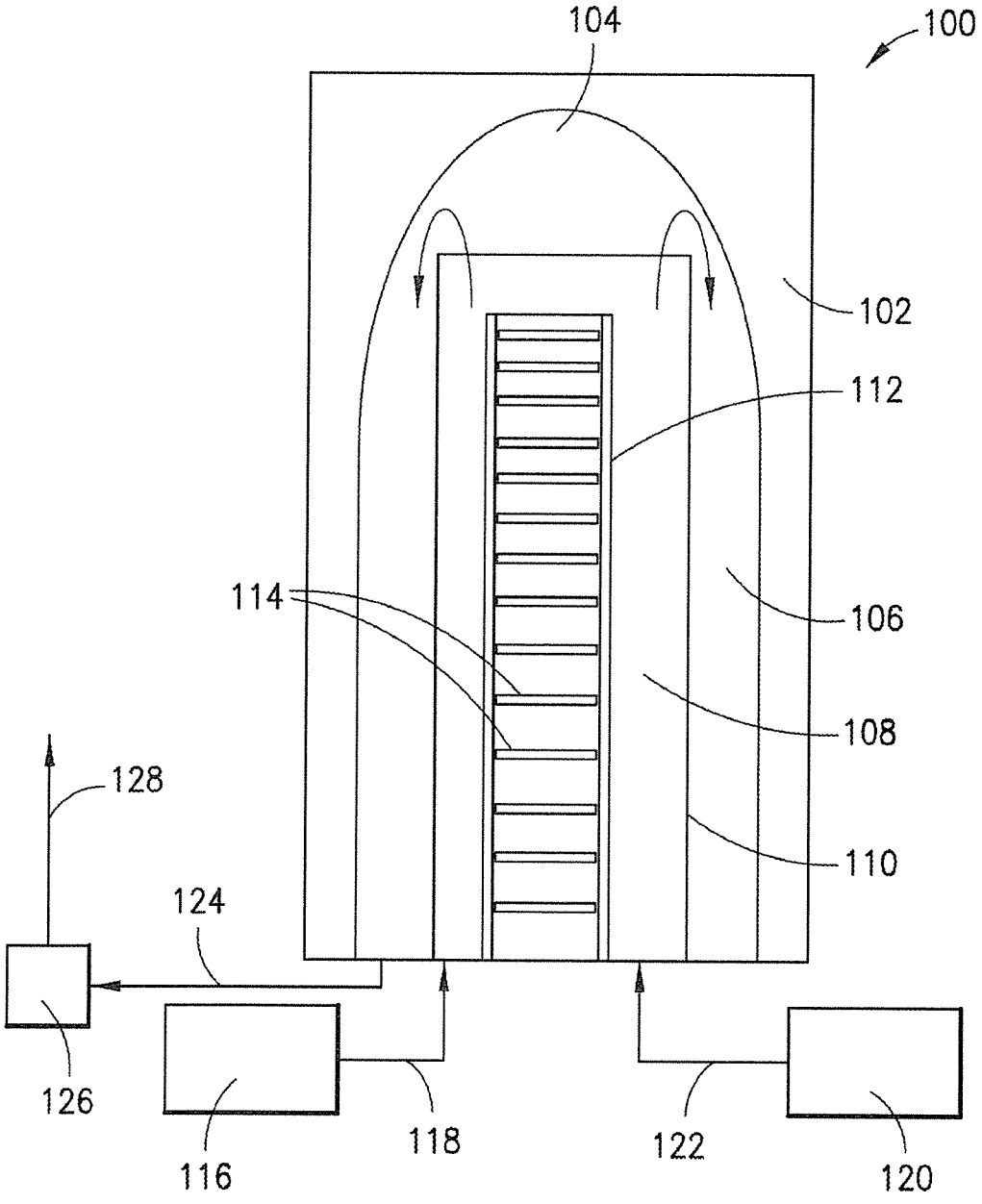

FIG. 1

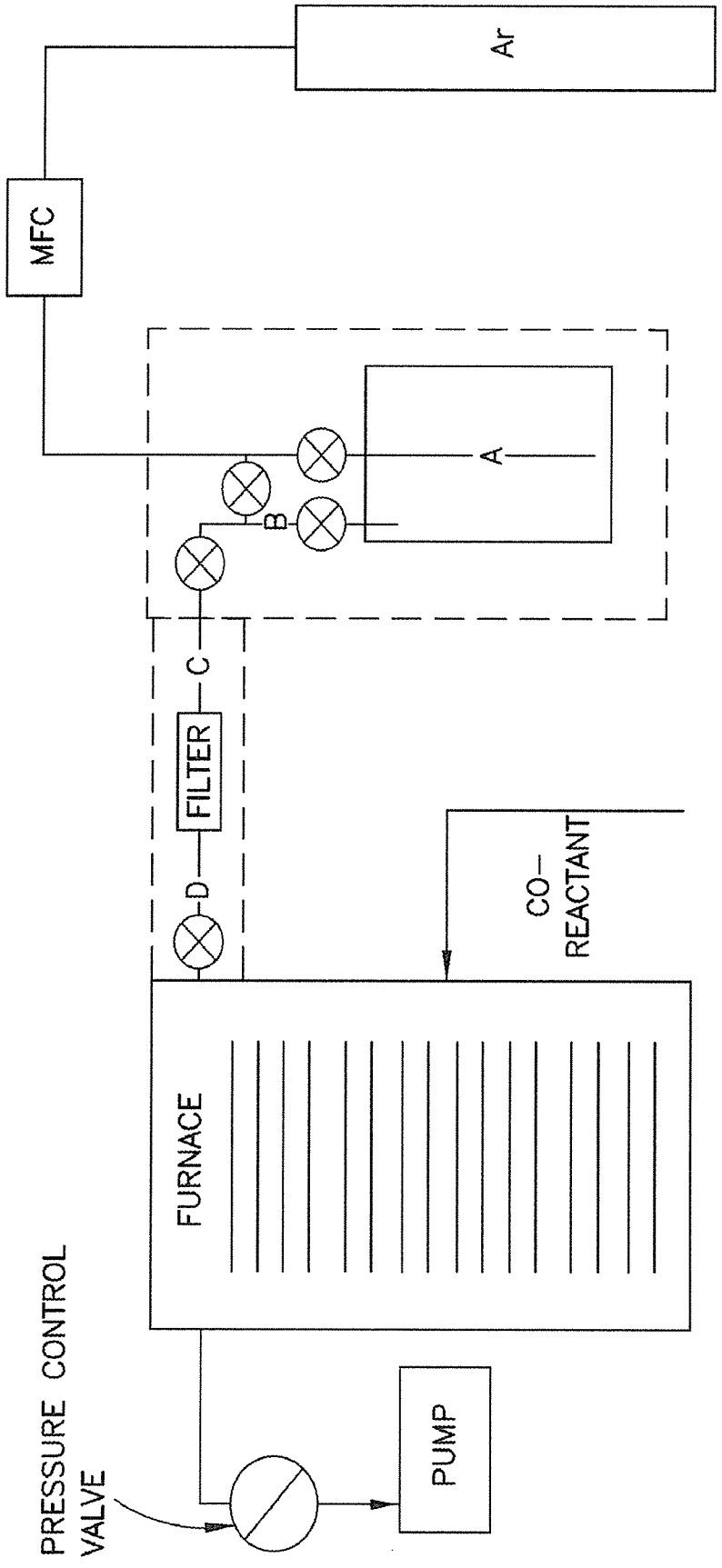
Ar
MFC
A
B
C
FILTER
D
CO-
REACTANT
FURNACE
PRESSURE CONTROL
VALVE
PUMP

FIG.2

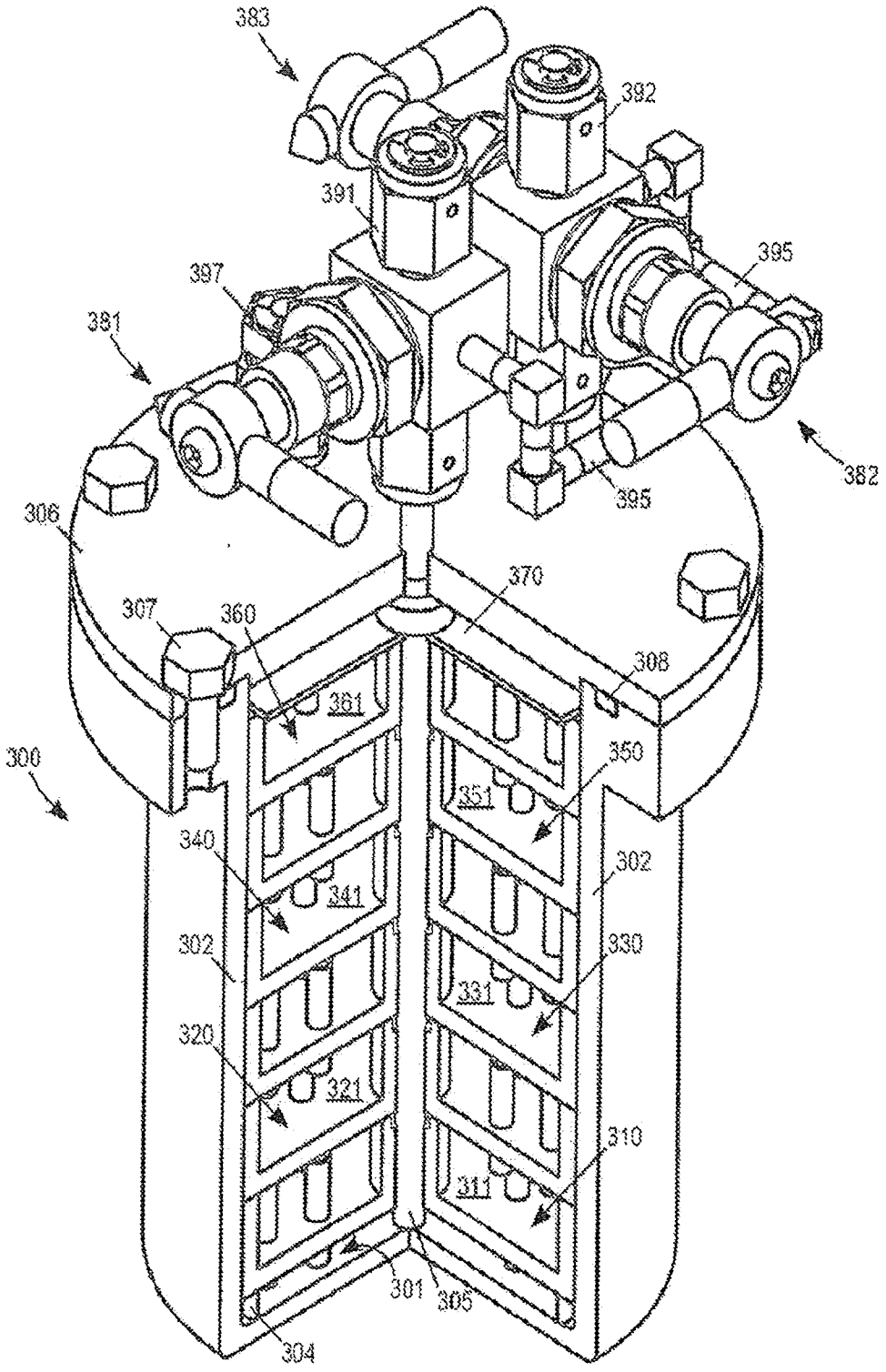
383
392
391
395
397
381
382
306
370
307
360
308
361
300
350
351
340
341
302
330
331
320
321
310
311
301
305
304

FIG.3

