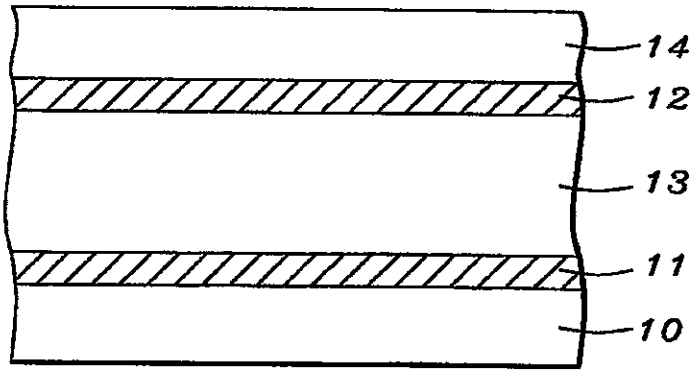



FIG. 1

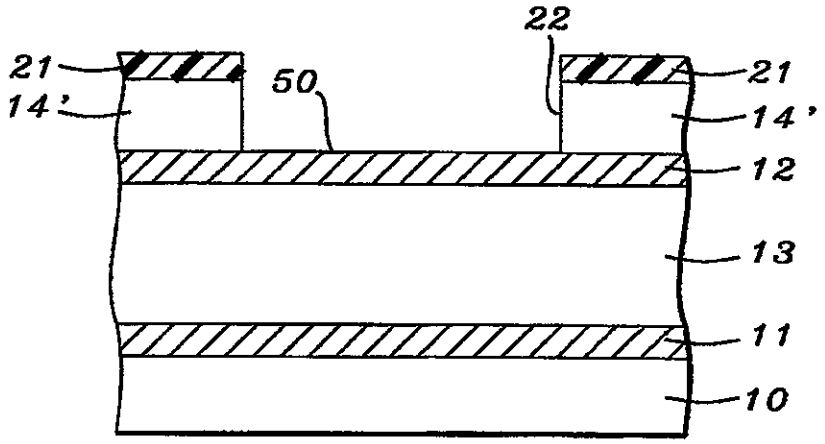



FIG. 2

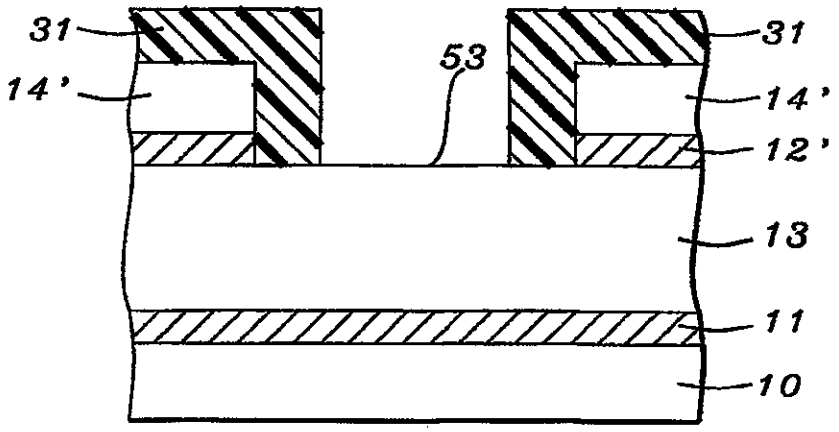



FIG. 3

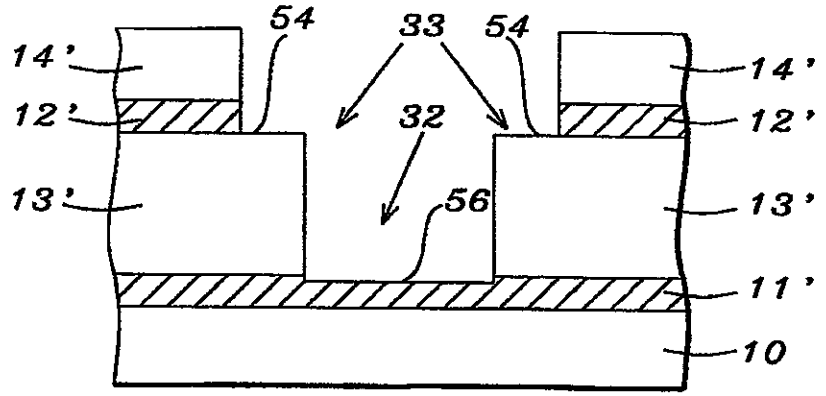



FIG. 4

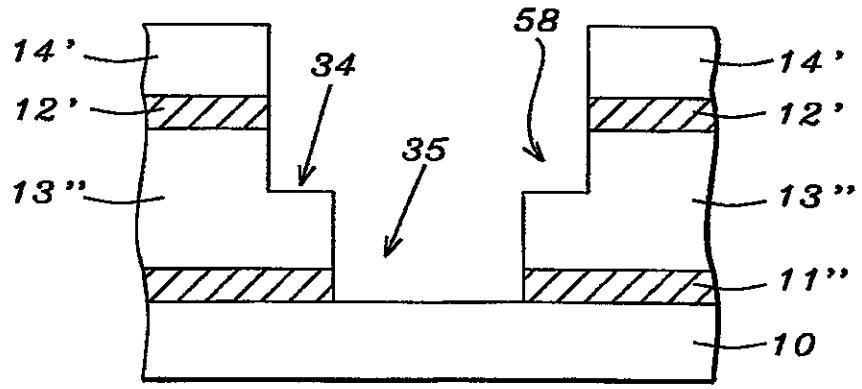



FIG. 5

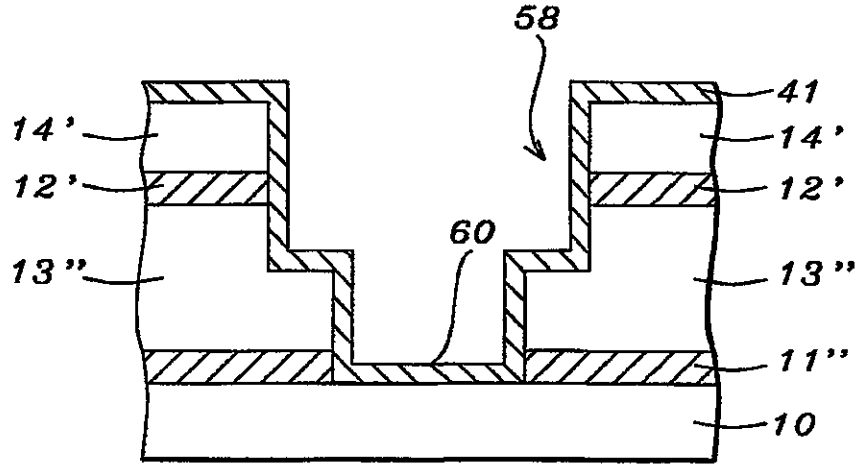



FIG. 6

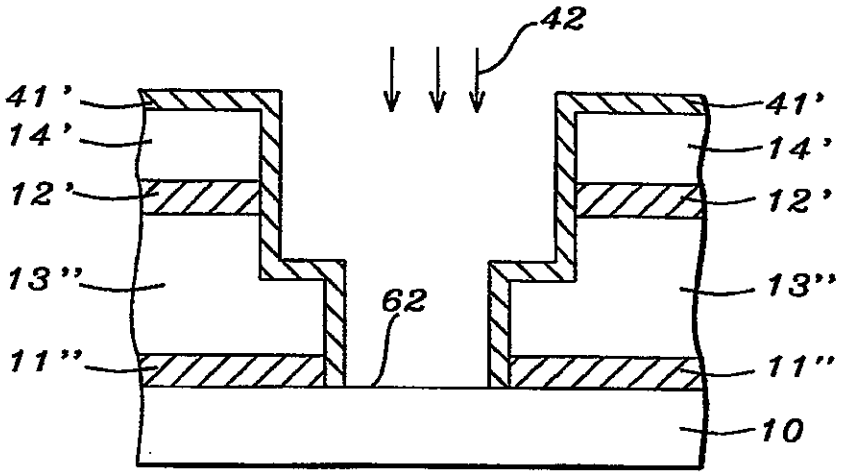

42
41'
14'
12'
13''
62
11''
41'
14'
12'
13''
11''
10

FIG. 7

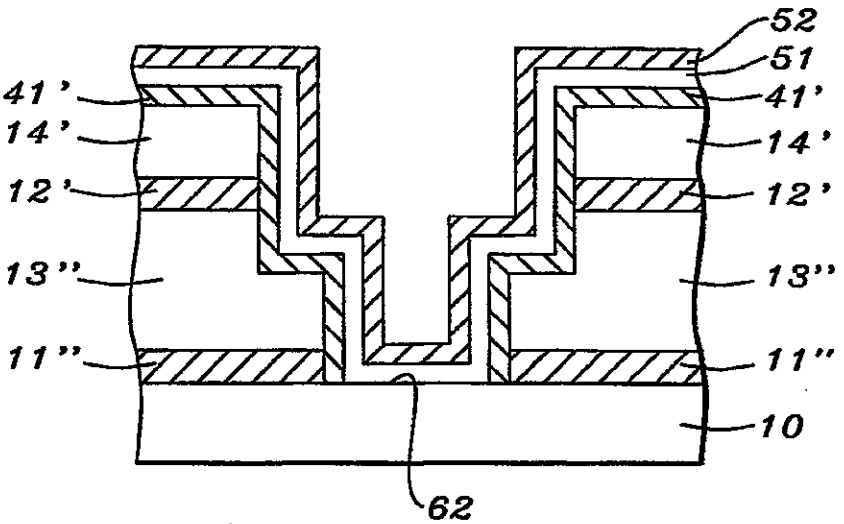

52
51
41'
14'
12'
13''
11''
41'
14'
12'
