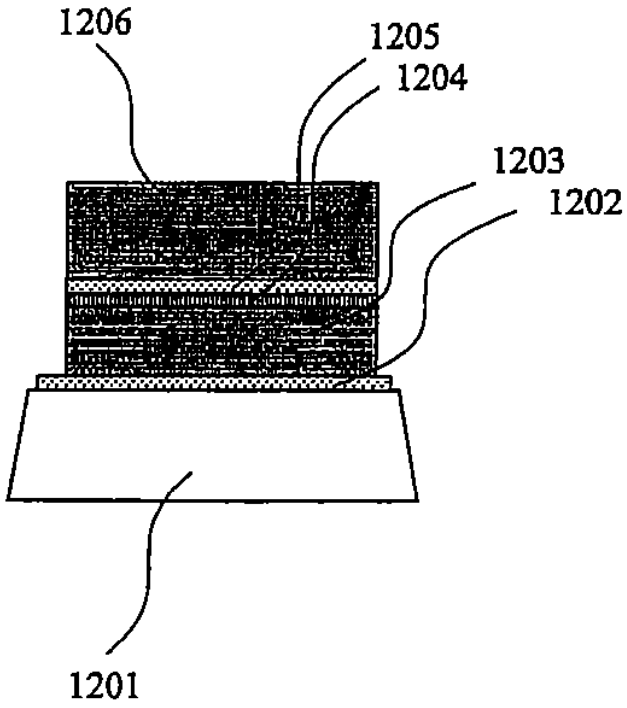
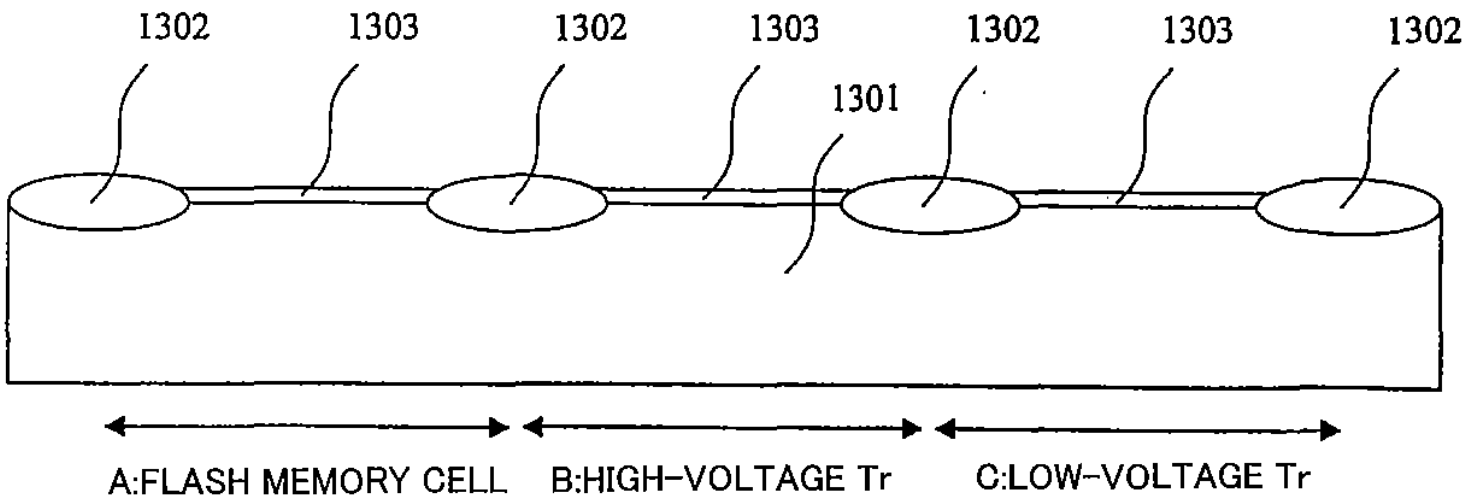