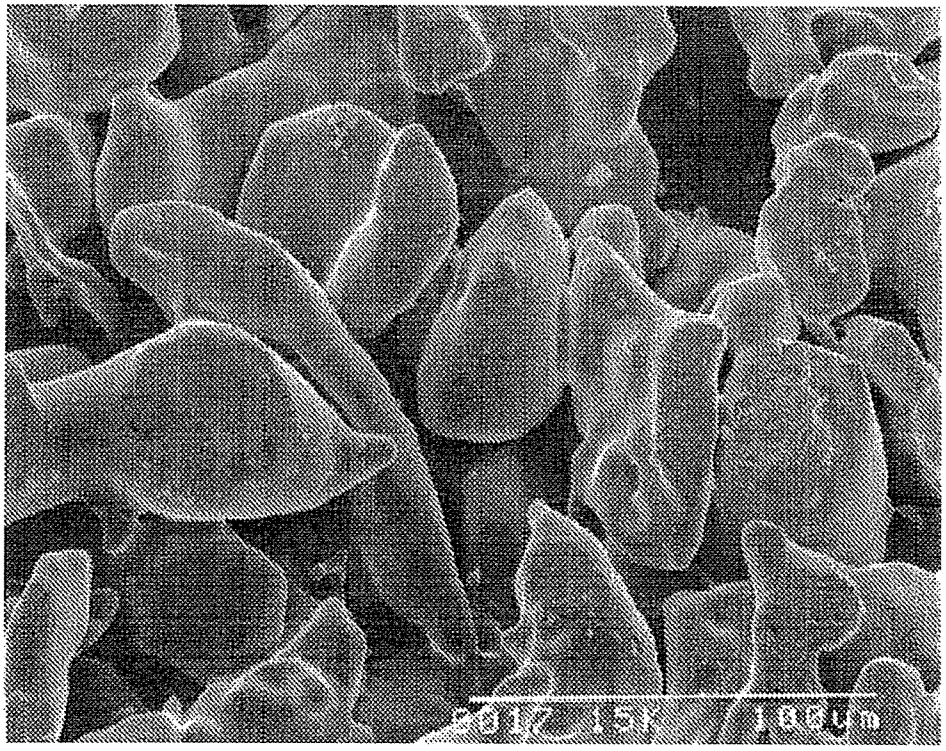

FIG.4

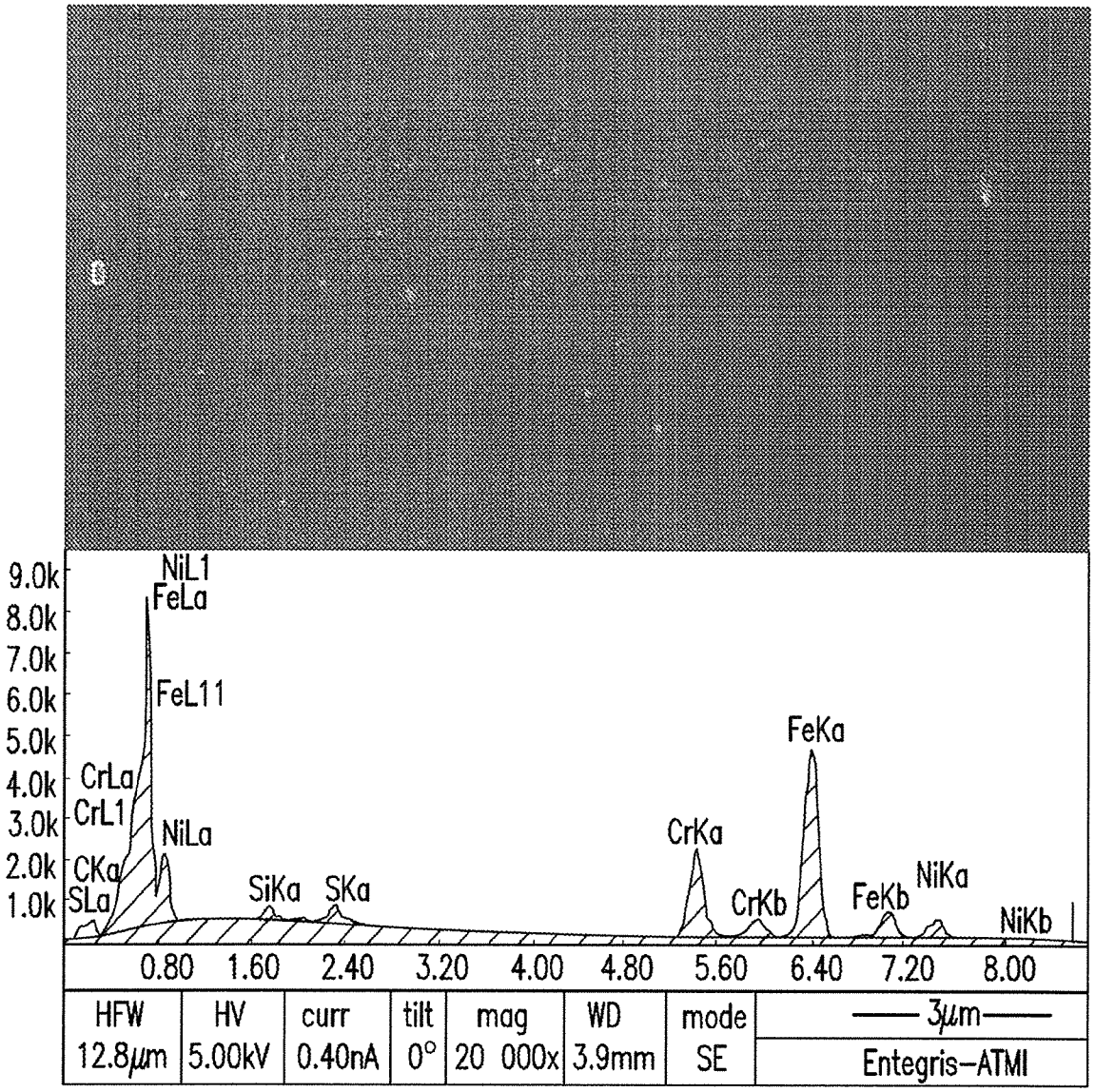
9.0k
8.0k
7.0k
6.0k
5.0k
4.0k
3.0k
2.0k
1.0k
NiL1
FeLa
FeL11
CrLa
CrL1
NiLa
CKa
SLa
SiKa
SKa
CrKa
CrKb
FeKa
FeKb
NiKa
NiKb
0.80
1.60
2.40
3.20
4.00
4.80
5.60
6.40
7.20
8.00
HFW
12.8μm
HV
5.00kV
curr
0.40nA
tilt
0°
mag
20 000x
WD
3.9mm
mode
SE
3μm
Entegris–ATMI