13''
11''
10
62

FIG. 8

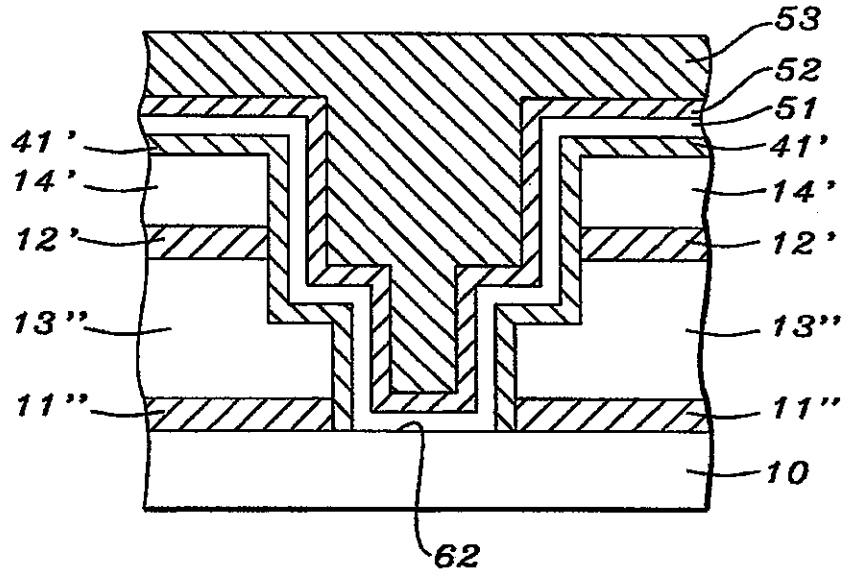

53
52
51
41'
41'
14'
14'
12'
12'
13''
13''
11''
11''
10
62

FIG. 9

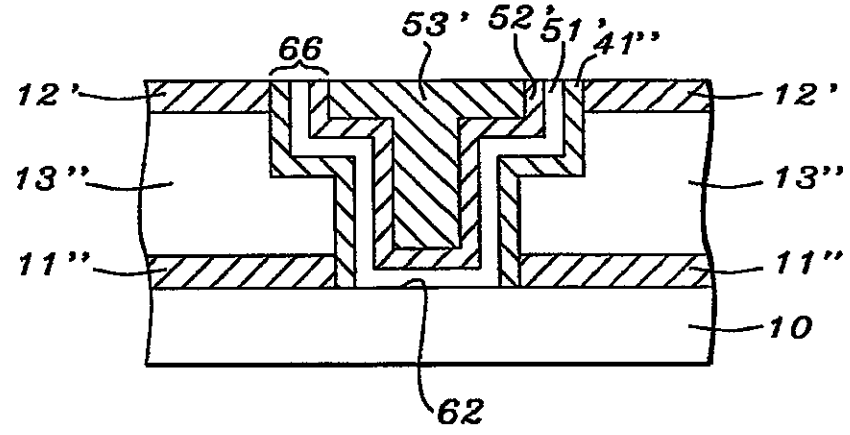

66
53'
52'
51'
41''
12'
12'
13''
13''
11''
11''
10
62

FIG. 10

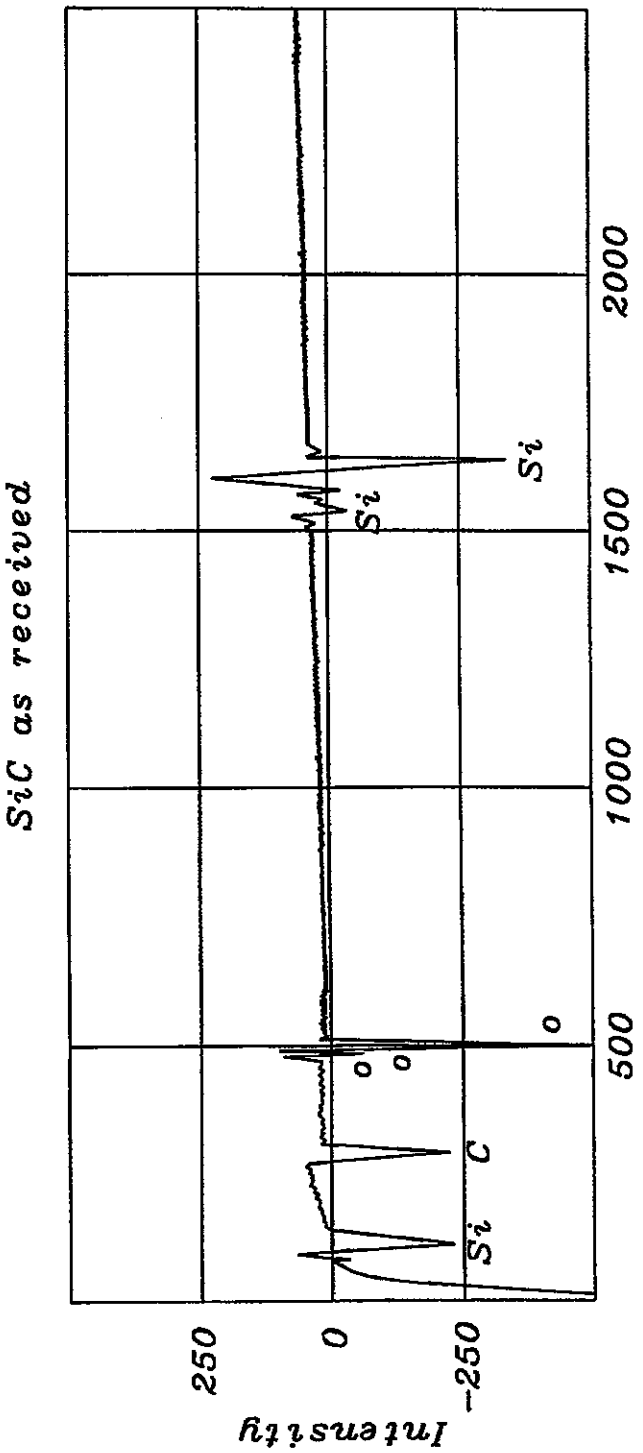

SiC as received
Intensity
250
0
-250
500
1000
1500
2000
Si
Si
Si
C
O
O
O

FIG. 11a

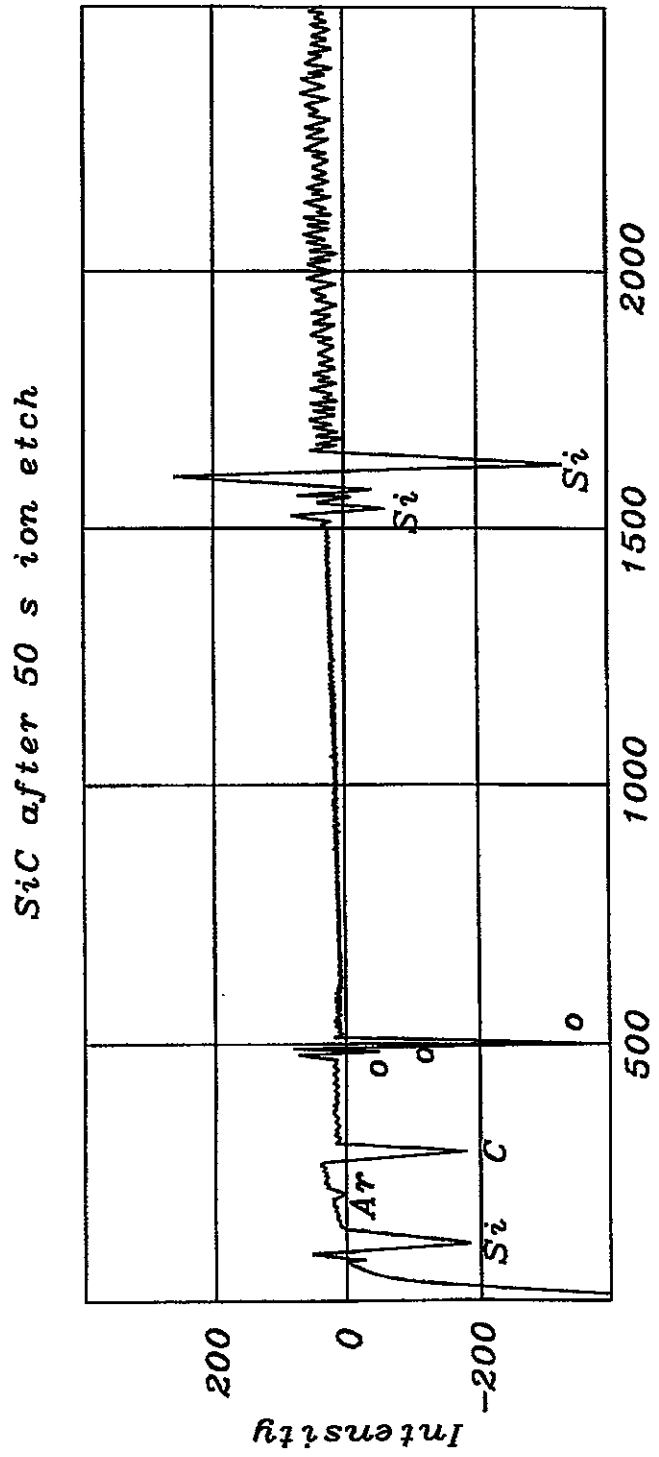

SiC after 50 s ion etch
Intensity
200
0
-200
500
1000
1500
2000
Si
Si
Si
O
O
O
Ar
Si
C

