

Figure 1

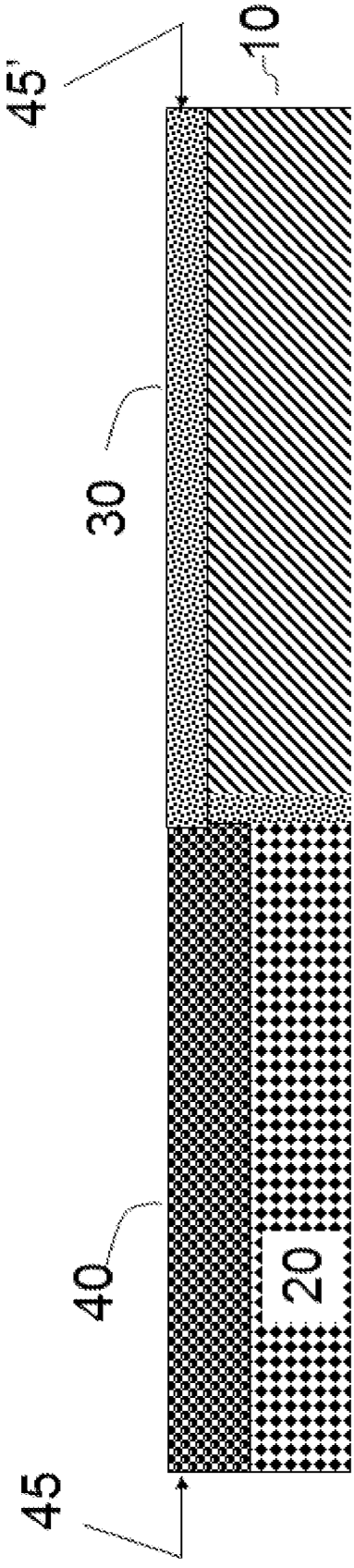


Figure 2

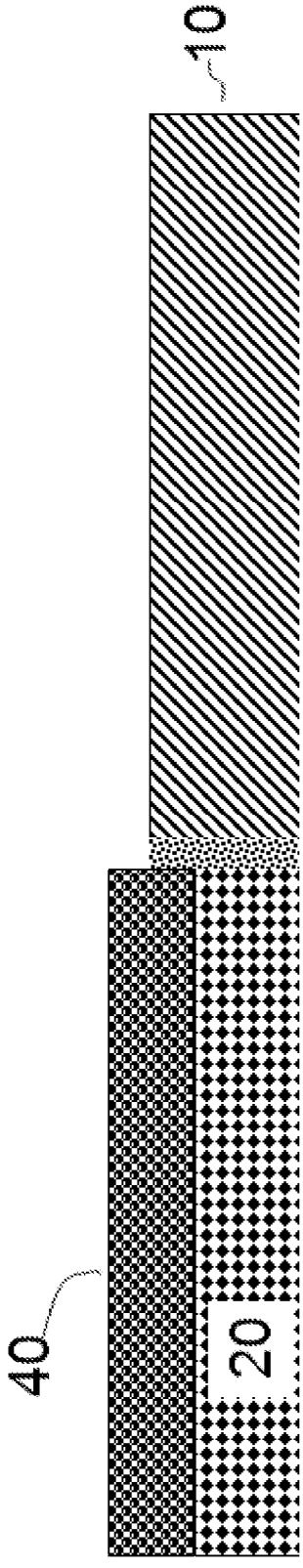


Figure 3

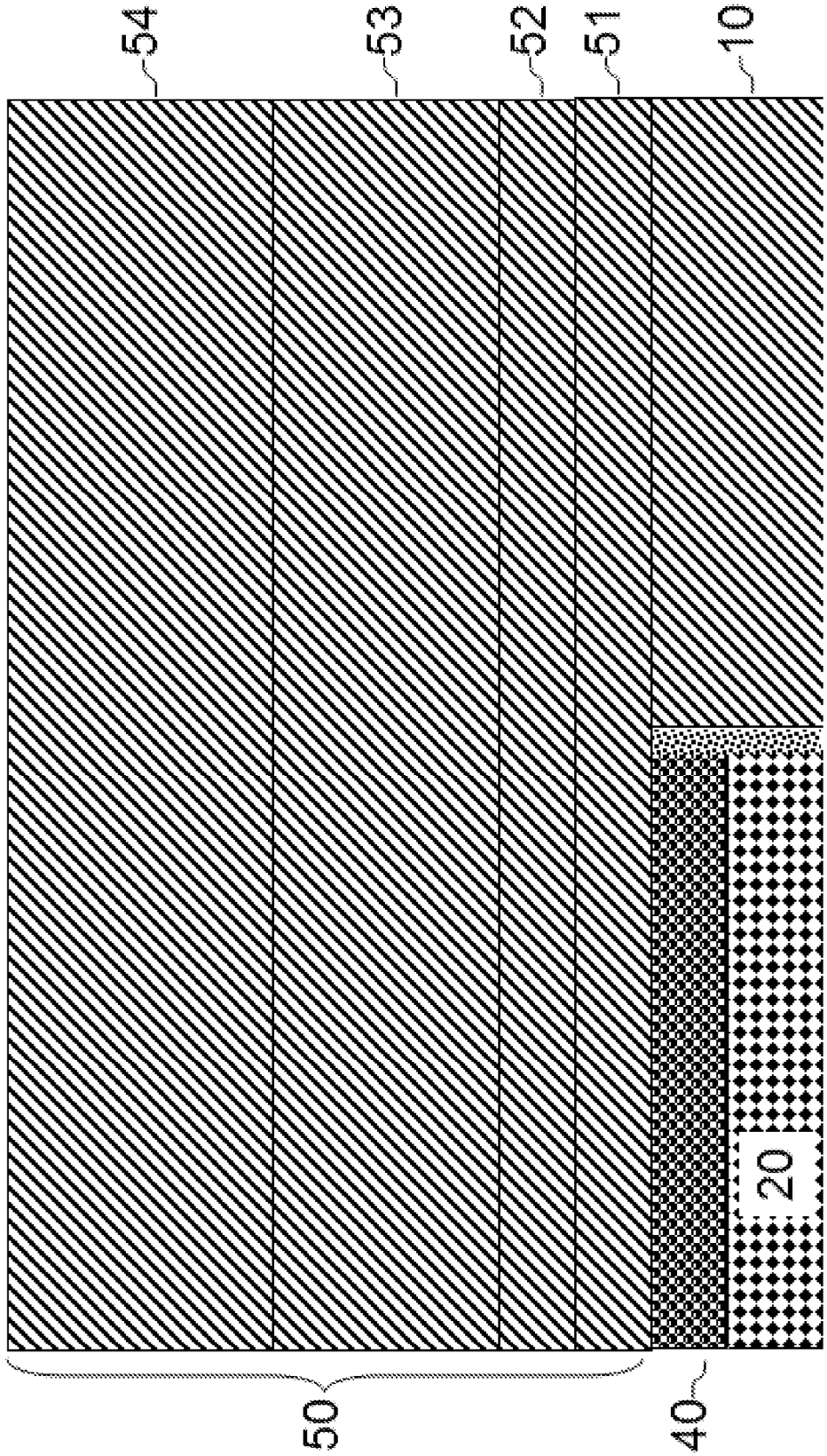


Figure 4