FIG.5

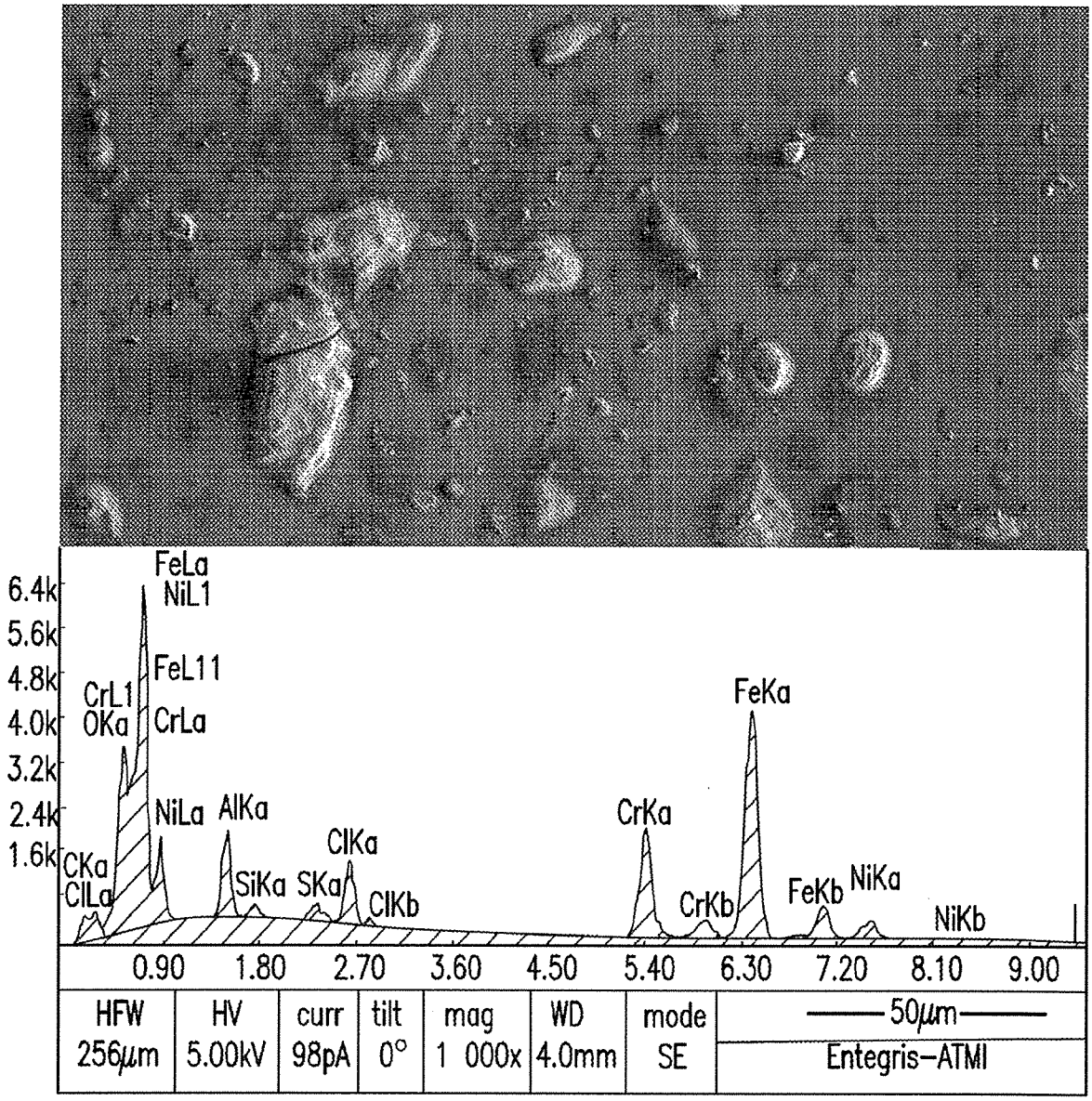
6.4k
5.6k
4.8k
4.0k
3.2k
2.4k
1.6k
FeLa
NiL1
FeL11
CrL1
OKa
CrLa
NiLa
AlKa
CKa
ClLa
SiKa
SKa
ClKa
ClKb
CrKa
CrKb
FeKa
FeKb
NiKa
NiKb
0.90
1.80
2.70
3.60
4.50
5.40
6.30
7.20
8.10
9.00
HFW
256µm
HV
5.00kV
curr
98pA
tilt
0°
mag
1 000x
WD
4.0mm
mode
SE
50µm
Entegris–ATMI

FIG.6

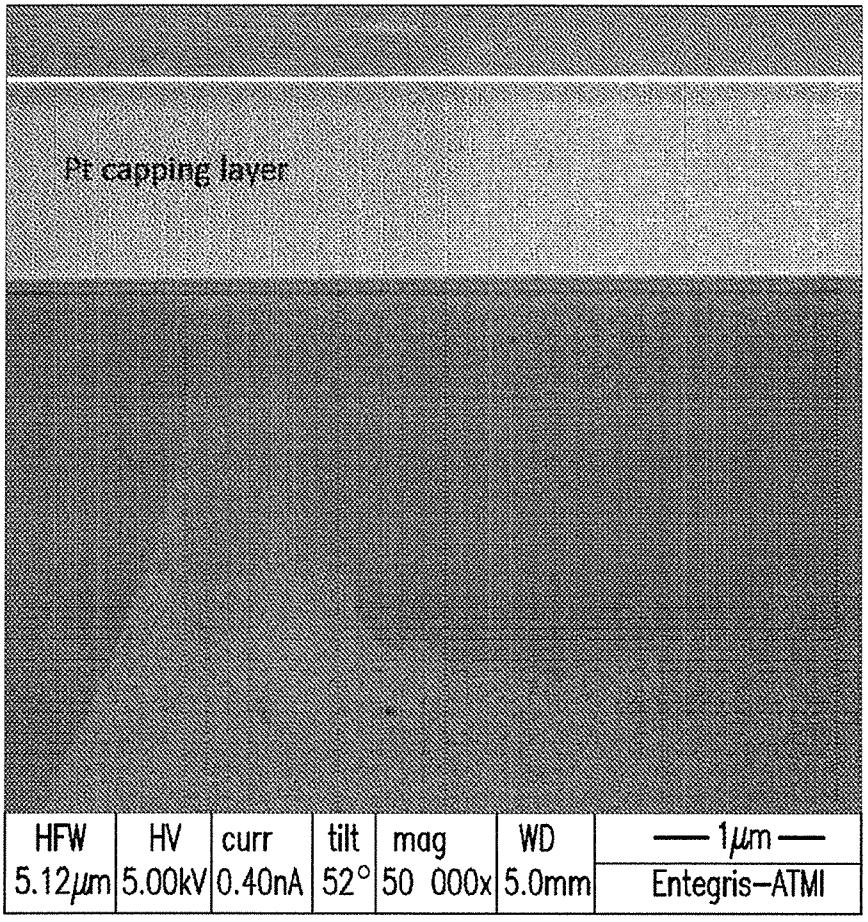
Pt capping layer
HFW
5.12μm
HV
5.00kV
curr
0.40nA
tilt
52°
mag
50 000x
WD
5.0mm
1μm
Entegris–ATMI