FIG. 11b

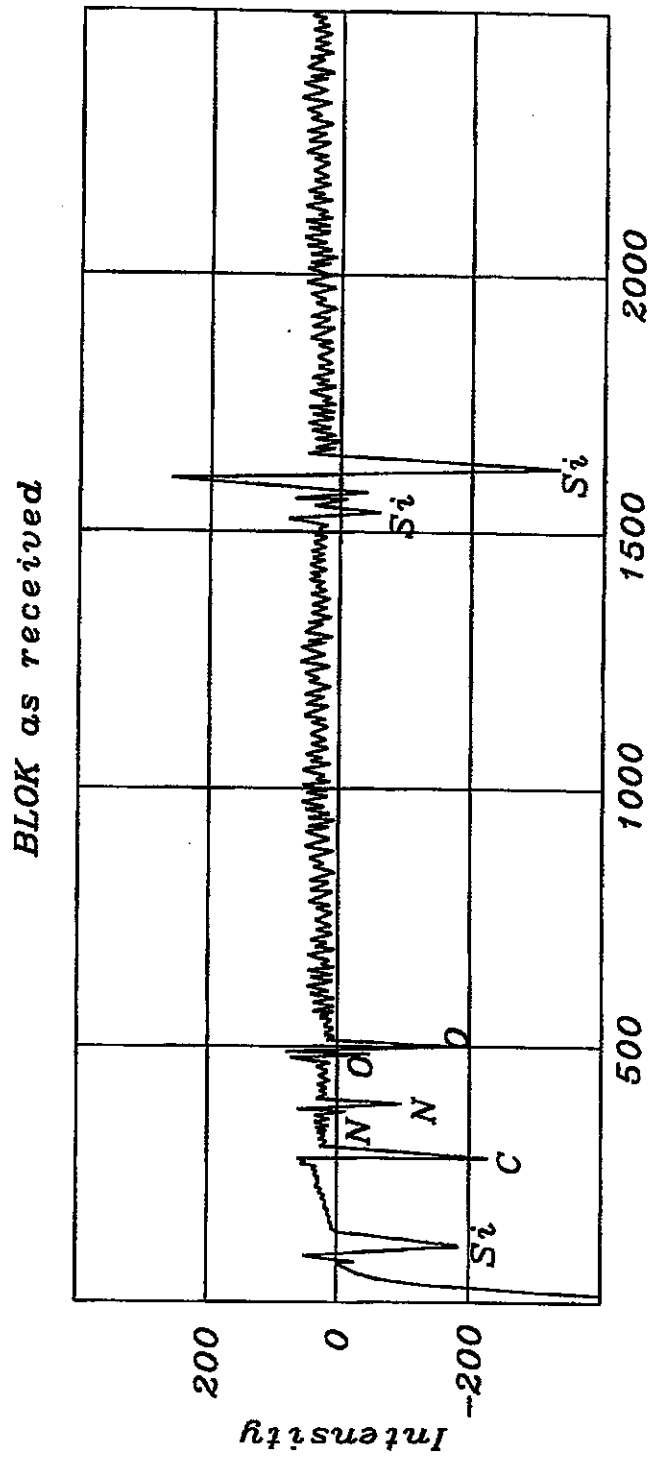

BLOK as received
Intensity
200
0
-200
500
1000
1500
2000
Si
Si
Si
C
N
N
O
O

FIG. 12a

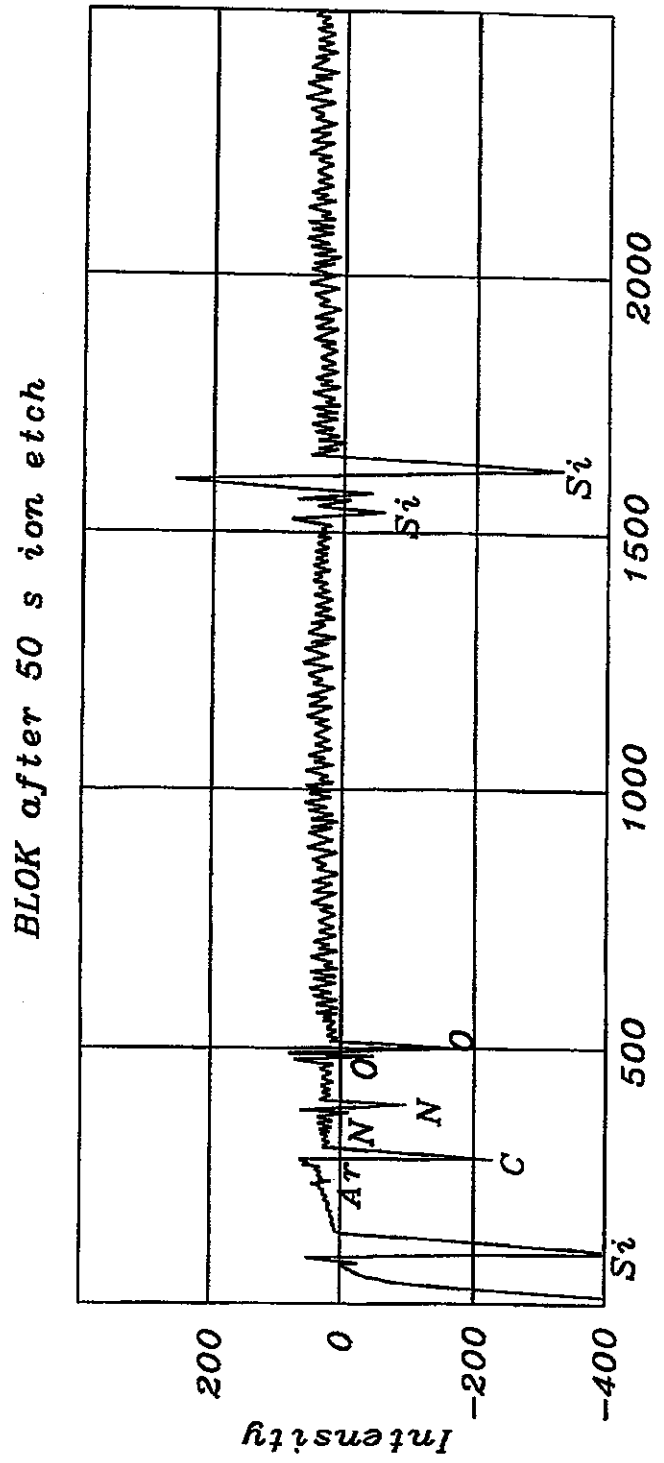

BLOK after 50 s ion etch
Intensity
200
0
-200
-400
500
1000
1500
2000
Si
Si
Si
O
O
N
N
C
Al

FIG. 12b

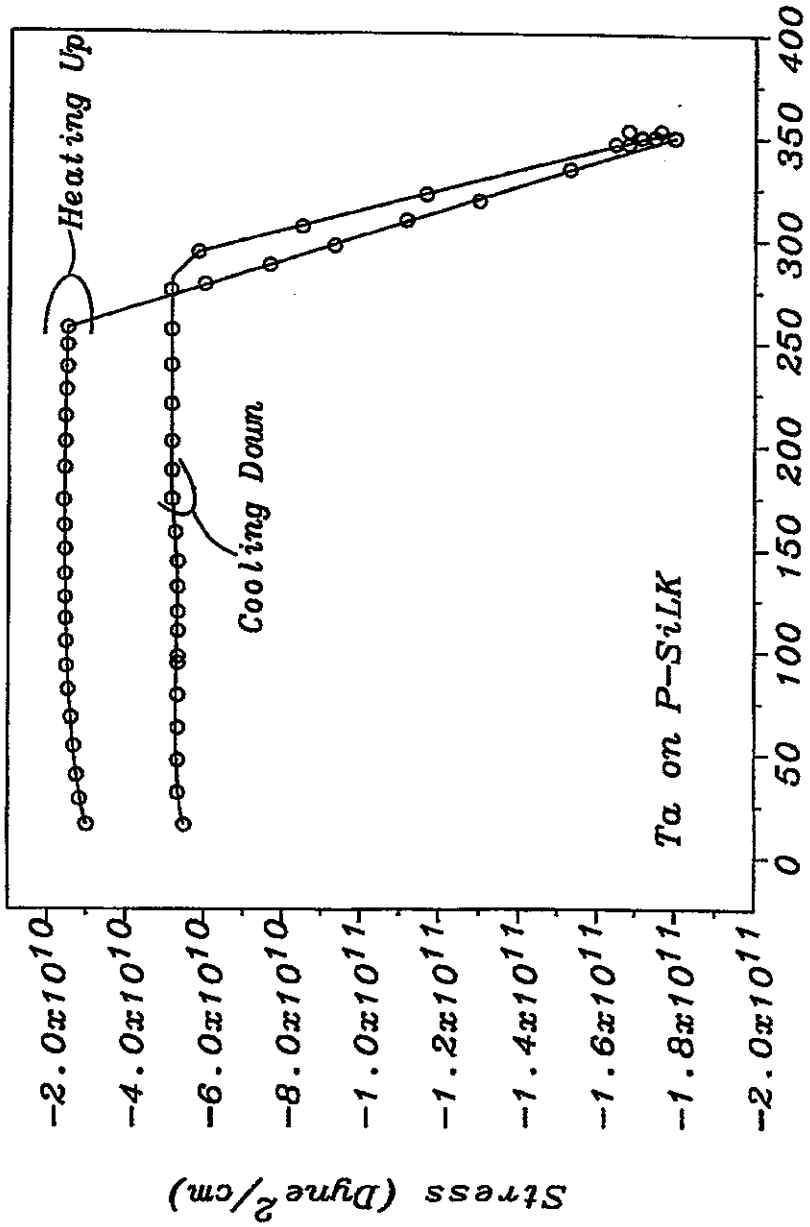

Heating Up
Cooling Down
Ta on P-SiLK
Stress (Dyne/cm²)
-2.0x10¹⁰
-4.0x10¹⁰
-6.0x10¹⁰