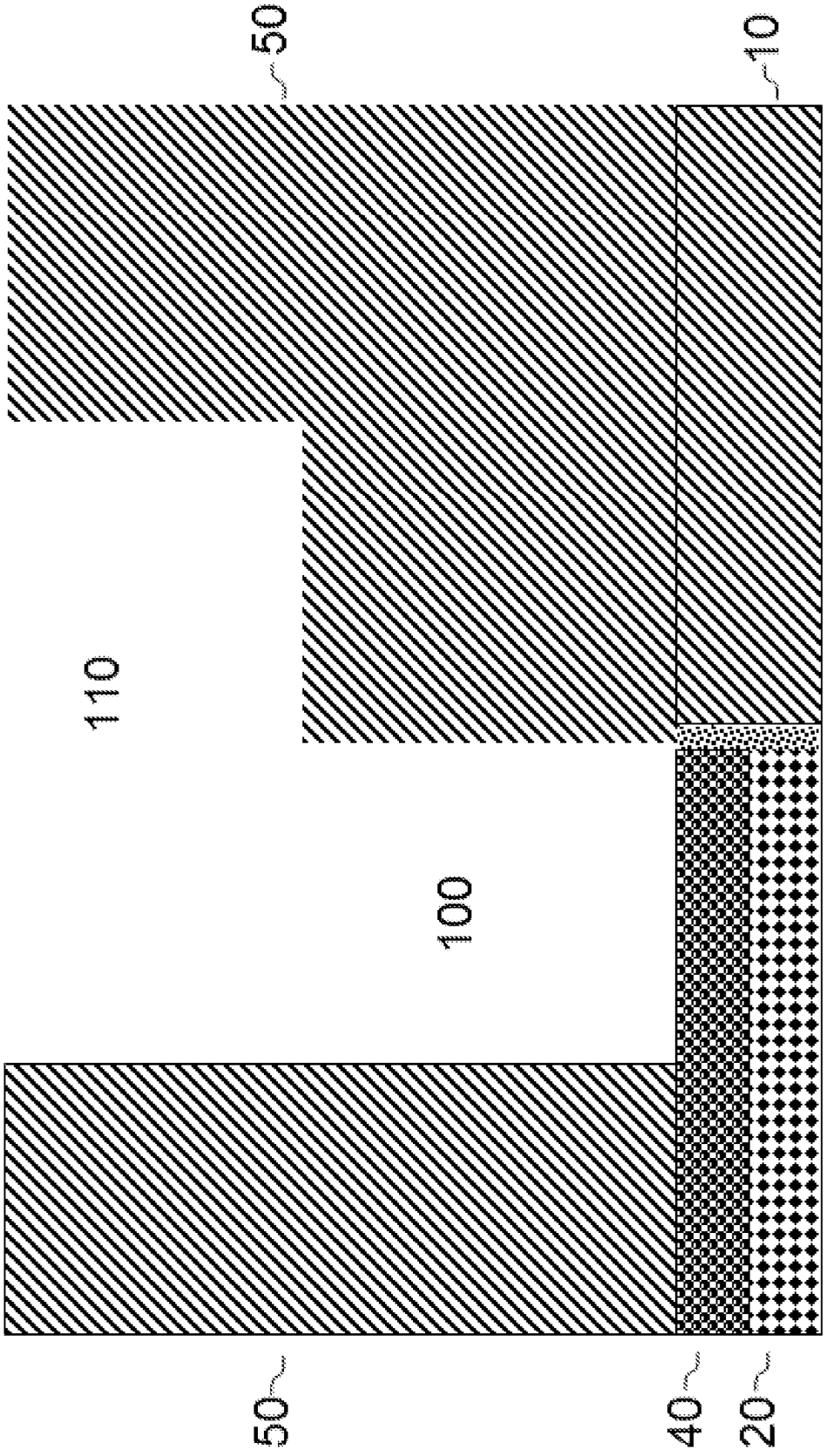


Figure 5

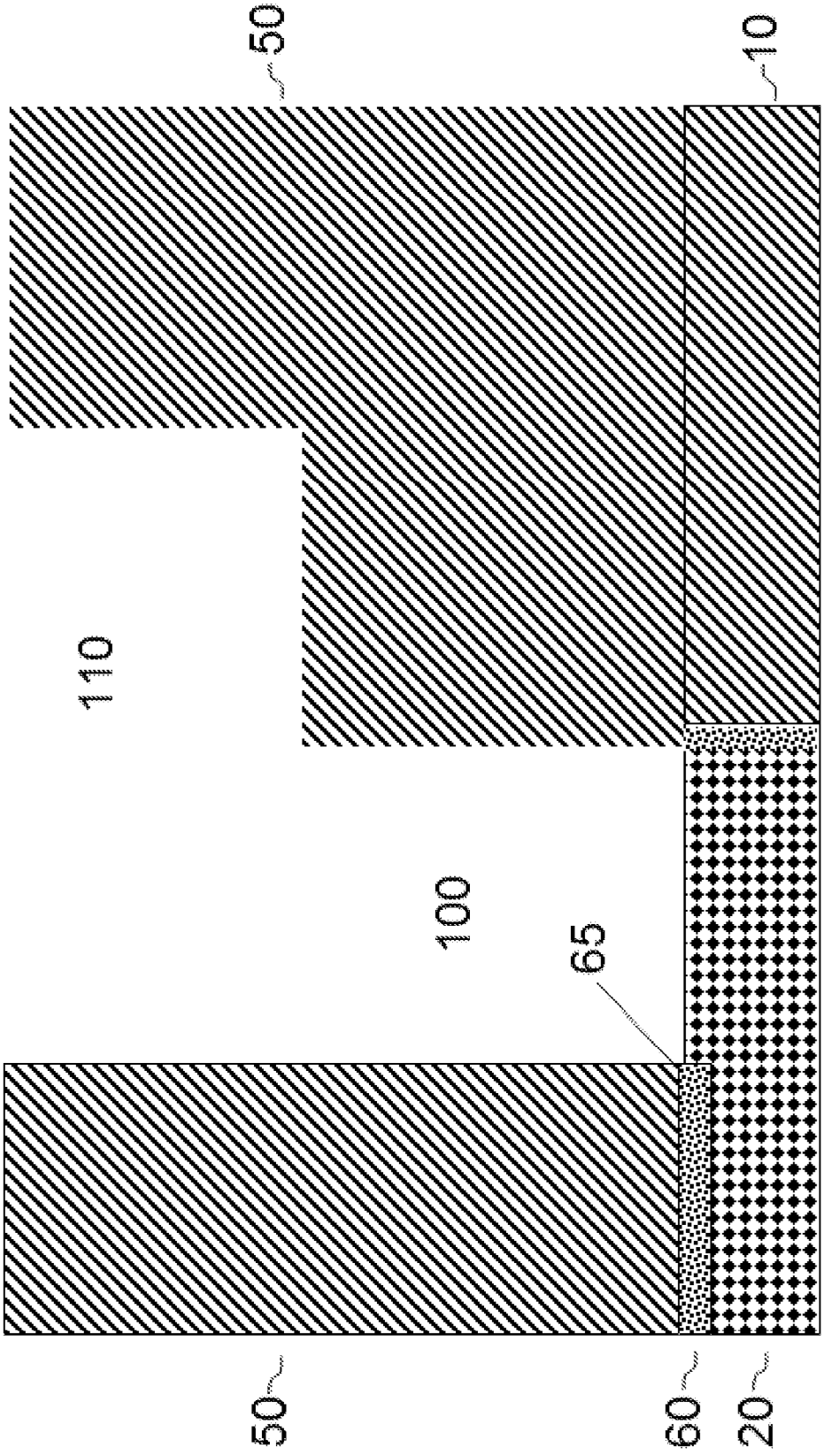


Figure 6

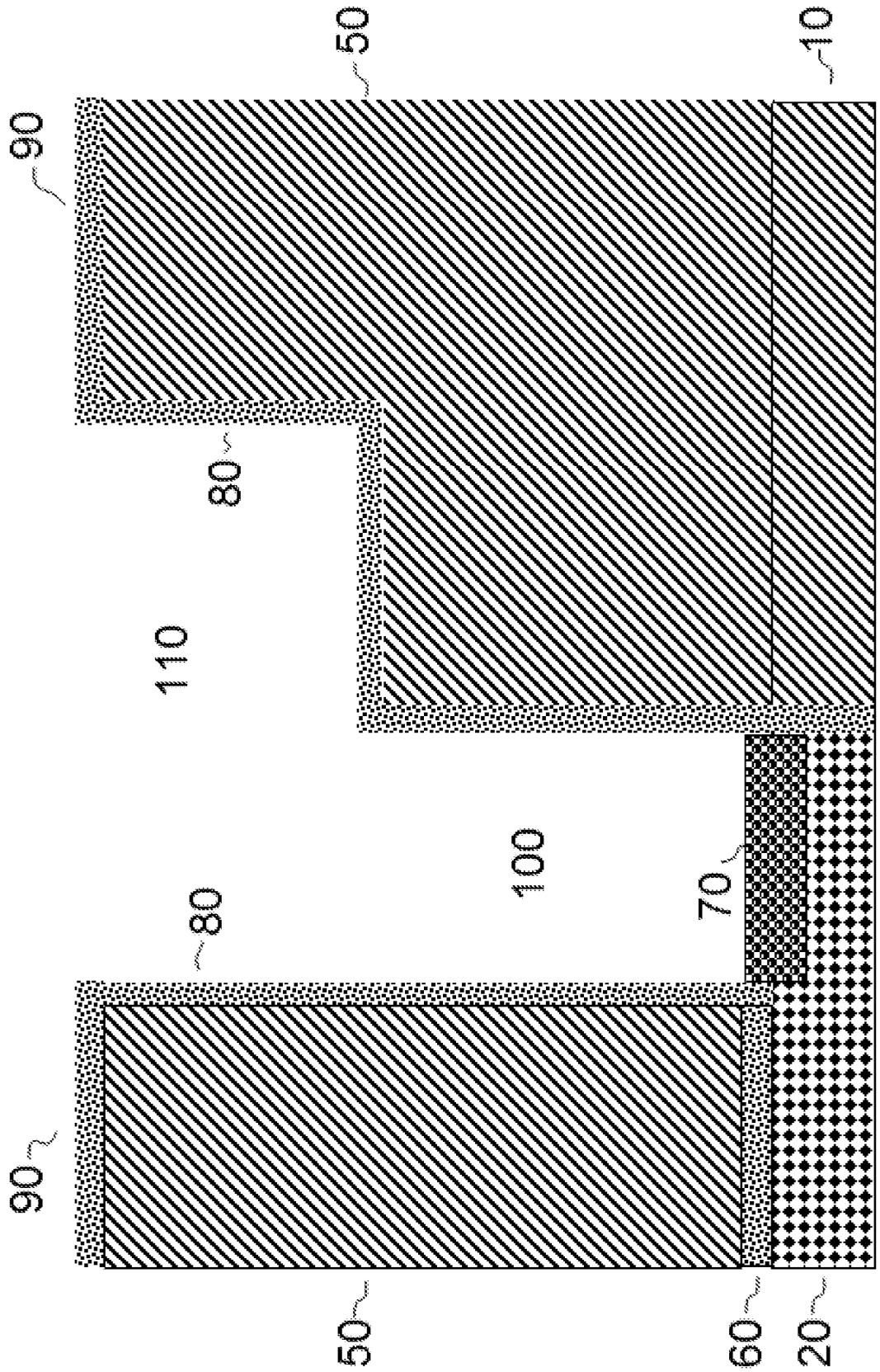


Figure 7