FIG.7

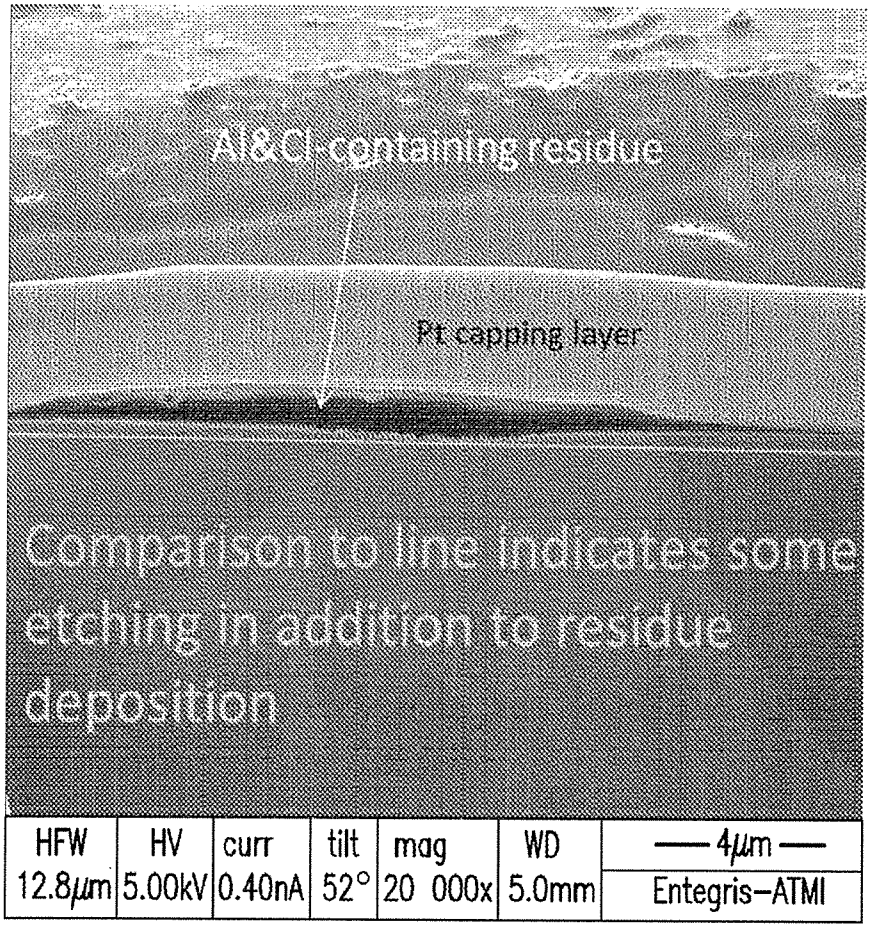
Al&Cl containing residue
Pt capping layer
Comparison to line indicates some etching in addition to residue deposition
HFW 12.8μm
HV 5.00kV
curr 0.40nA
tilt 52°
mag 20 000x
WD 5.0mm
4μm
Entegris–ATMI

FIG.8

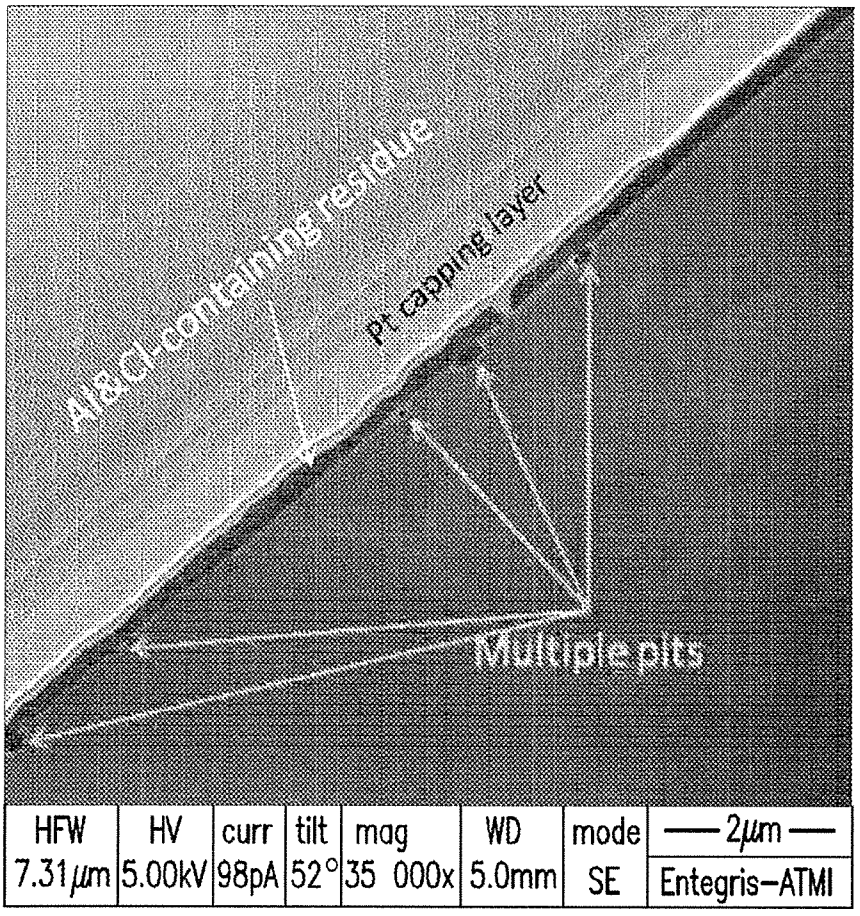
Al&Cl-containing residue
Pt capping layer
Multiple pits
HFW
7.31μm
HV
5.00kV
curr
98pA
tilt
52°
mag
35 000x
WD
5.0mm
mode
SE
2μm
Entegris–ATMI