-8.0x10¹⁰
-1.0x10¹¹
-1.2x10¹¹
-1.4x10¹¹
-1.6x10¹¹
-1.8x10¹¹
-2.0x10¹¹
0
50
100
150
200
250
300
350
400
Temperature (°C)

FIG. 13

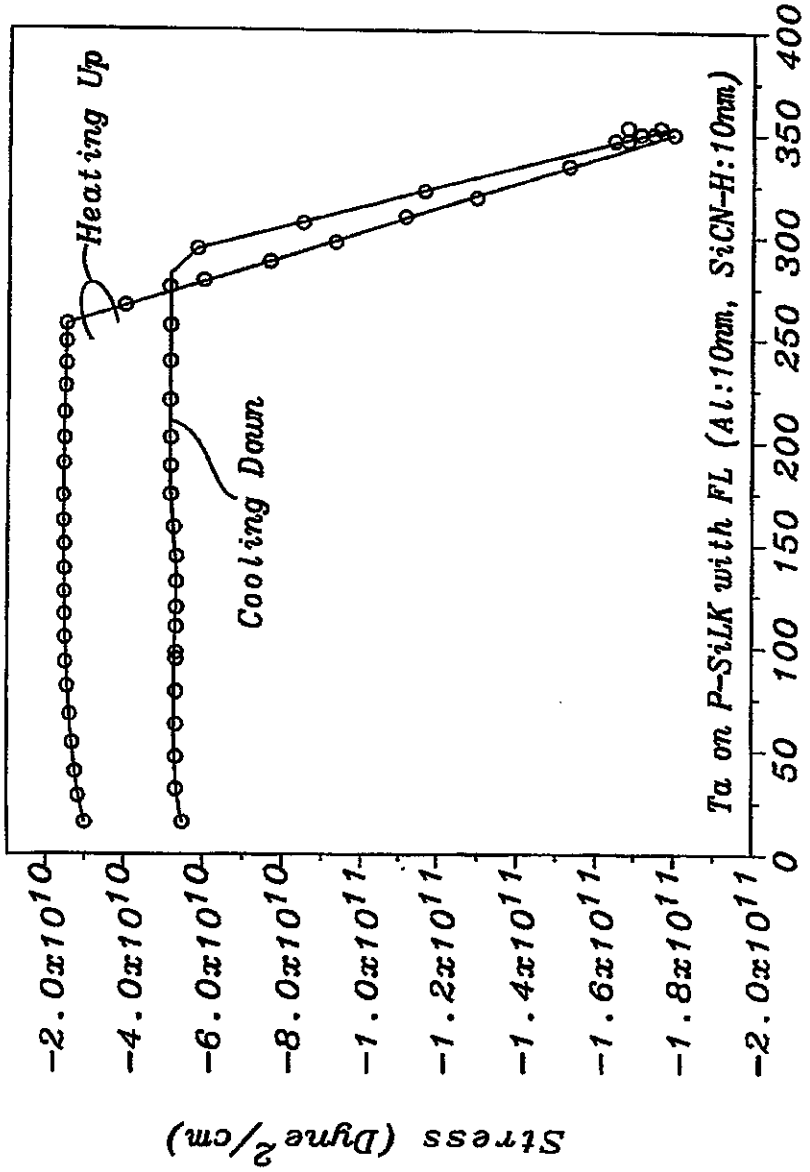

Heating Up
Cooling Down
Ta on P-SiLK with FL (Al:10nm, SiCN-H:10nm)
Temperature (°C)
Stress (Dyne/cm²)
0
50
100
150
200
250
300
350
400
-2.0x10¹⁰
-4.0x10¹⁰
-6.0x10¹⁰
-8.0x10¹⁰
-1.0x10¹¹
-1.2x10¹¹
-1.4x10¹¹
-1.6x10¹¹
-1.8x10¹¹
-2.0x10¹¹