FIG.14



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FIG.15

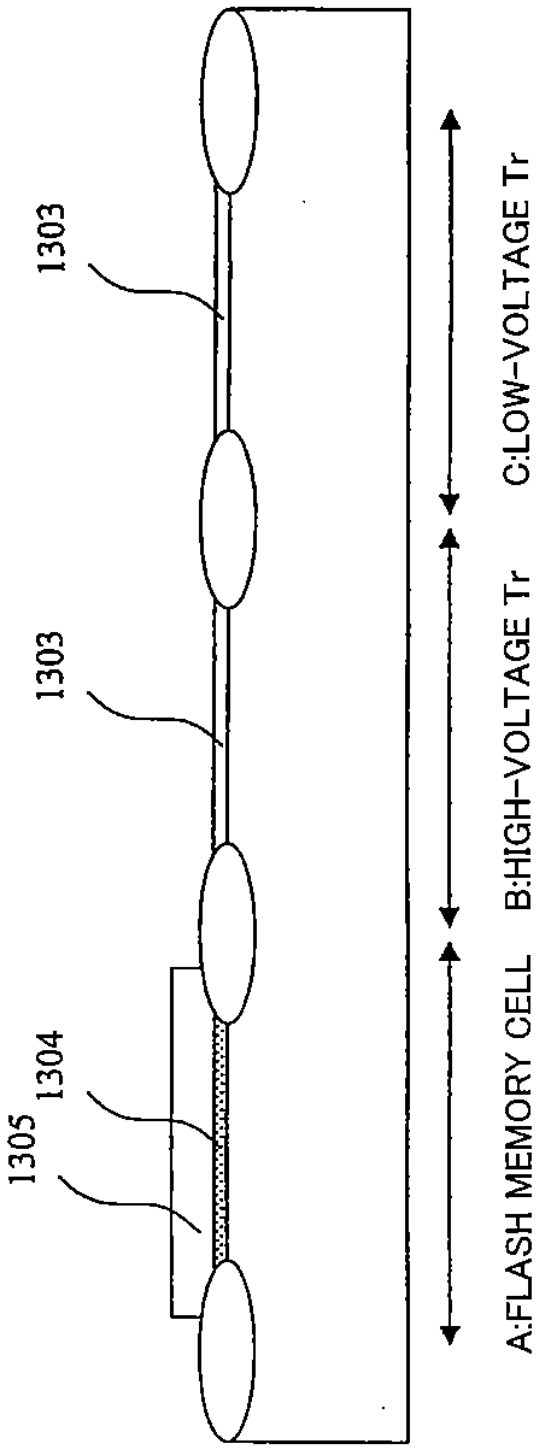