FIG.9

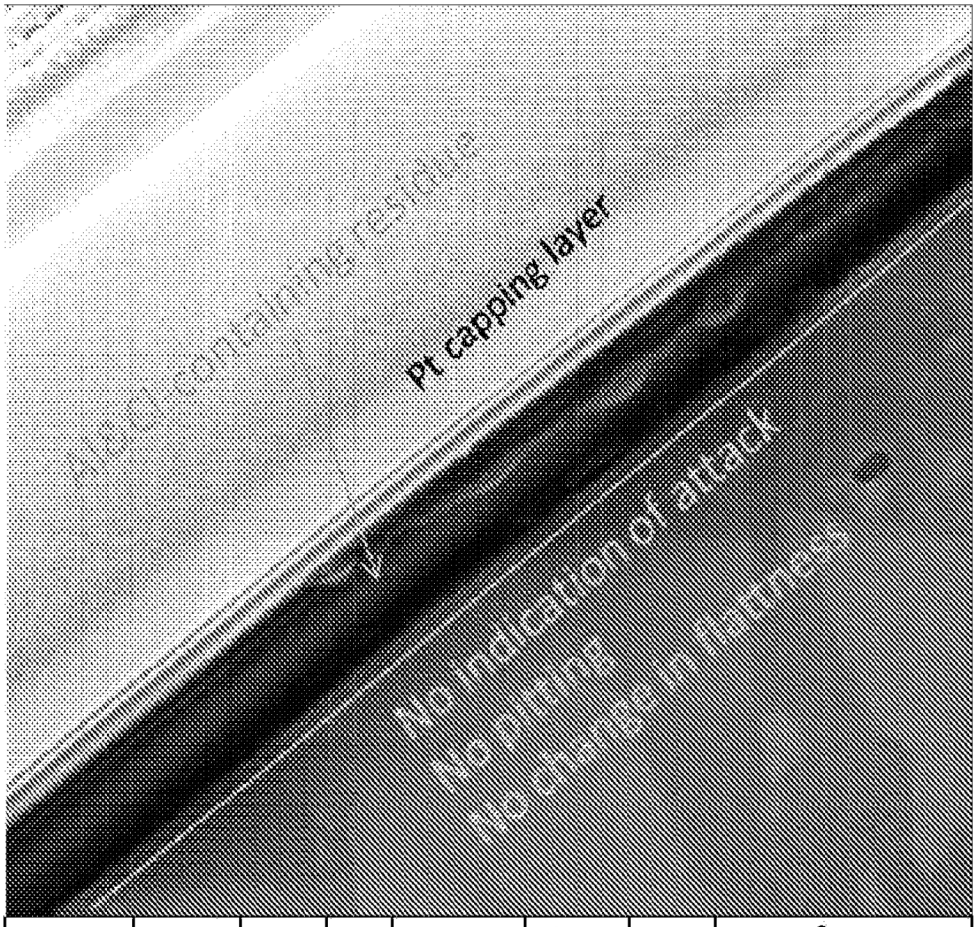
Pt capping layer
HFW
7.31μm
HV
5.00kV
curr
98pA
tilt
52°
mag
35 000x
WD
5.0mm
mode
SE
2μm
Entegris-ATMI

FIG. 10

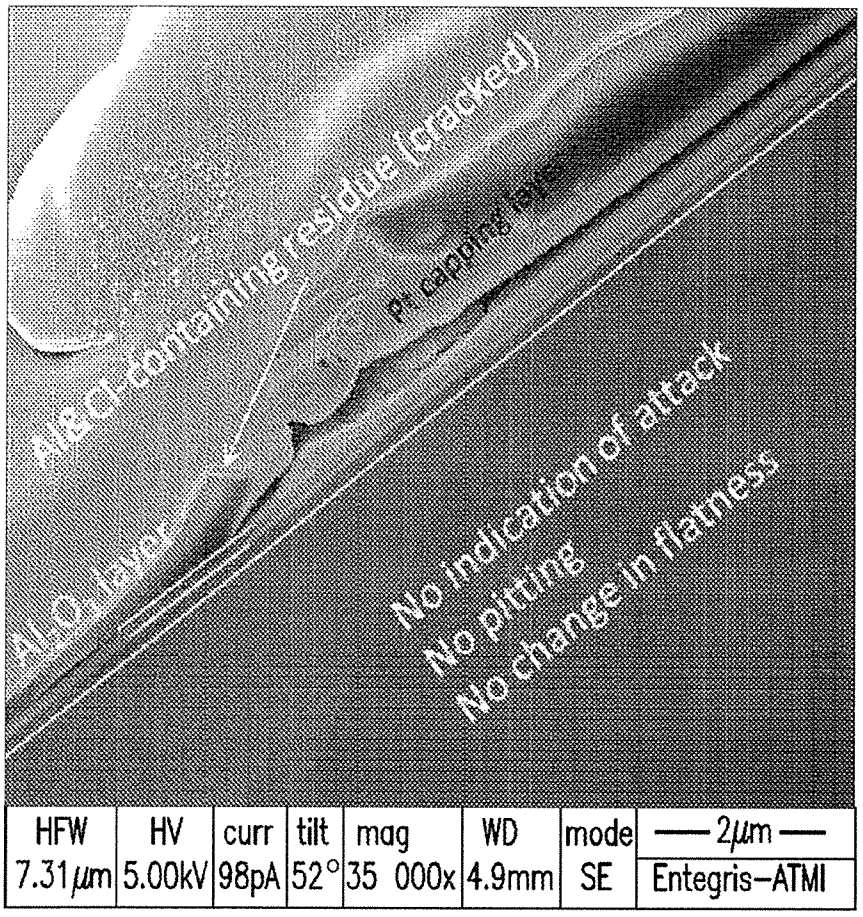
Al& Cl-containing residue (cracked)
Pt capping layer
Al_2O_3 layer
No indication of attack
No pitting
No change in flatness
HFW 7.31μm
HV 5.00kV
curr 98pA
tilt 52°
mag 35 000x
WD 4.9mm
mode SE
2μm
Entegris-ATMI