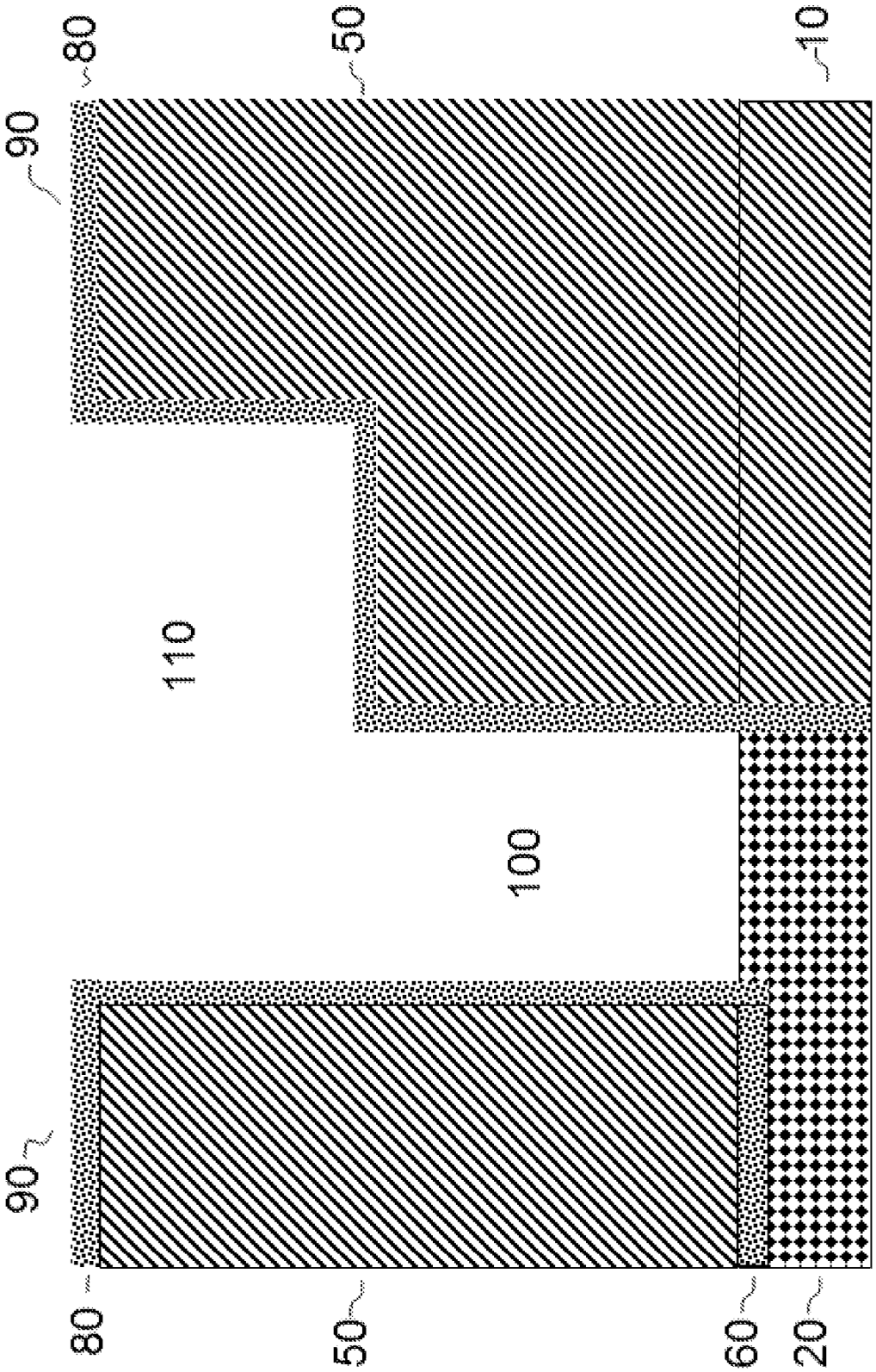


Figure 8

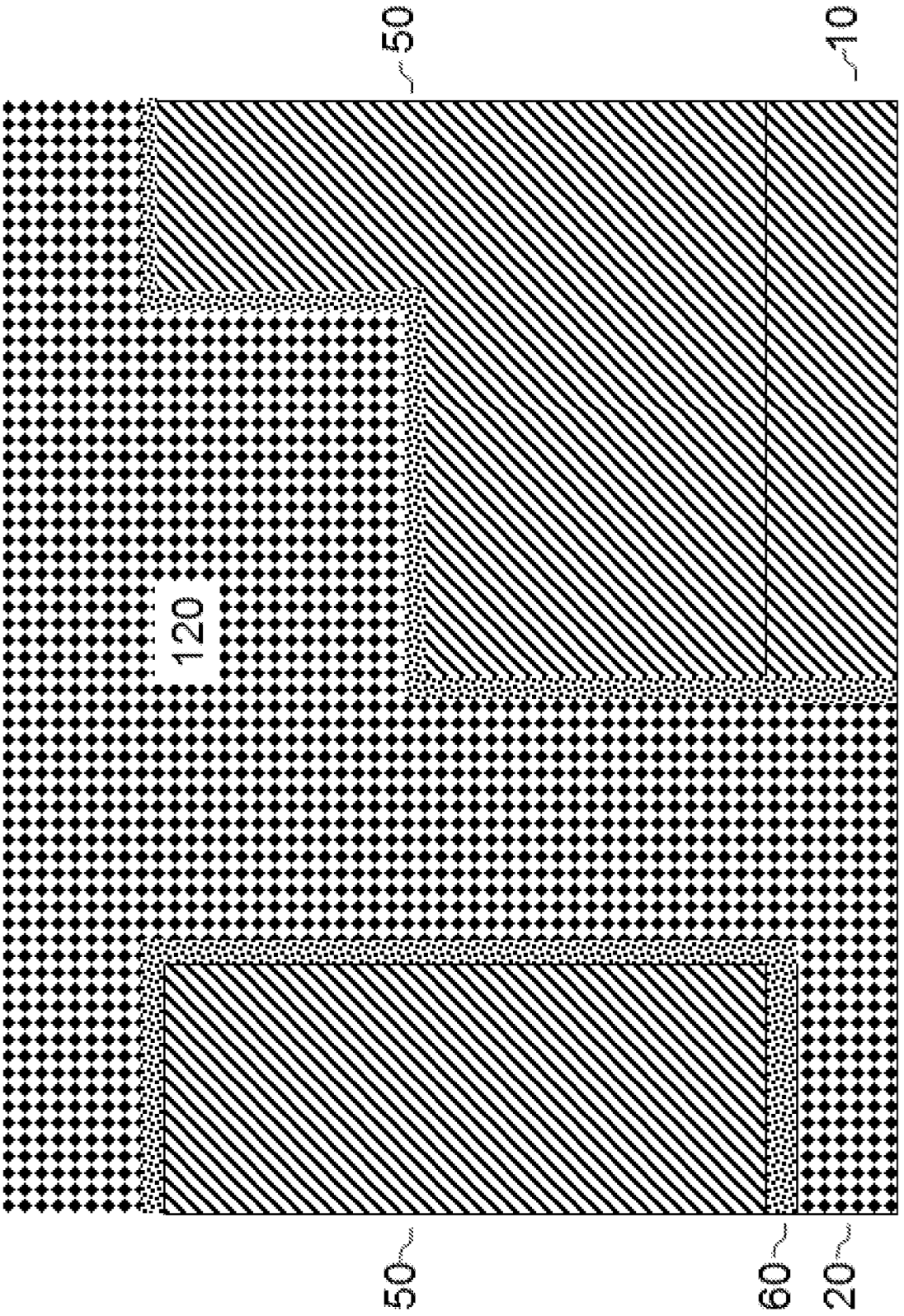


Figure 9

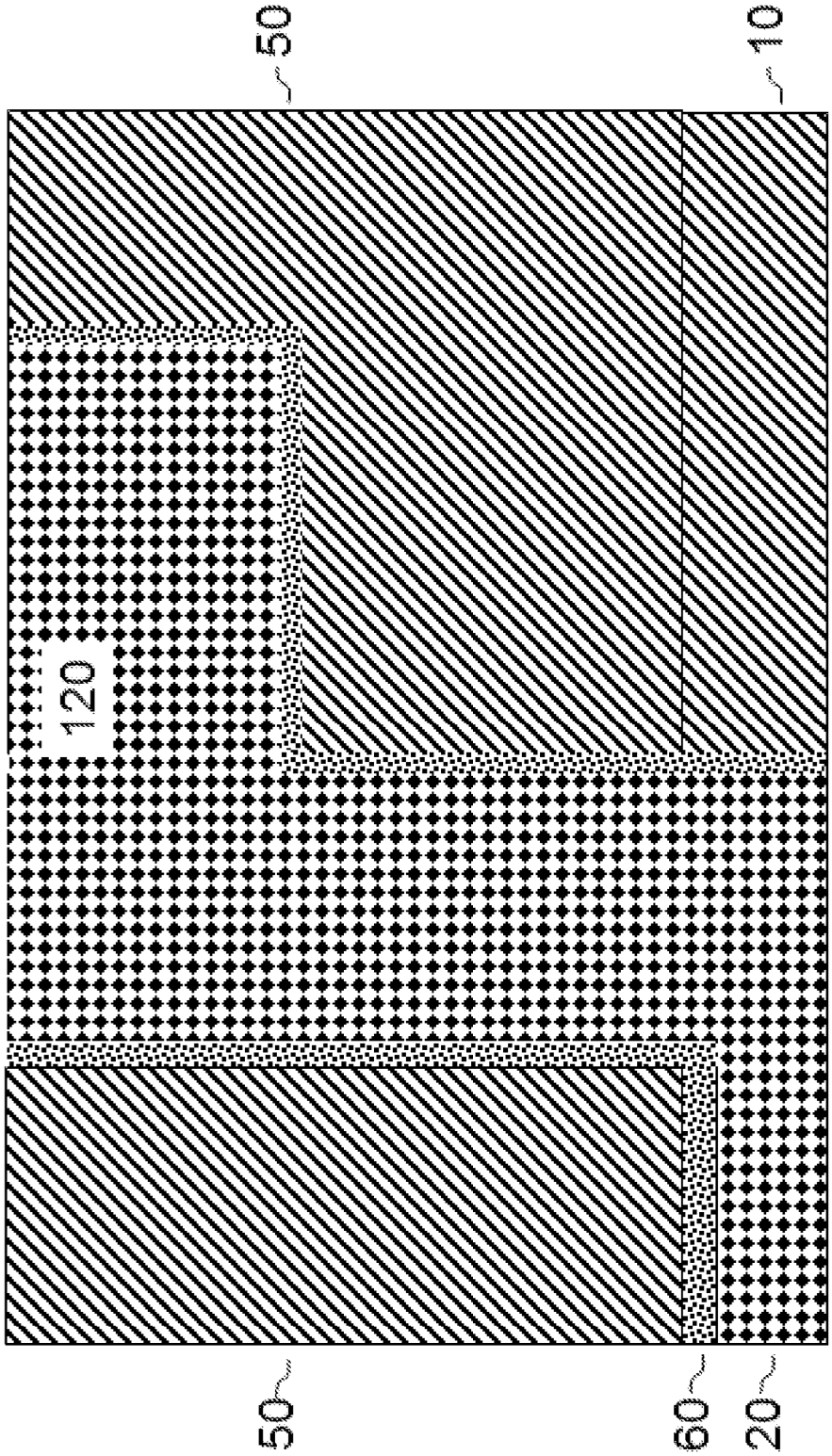


Figure 10

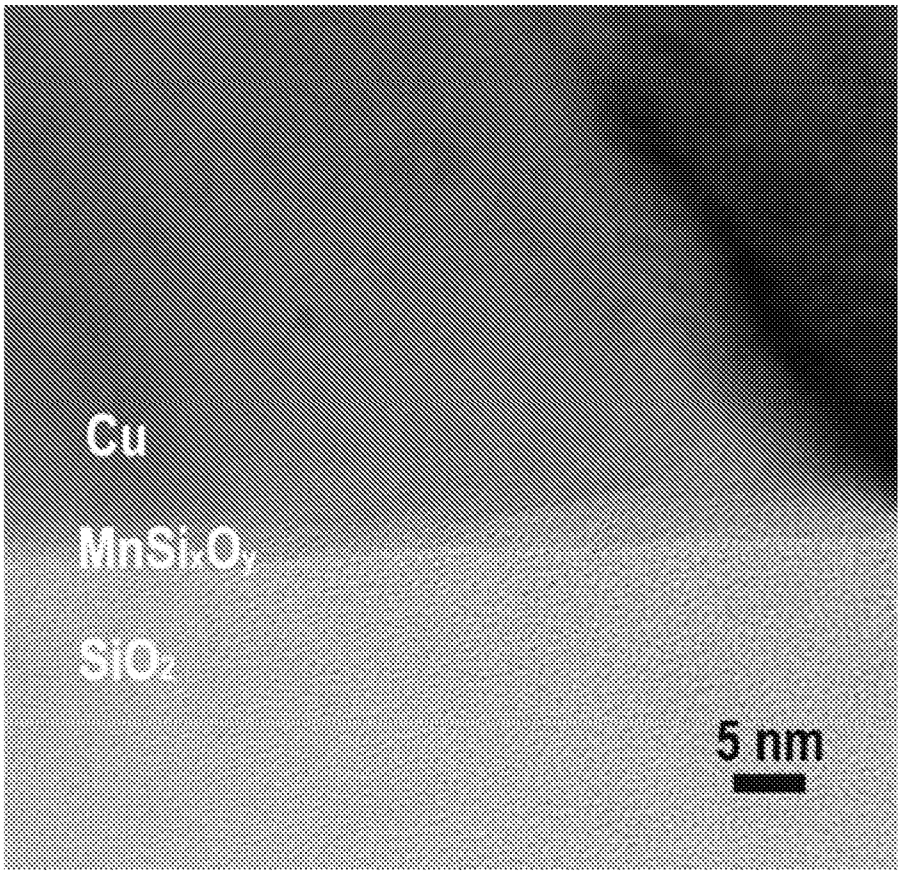