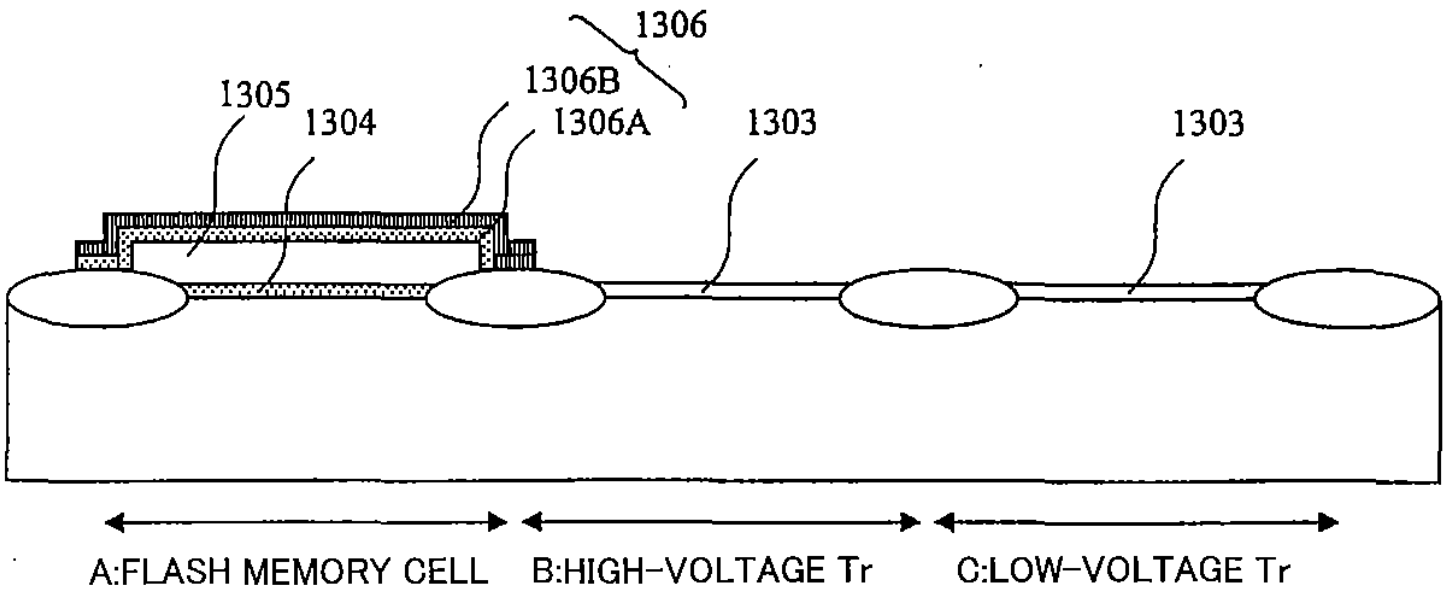
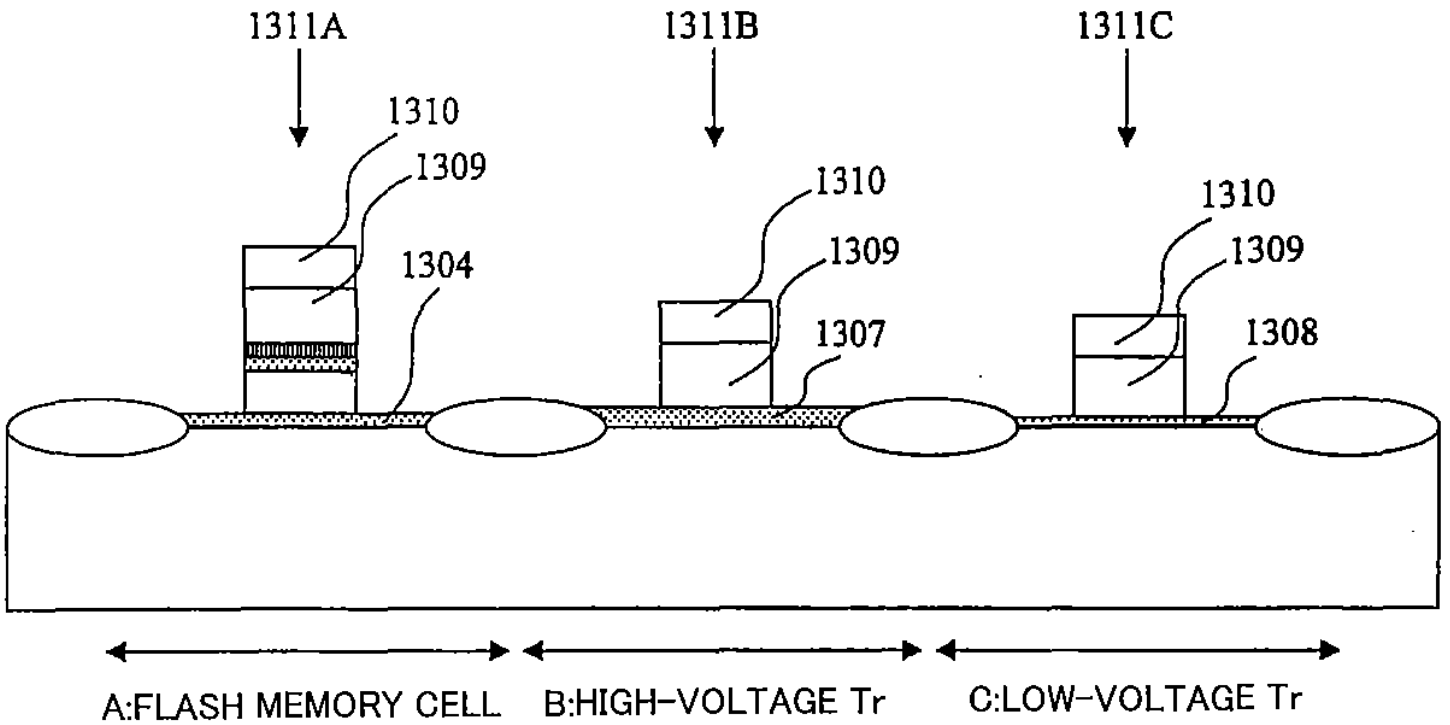