FIG.11

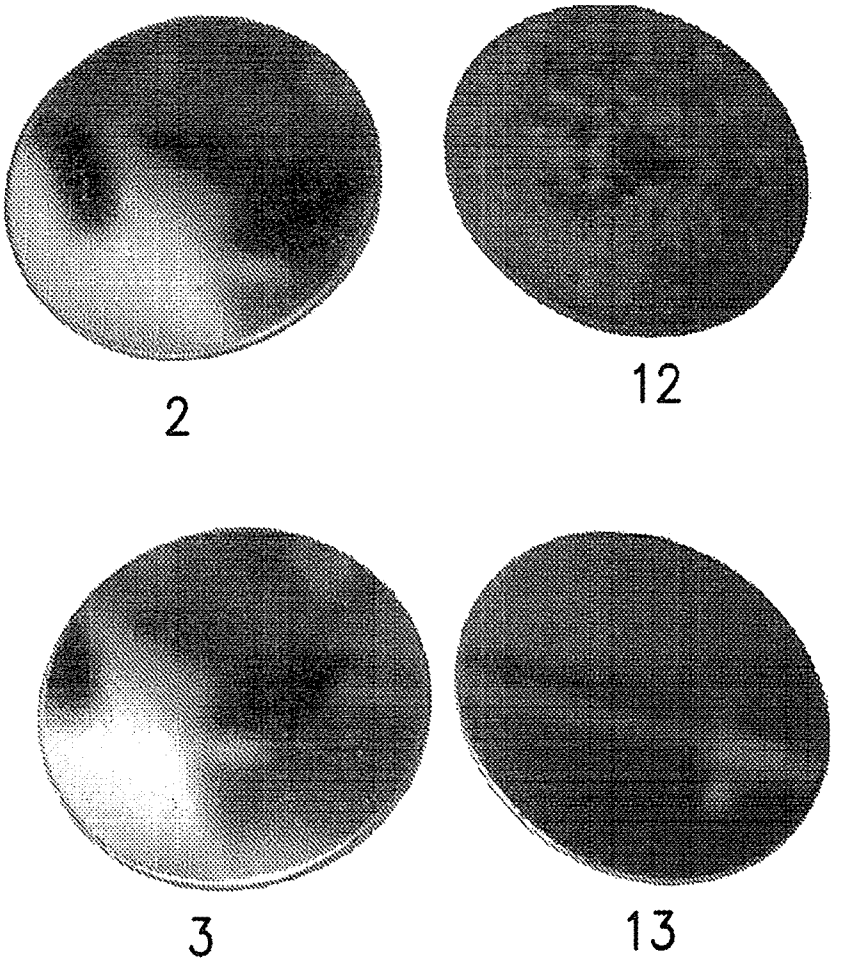

FIG.12

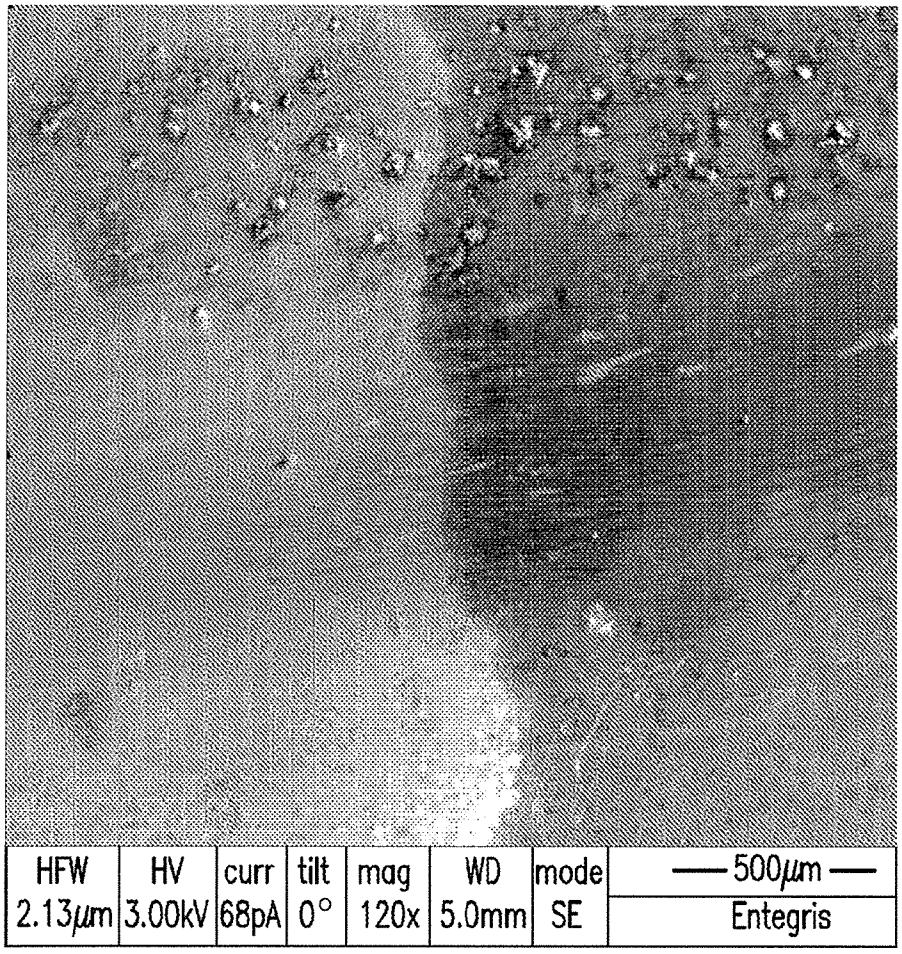
HFW
2.13μm
HV
3.00kV
curr
68pA
tilt
0°
mag
120x
WD
5.0mm
mode
SE
500μm
Entegris

FIG.13

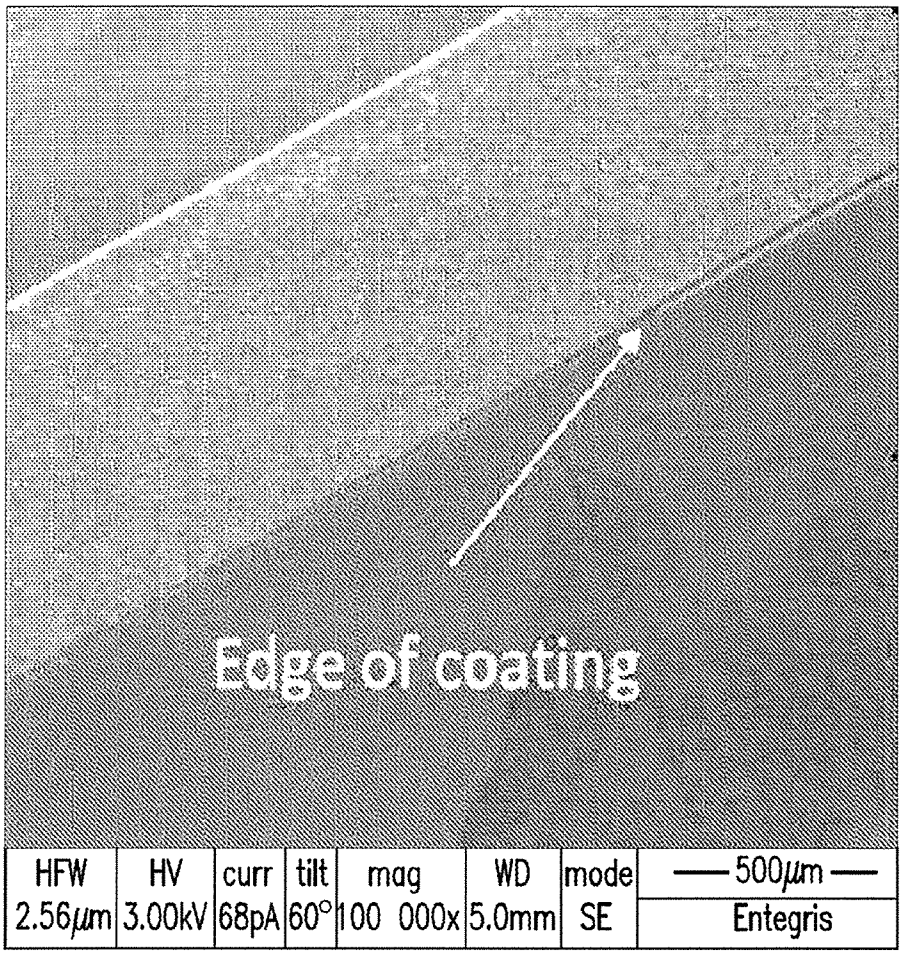
Edge of coating
HFW
2.56μm
HV
3.00kV
curr
68pA
tilt
60°
mag
100 000x
WD
5.0mm
mode
SE
500μm
Entegris