FIG. 14

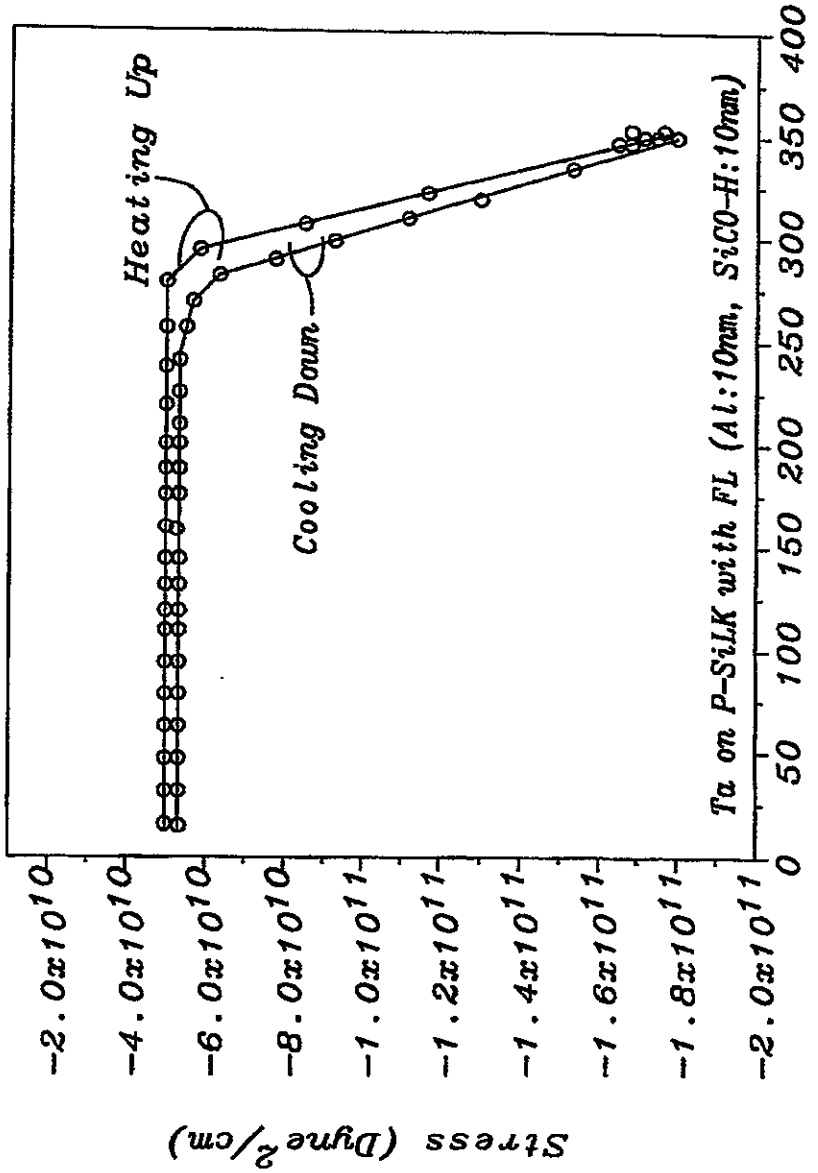

Heating Up
Cooling Down
Ta on P-SiLK with FL (Al:10nm, SiCO-H:10nm)
Temperature (°C)
Stress (Dyne/cm²)
0
50
100
150
200
250
300
350
400
-2.0x10¹⁰
-4.0x10¹⁰
-6.0x10¹⁰
-8.0x10¹⁰
-1.0x10¹¹
-1.2x10¹¹
-1.4x10¹¹
-1.6x10¹¹
-1.8x10¹¹
-2.0x10¹¹

FIG. 15

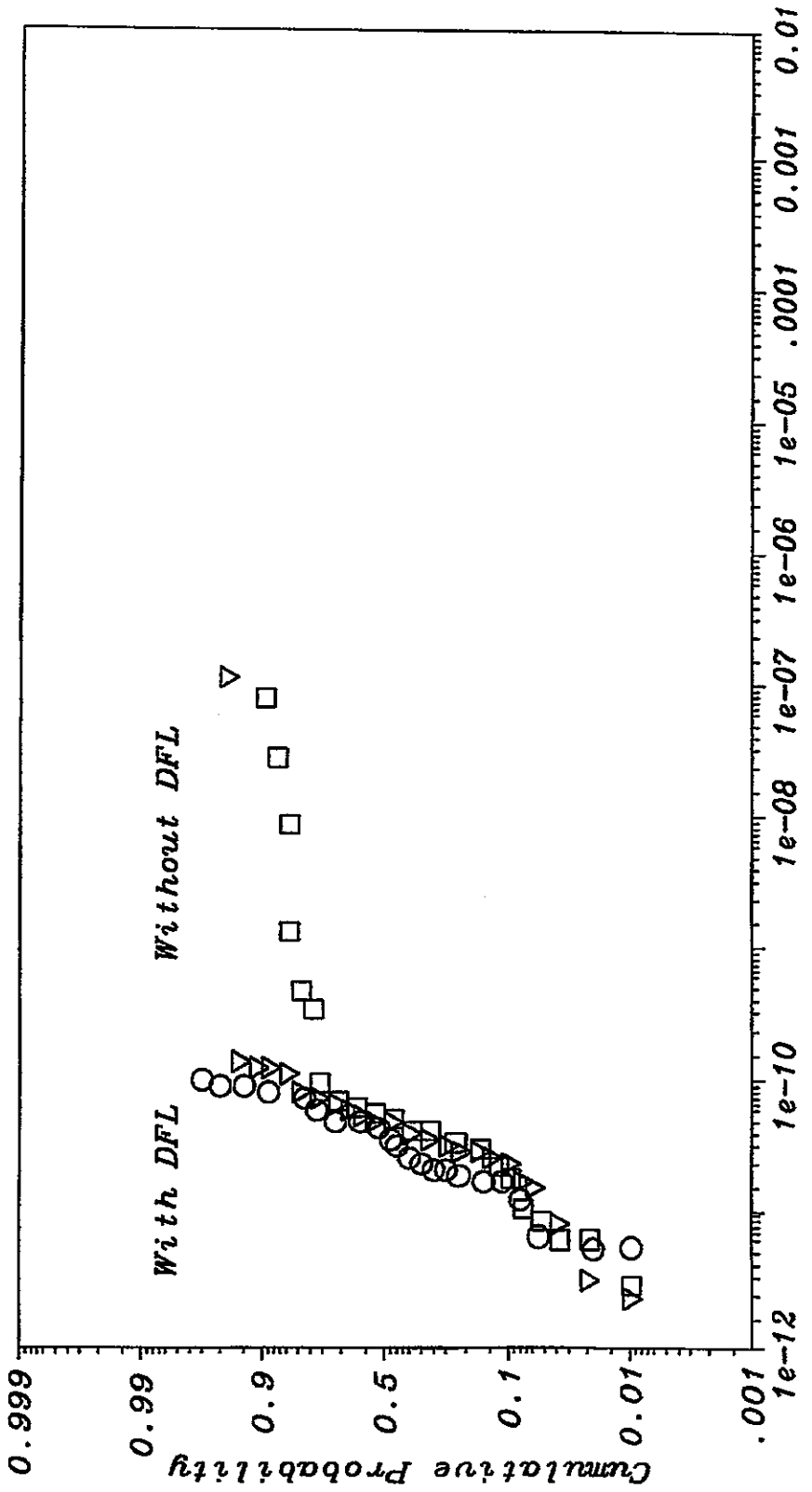

Cumulative Probability
0.999
0.99
0.9
0.5
0.1
0.01
.001
With DFL
Without DFL
1e-12
1e-10
1e-08
1e-07
1e-06
1e-05
.0001
0.001
0.01
Leakage Current (A)