1303
1303
1304
1305
A:FLASH MEMORY CELL
B:HIGH-VOLTAGE Tr
C:LOW-VOLTAGE Tr

FIG.16



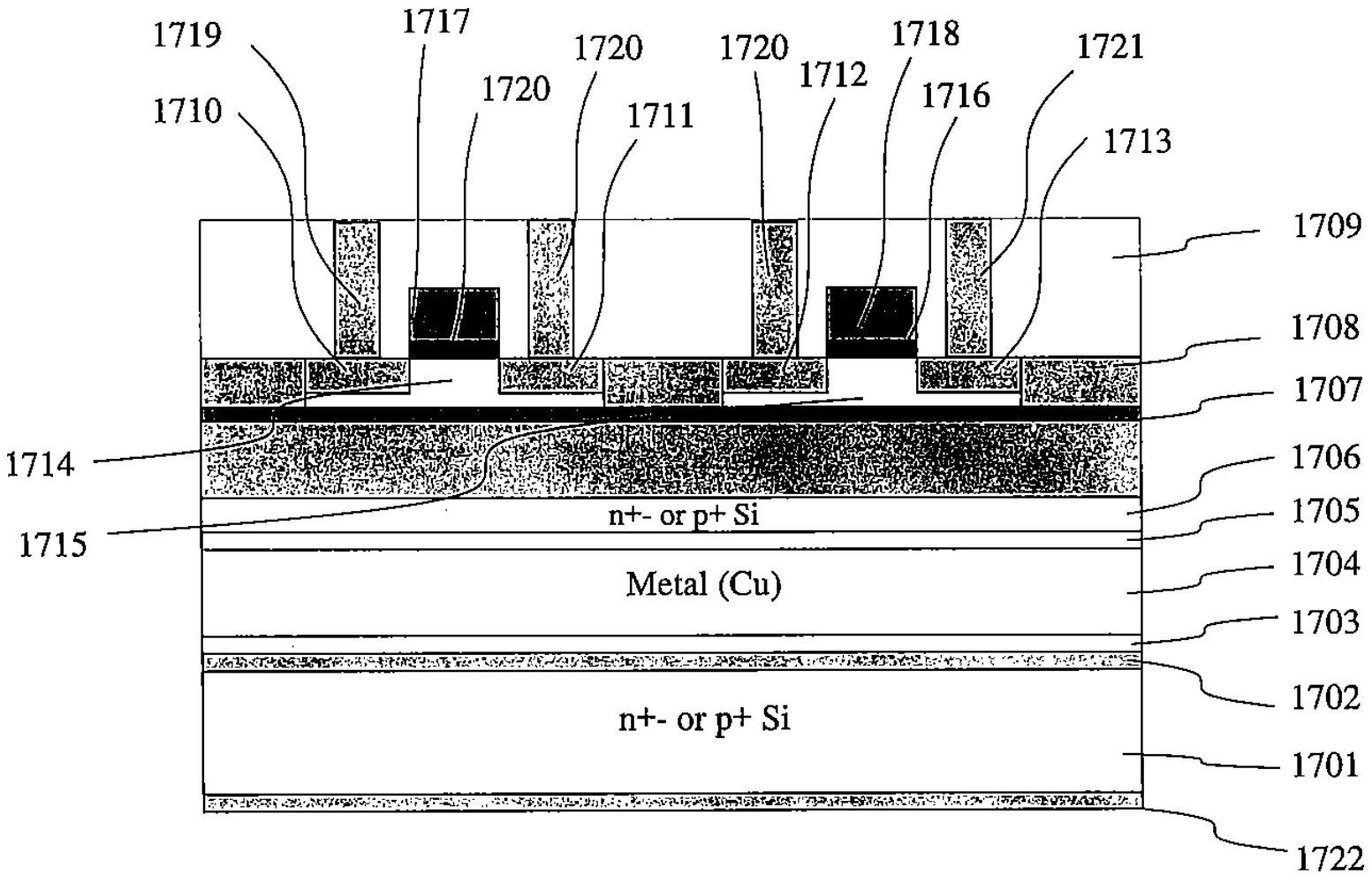
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FIG.17