FIG.14

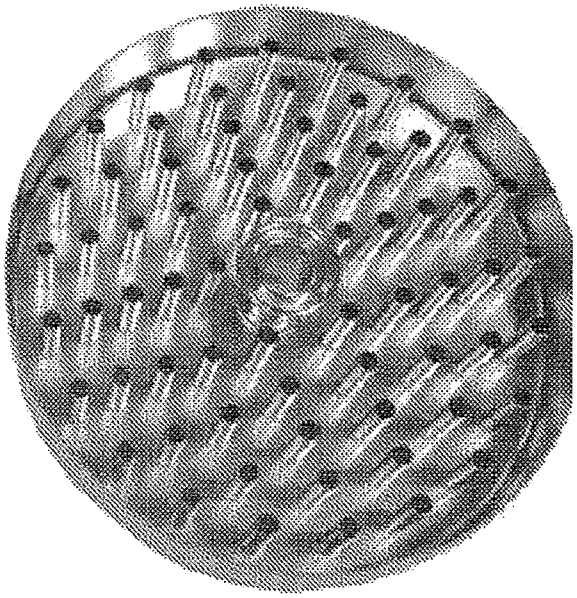

FIG.15

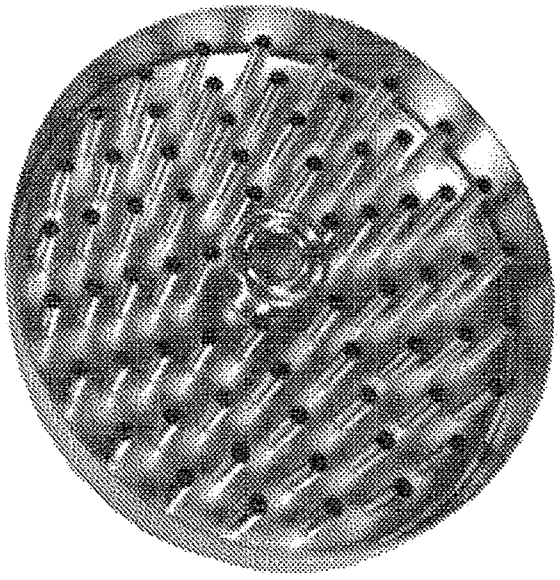

FIG.16

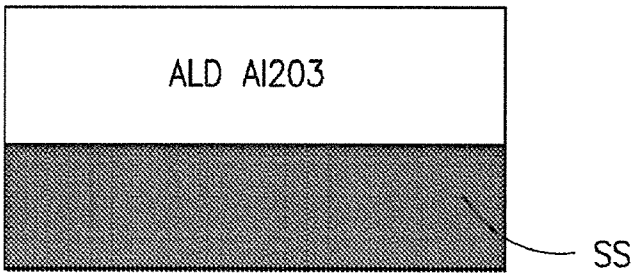

FIG.17

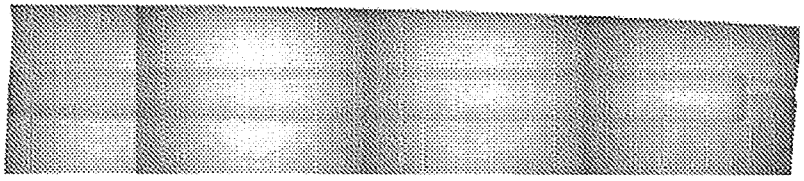

FIG.18

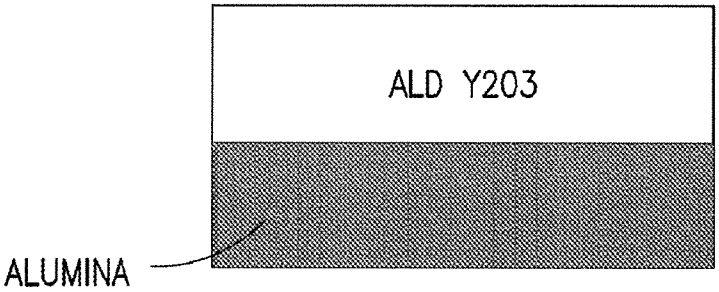

FIG.19

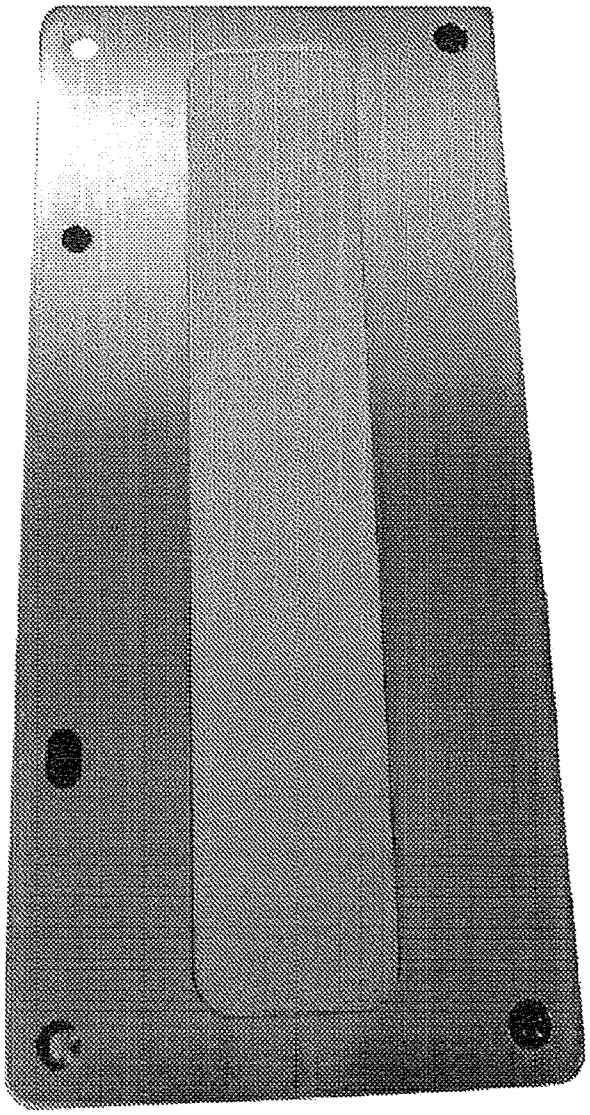

FIG.20

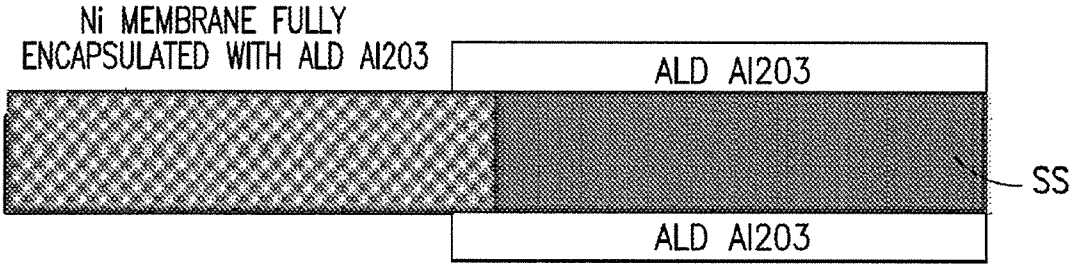
Ni MEMBRANE FULLY
ENCAPSULATED WITH ALD Al203
ALD Al203
SS
ALD Al203