Figure 11

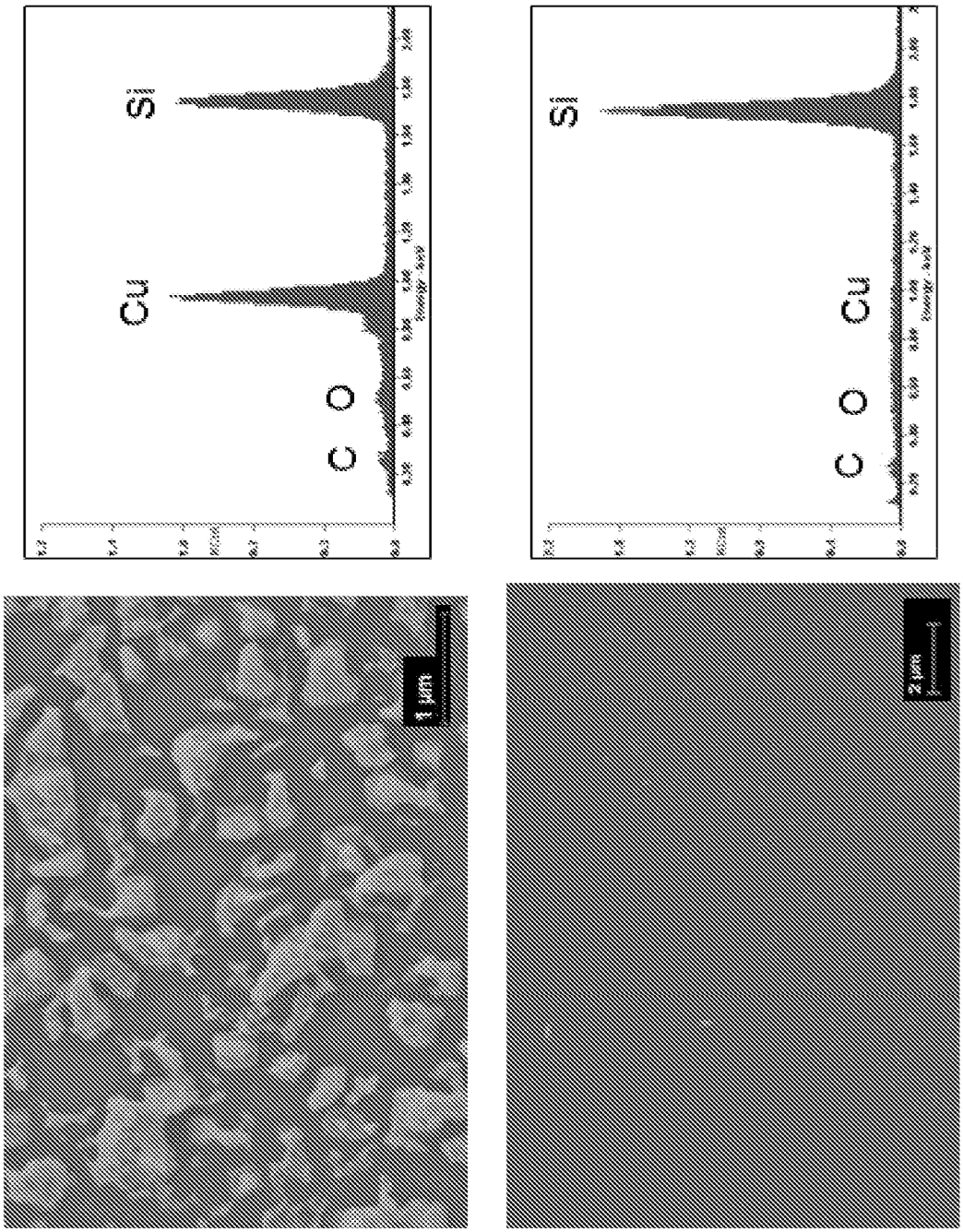


Figure 12

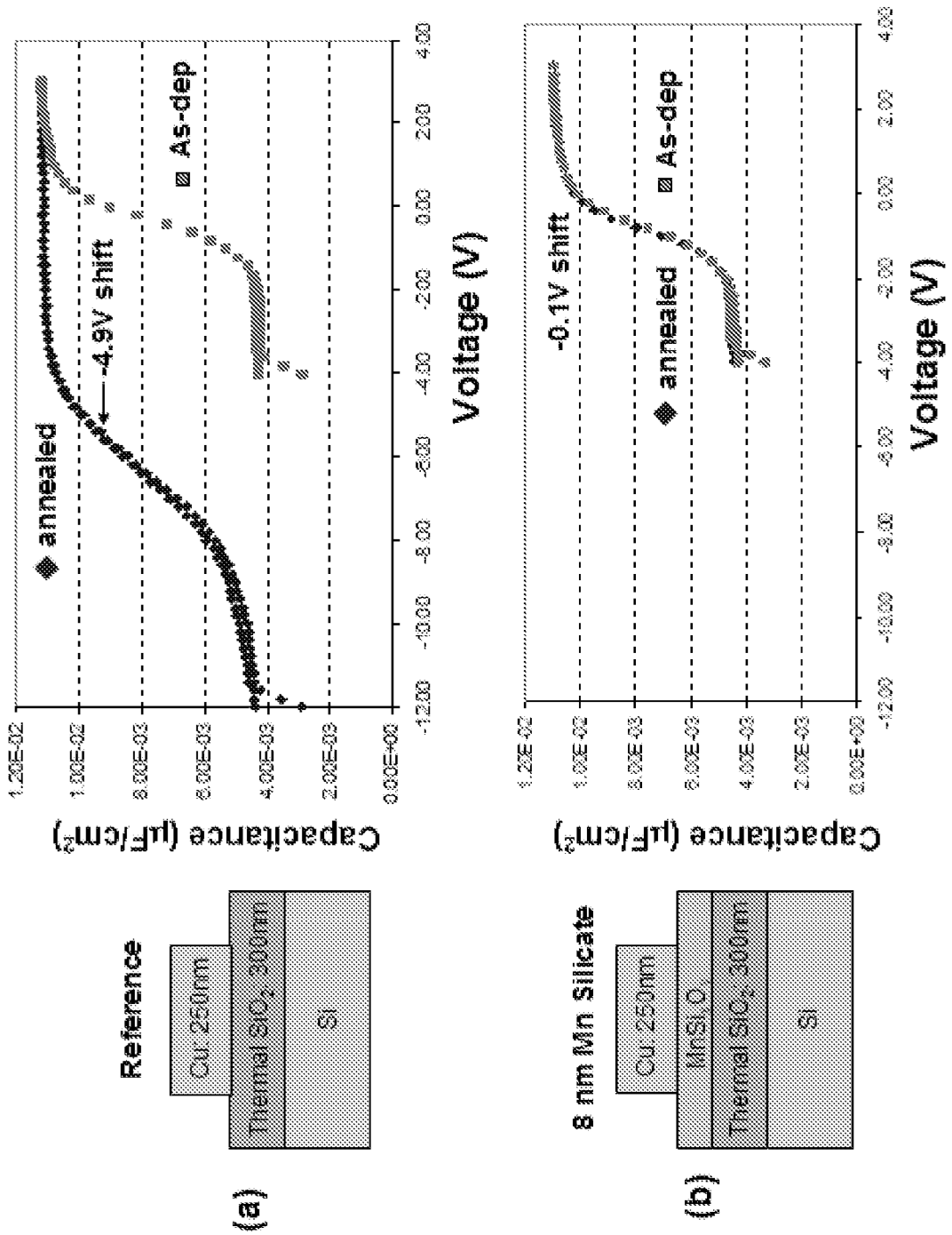

(a)
Reference
Cu 250nm
Thermal SiO2 300nm
Si