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FIG.18



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FIG.19

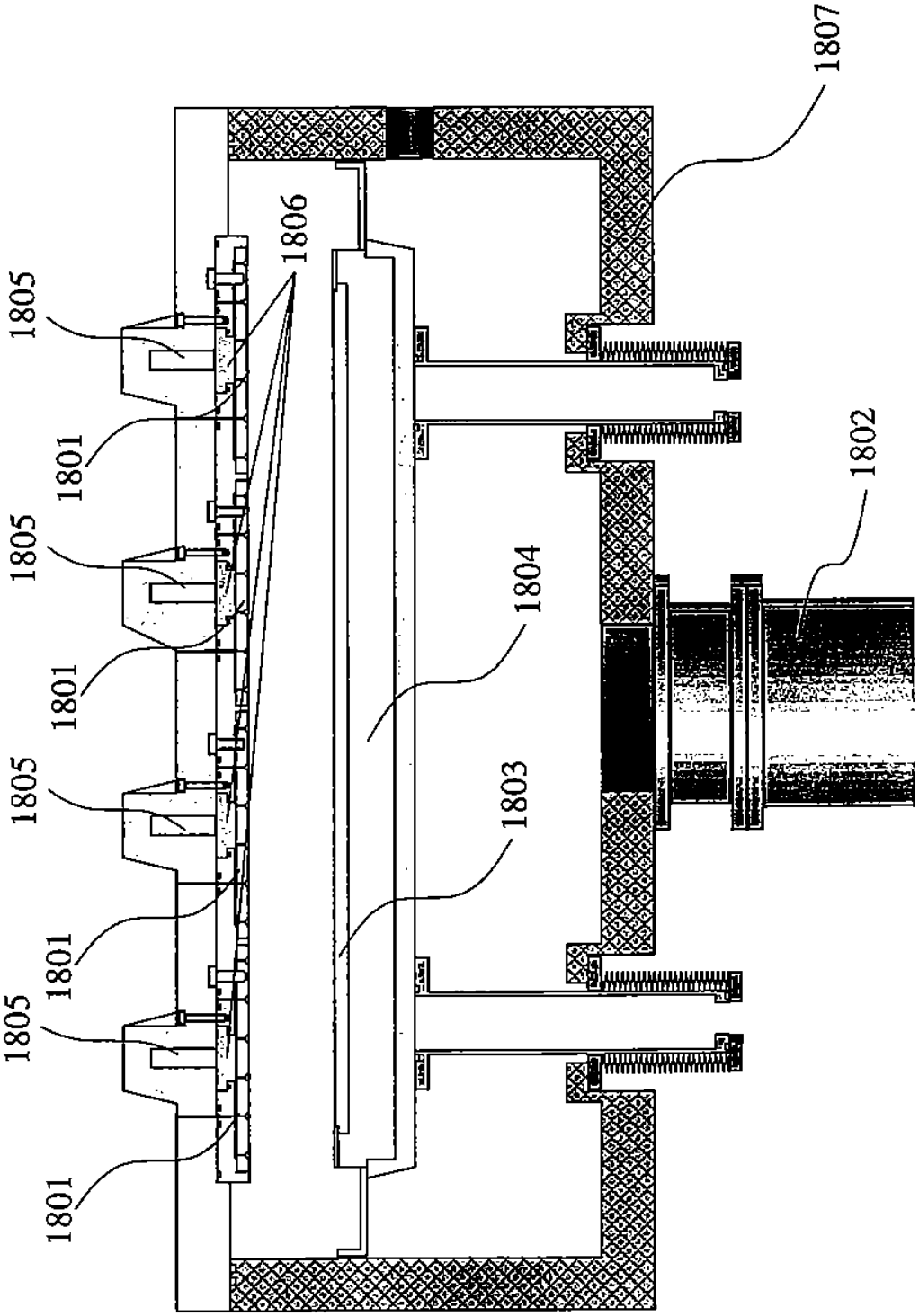
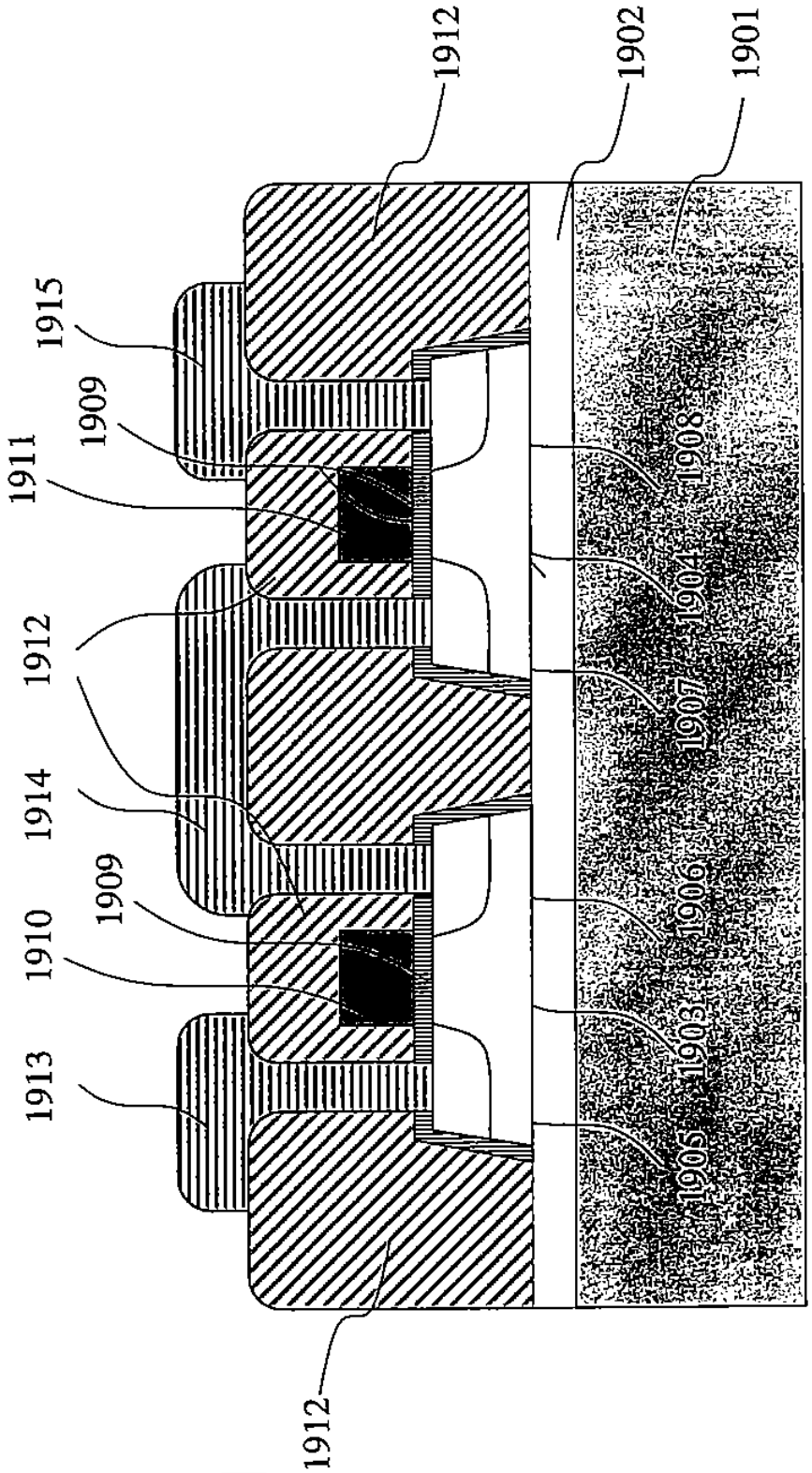

1807
1806
1805
1801
1805
1801
1805
1801
1805
1801
1802
1804
1803

FIG.20


1912
1902
1901
1915
1909
1911
1908
1912
1904
1914
1907
1909
1910
1906
1913
1903
1905
1912

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FIG.21