FIG. 16

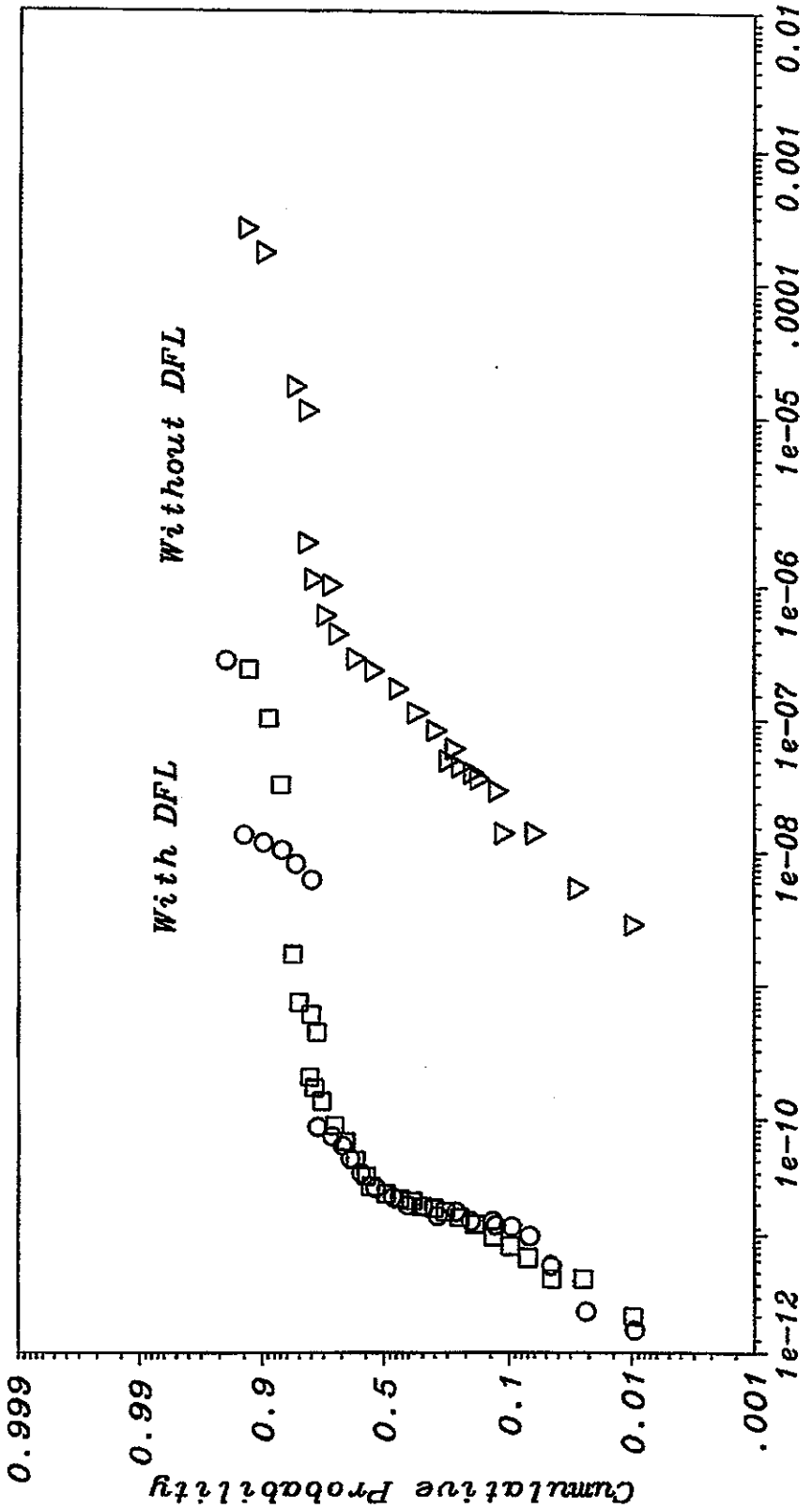

Without DFL
With DFL
Cumulative Probability
0.999
0.99
0.9
0.5
0.1
0.01
.001
1e-12
1e-10
1e-08
1e-07
1e-06
1e-05
.0001
0.001
0.01
Leakage Current (A)

FIG. 17

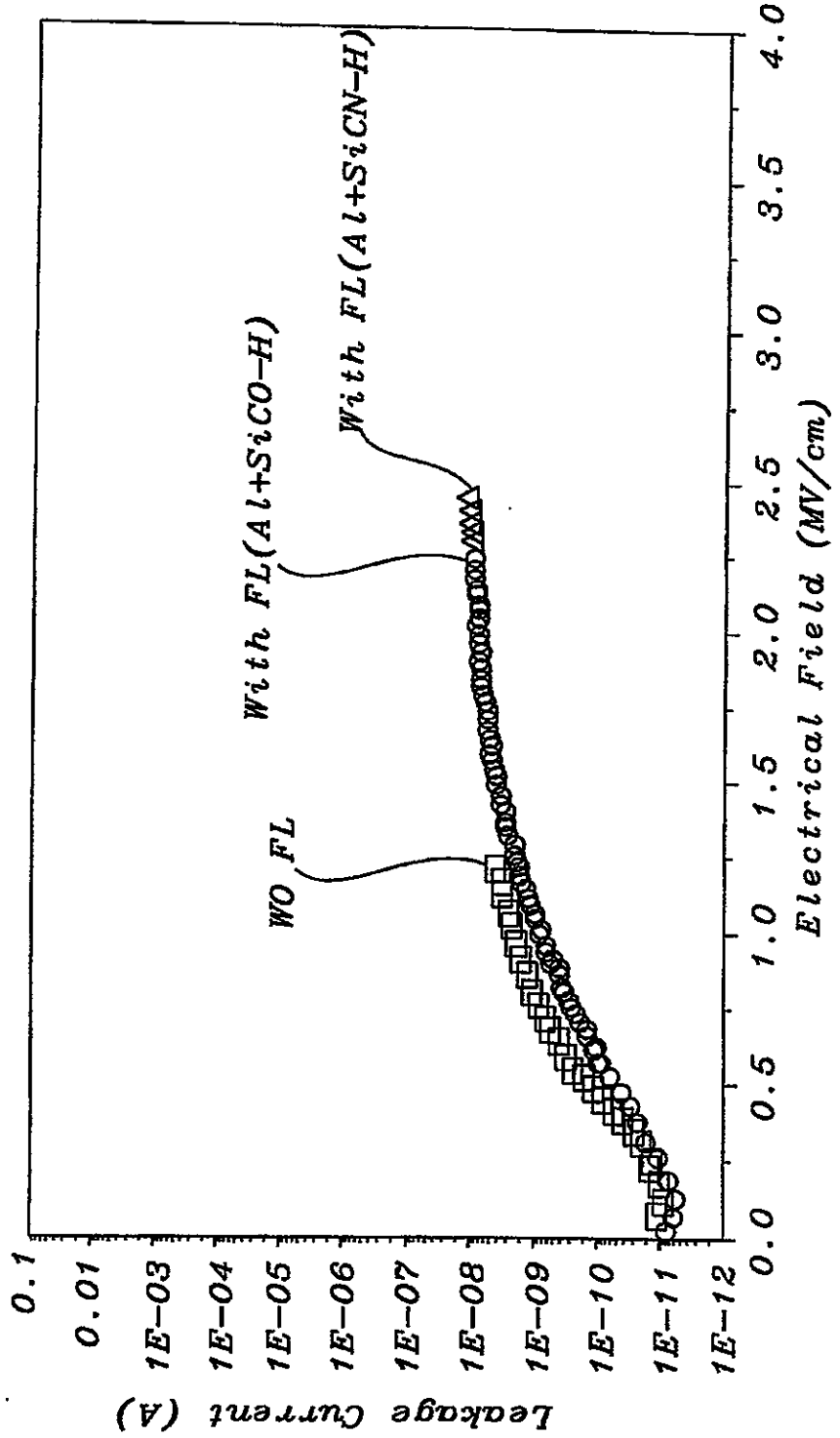

Leakage Current (A)
0.1
0.01
1E-03
1E-04
1E-05
1E-06
1E-07
1E-08
1E-09
1E-10
1E-11
1E-12
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Electrical Field (MV/cm)
WO FL
With FL(Al+SiCO-H)
With FL(Al+SiCN-H)