annealed
-4.9V shift
As-dep
Capacitance (μF/cm²)
Voltage (V)
(b)
8 nm Mn Silicate
Cu 250nm
MnSixOy
Thermal SiO2 300nm
Si
annealed
-0.1V shift
As-dep
Capacitance (μF/cm²)
Voltage (V)

Figure 13

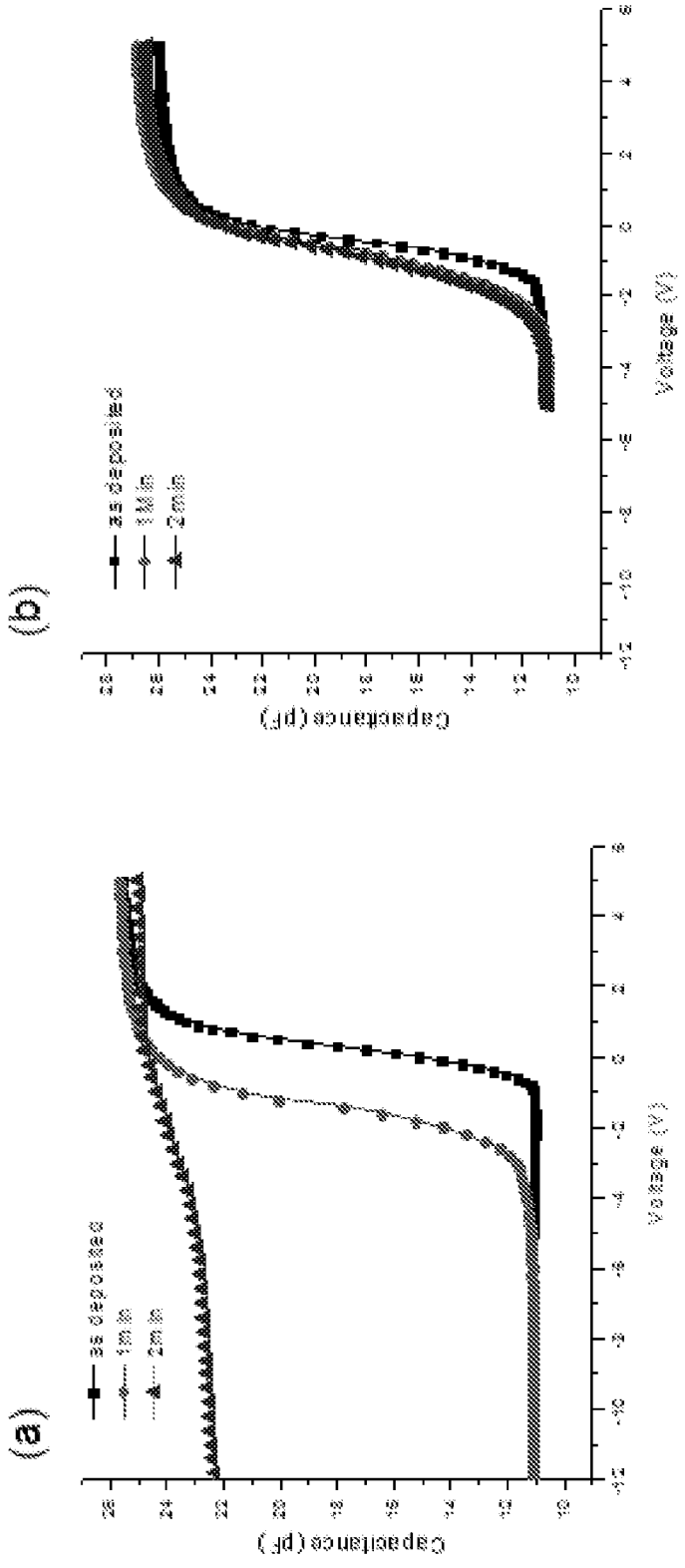

(a)
as deposited
1min
2min
Capacitance (pF)
Voltage (V)
(b)
as deposited
1Min
2min
Capacitance (pF)
Voltage (V)