FIG.21

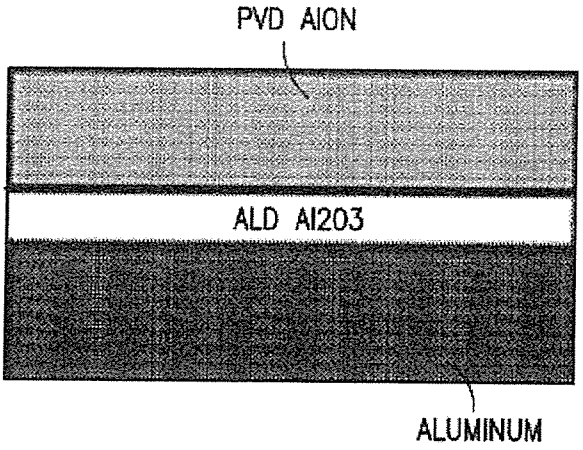

FIG.22

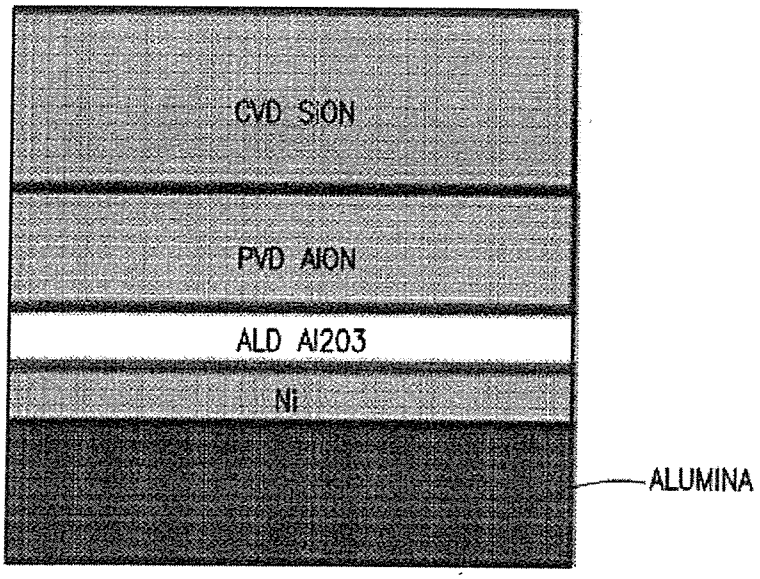

FIG.23

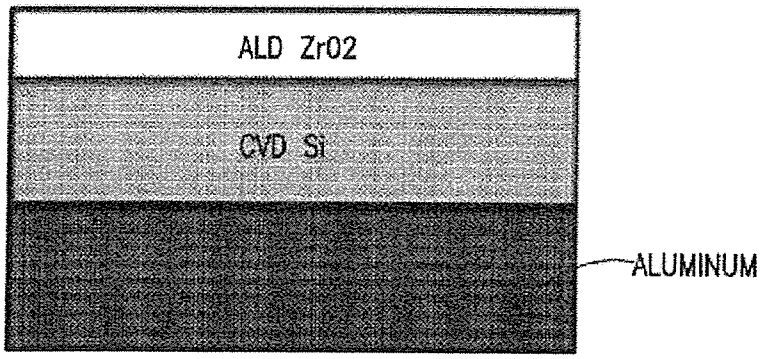

FIG.24

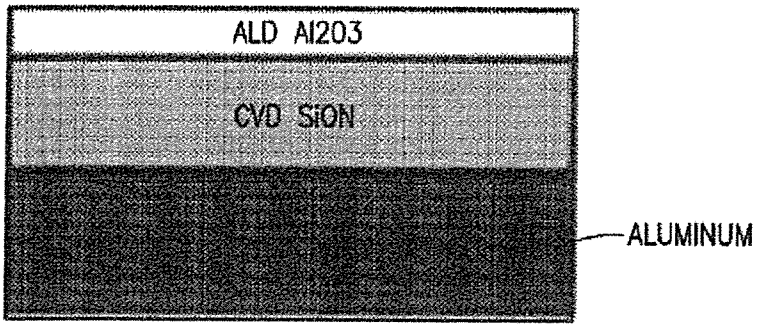

FIG.25

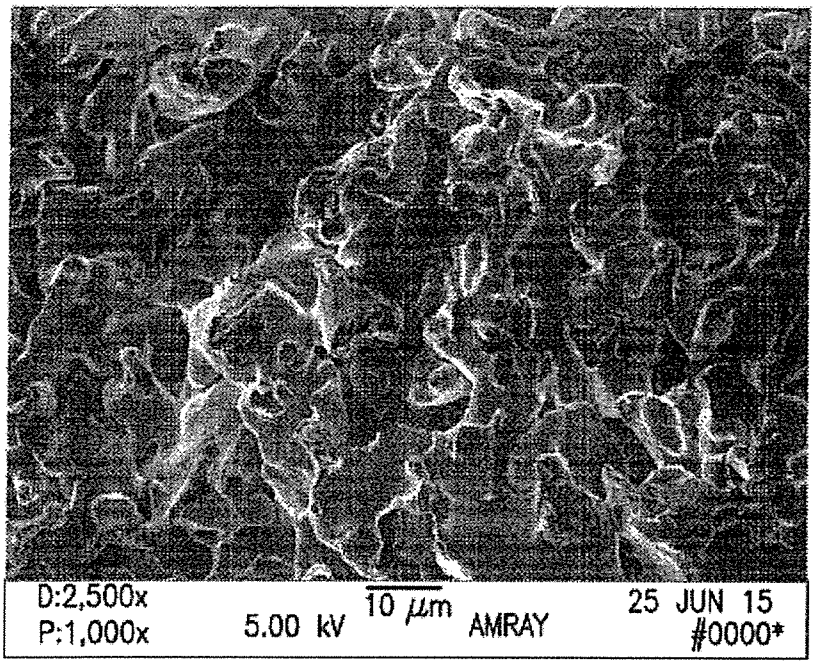

FIG.26

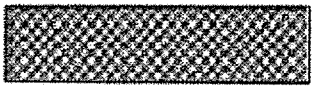

FIG.27

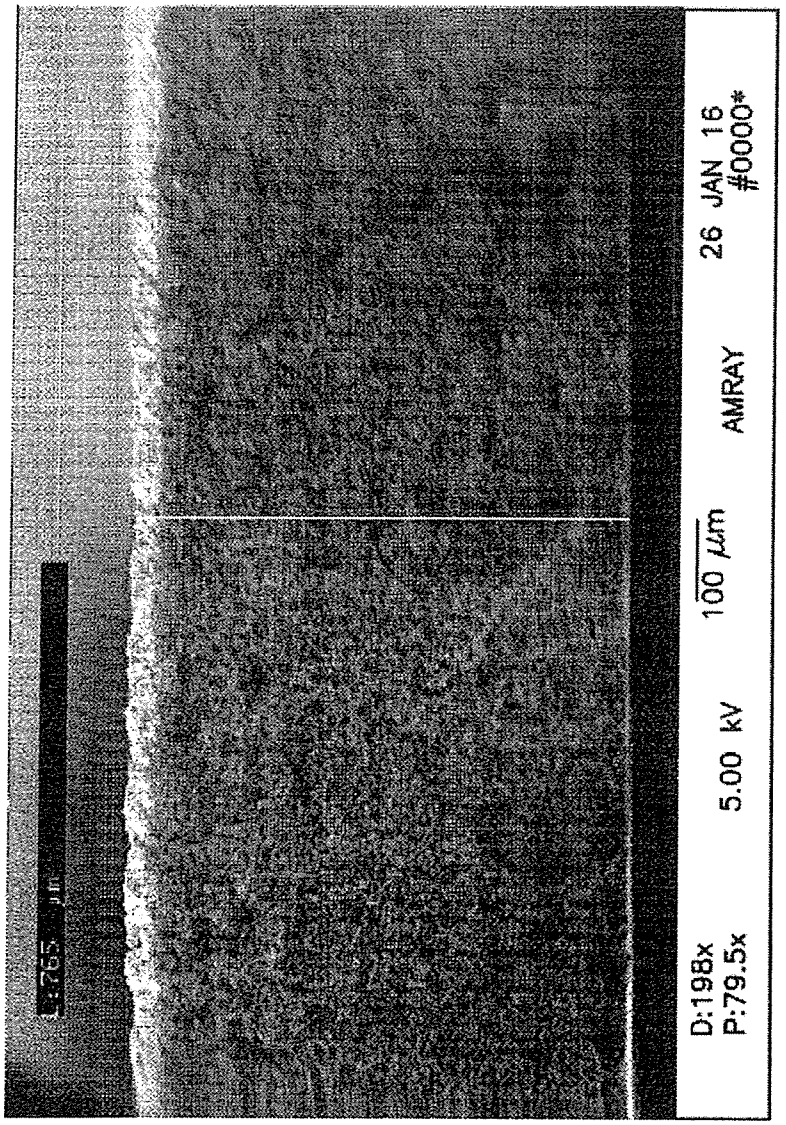

FIG.28

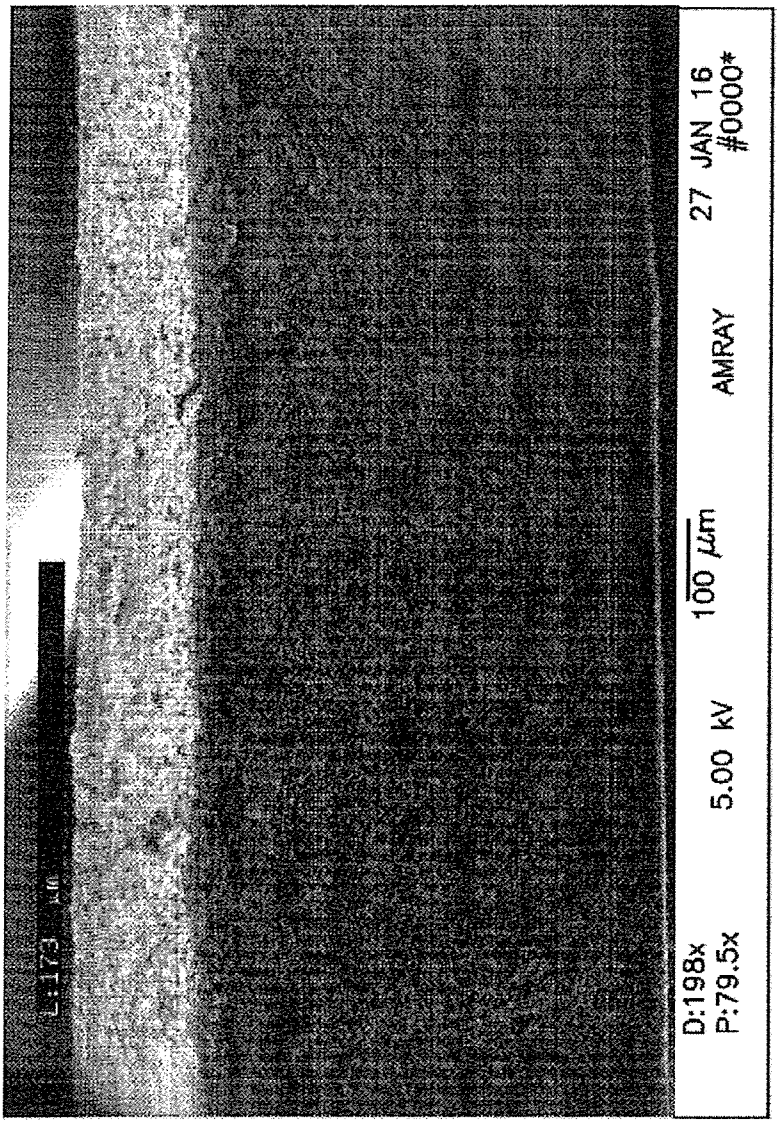

FIG.29