FIG. 18

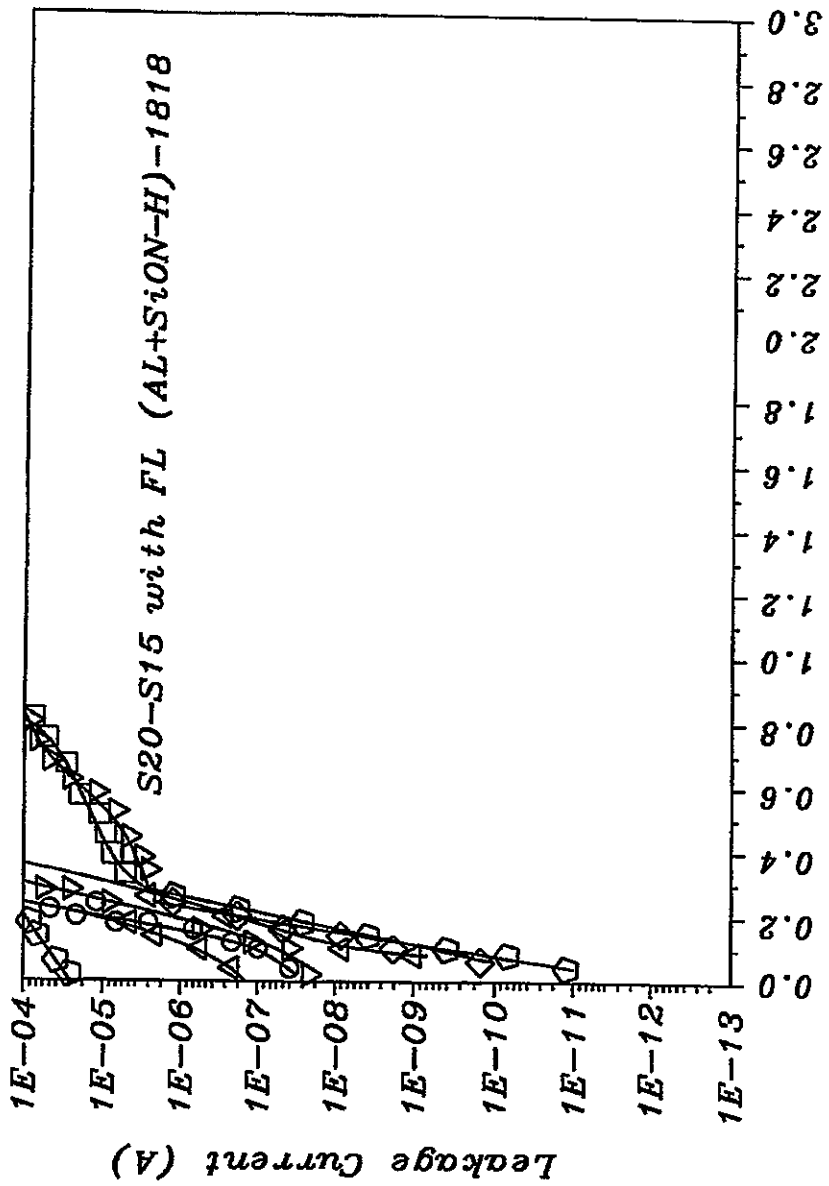

S20-S15 with FL (AL+SiON-H)-1818
Leakage Current (A)
1E-04
1E-05
1E-06
1E-07
1E-08
1E-09
1E-10
1E-11
1E-12
1E-13
Electrical Field (MV/cm)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0

FIG. 19

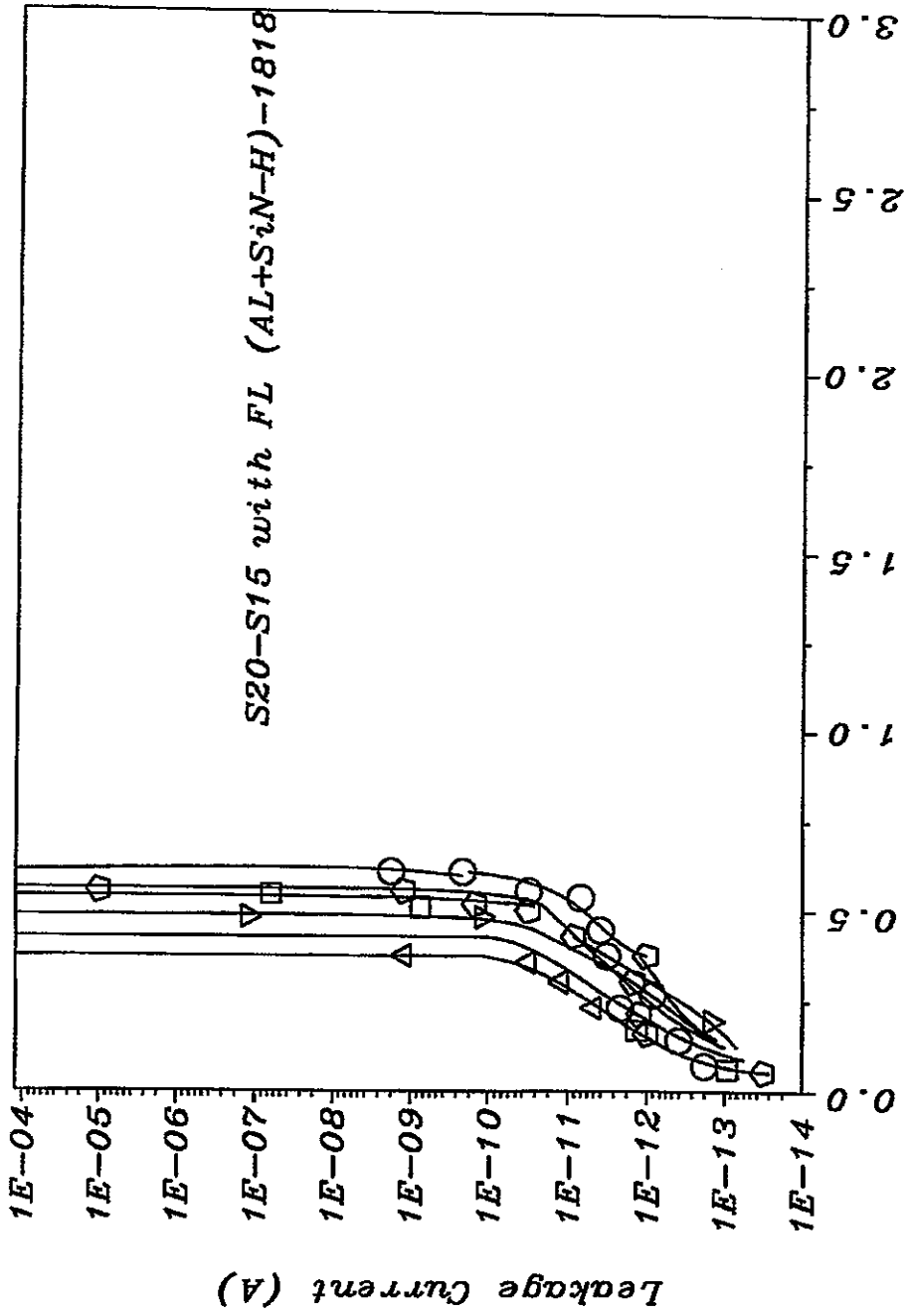

S20-S15 with FL (AL+SiN-H)-1818
Leakage Current (A)
1E-04
1E-05
1E-06
1E-07
1E-08
1E-09
1E-10
1E-11
1E-12
1E-13
1E-14
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Electrical Field (MV/cm)

FIG. 20

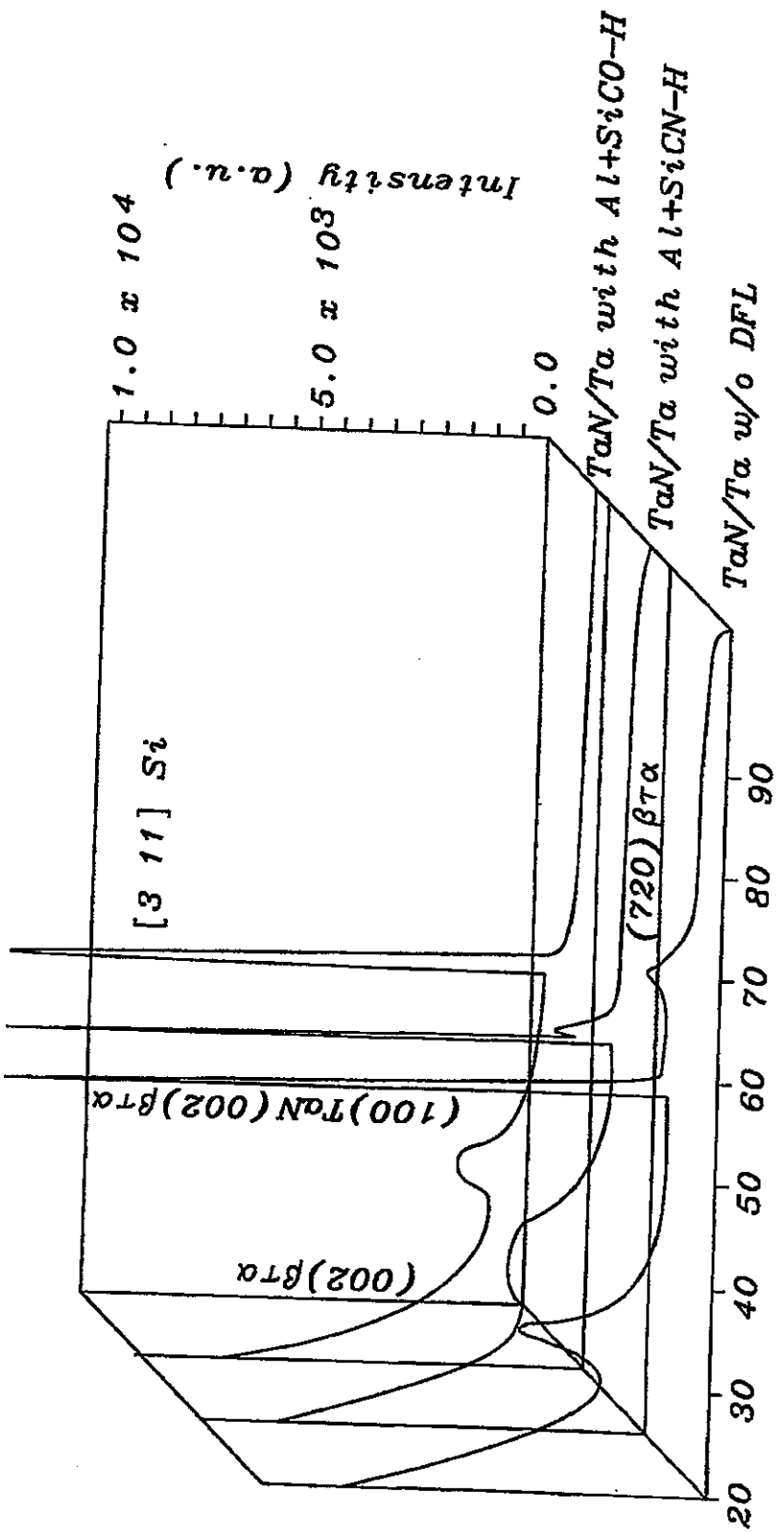

Intensity (a.u.)
1.0 x 10 4
5.0 x 10 3
0.0
TaN/Ta with Al+SiCO-H
TaN/Ta with Al+SiCN-H
TaN/Ta w/o DFL
[3 11] Si
(100)TaN (002)βTa
(002)βTa
(720) βTa
20
30
40
50
60
70
80
90
Angle (2Θ)

FIG. 21

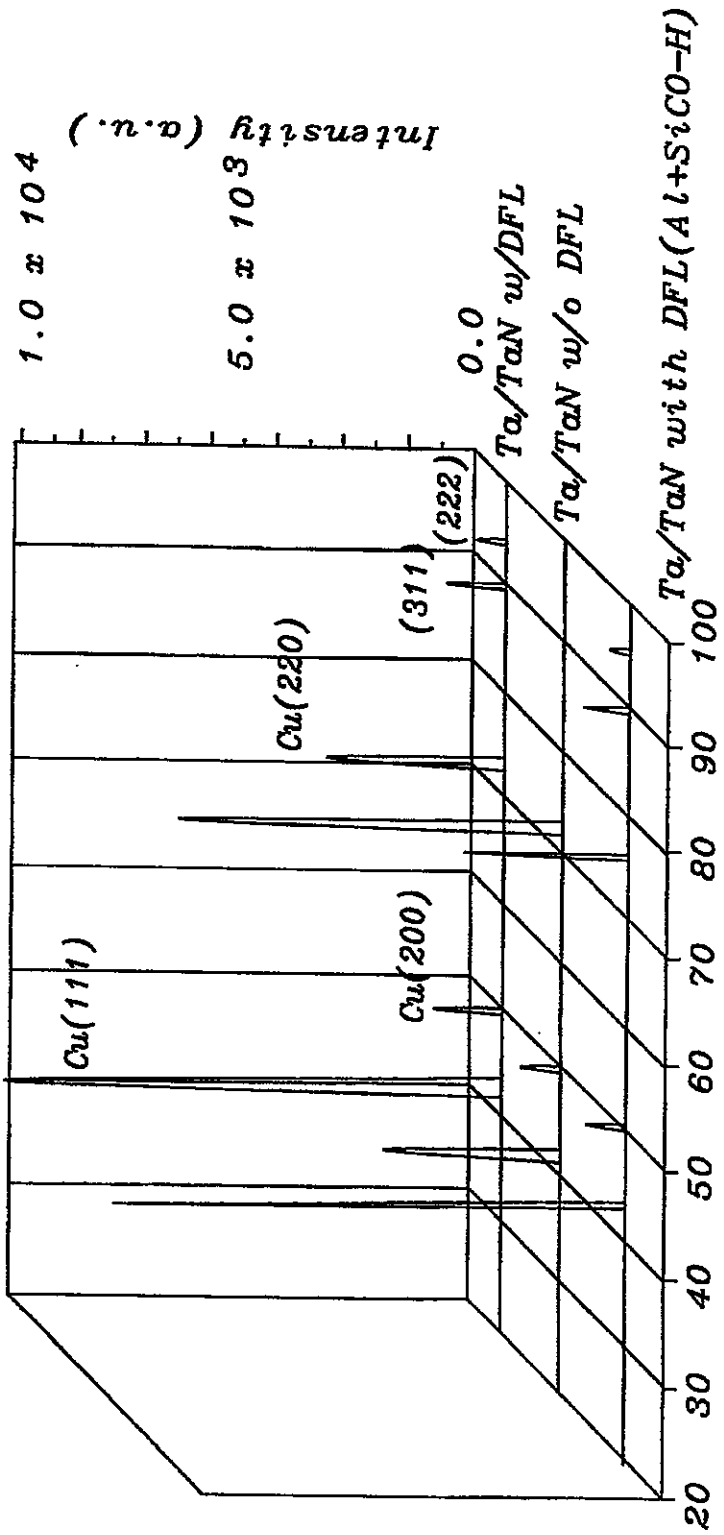

Intensity (a.u.)
1.0 x 10 4
5.0 x 10 3
0.0
Ta/TaN w/DFL
Ta/TaN w/o DFL
Ta/TaN with DFL(Al+SiCO-H)
Cu(111)
Cu(200)
Cu(220)
(311)
(222)
20
30
40
50
60
70
80
90
100
Angle (2θ)

FIG. 22