Figure 14

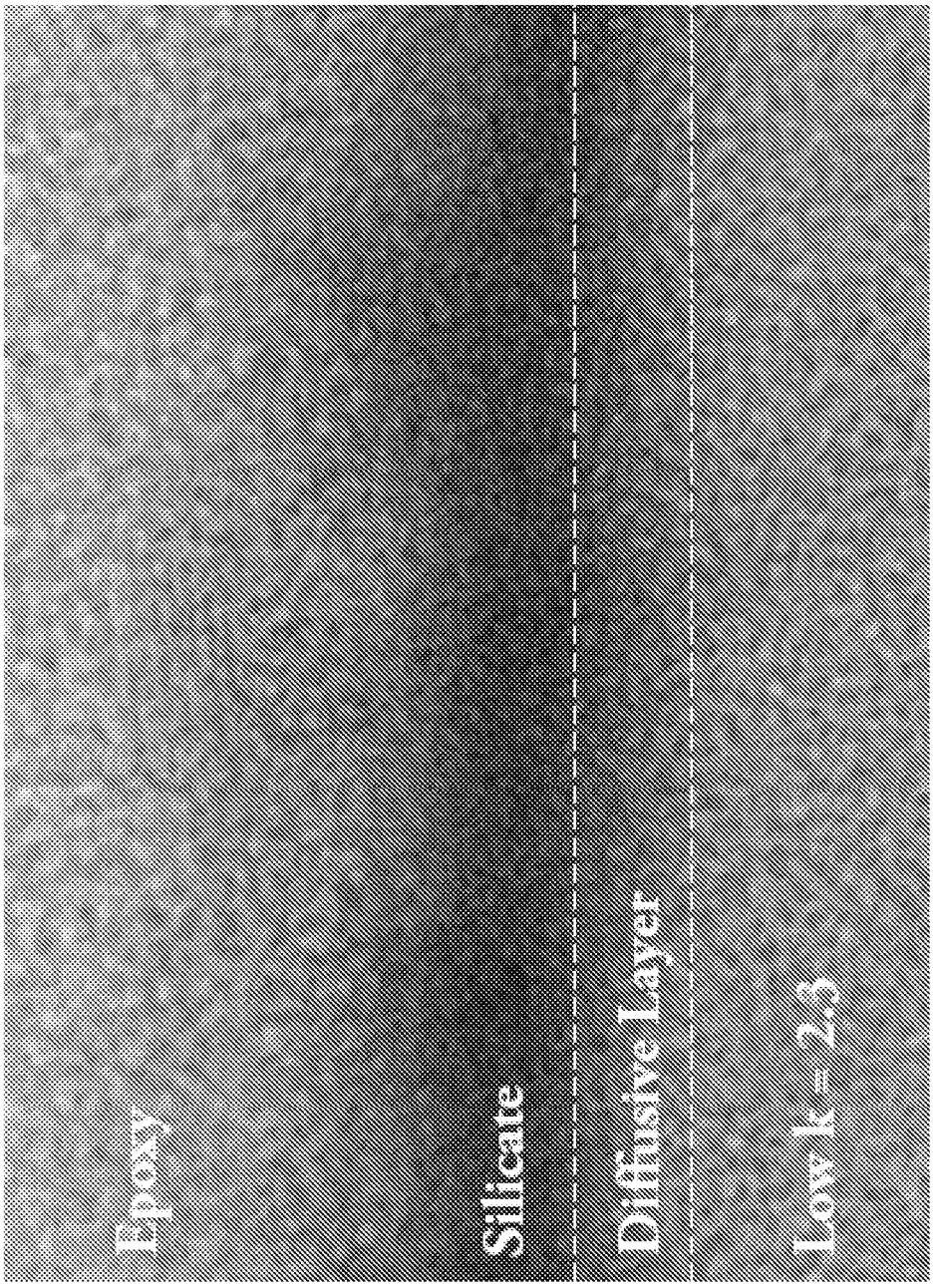


Figure 15

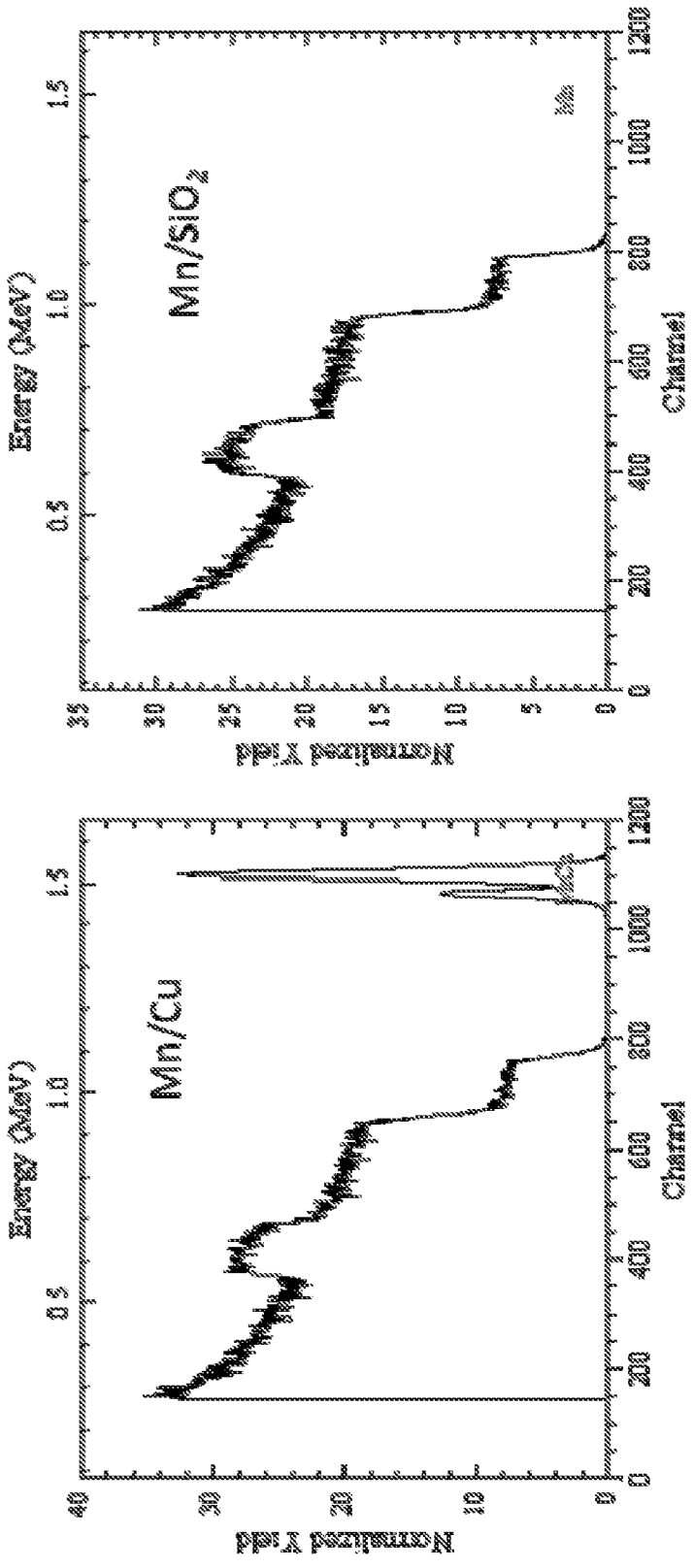


Figure 16

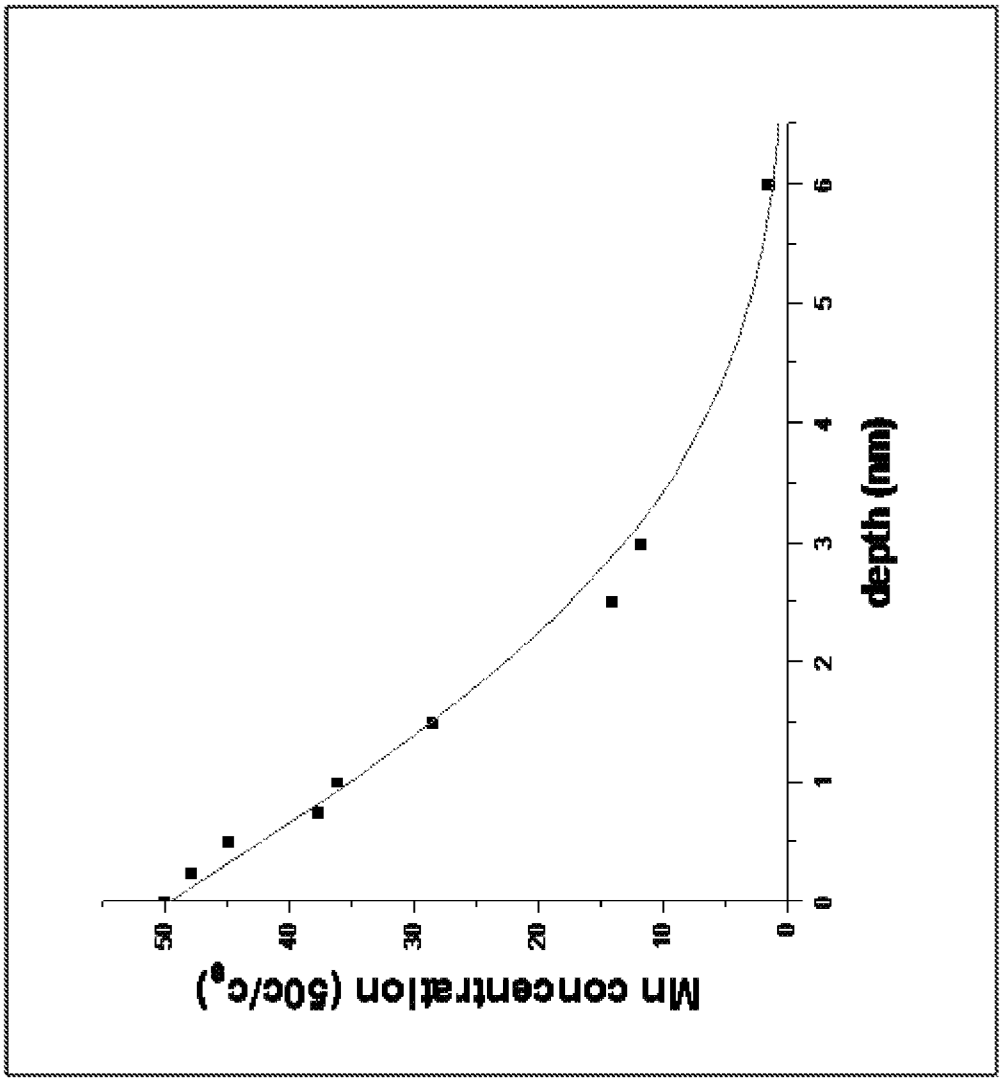


Figure 17

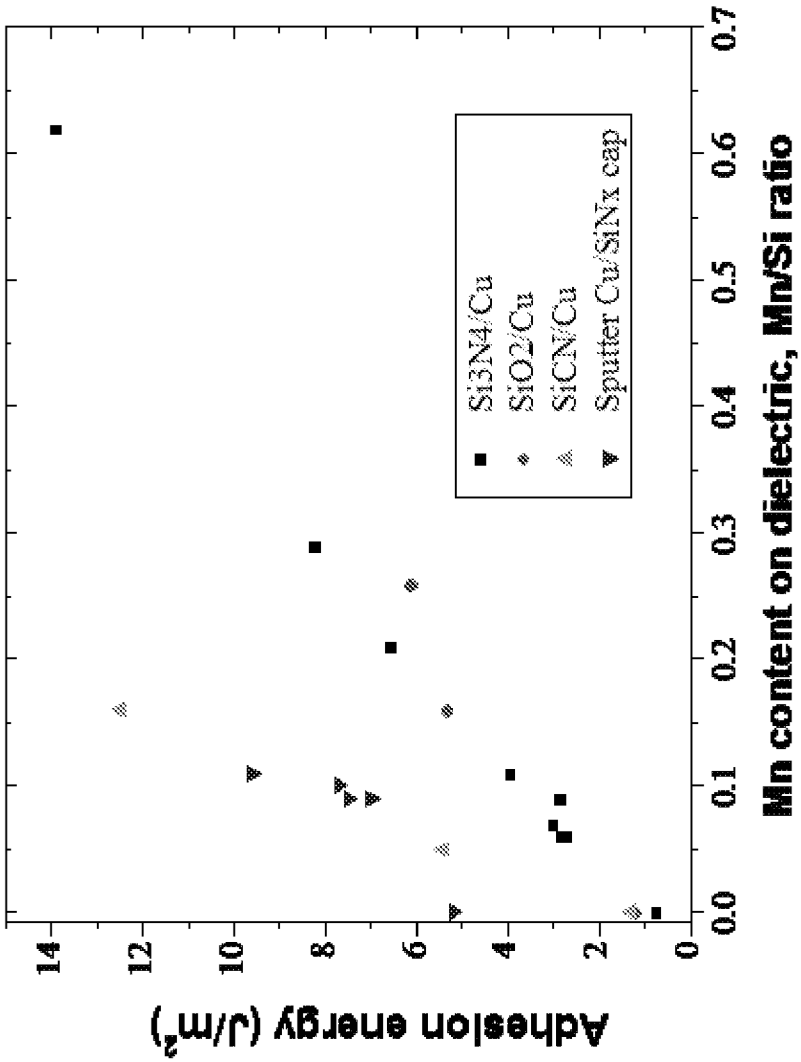

Adhesion energy (J/m²)
Mn content on dielectric, Mn/Si ratio
Si3N4/Cu
SiO2/Cu
SiCN/Cu
Sputter Cu/SiNx cap
0
2
4
6
8
10
12
14
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7

Figure 18

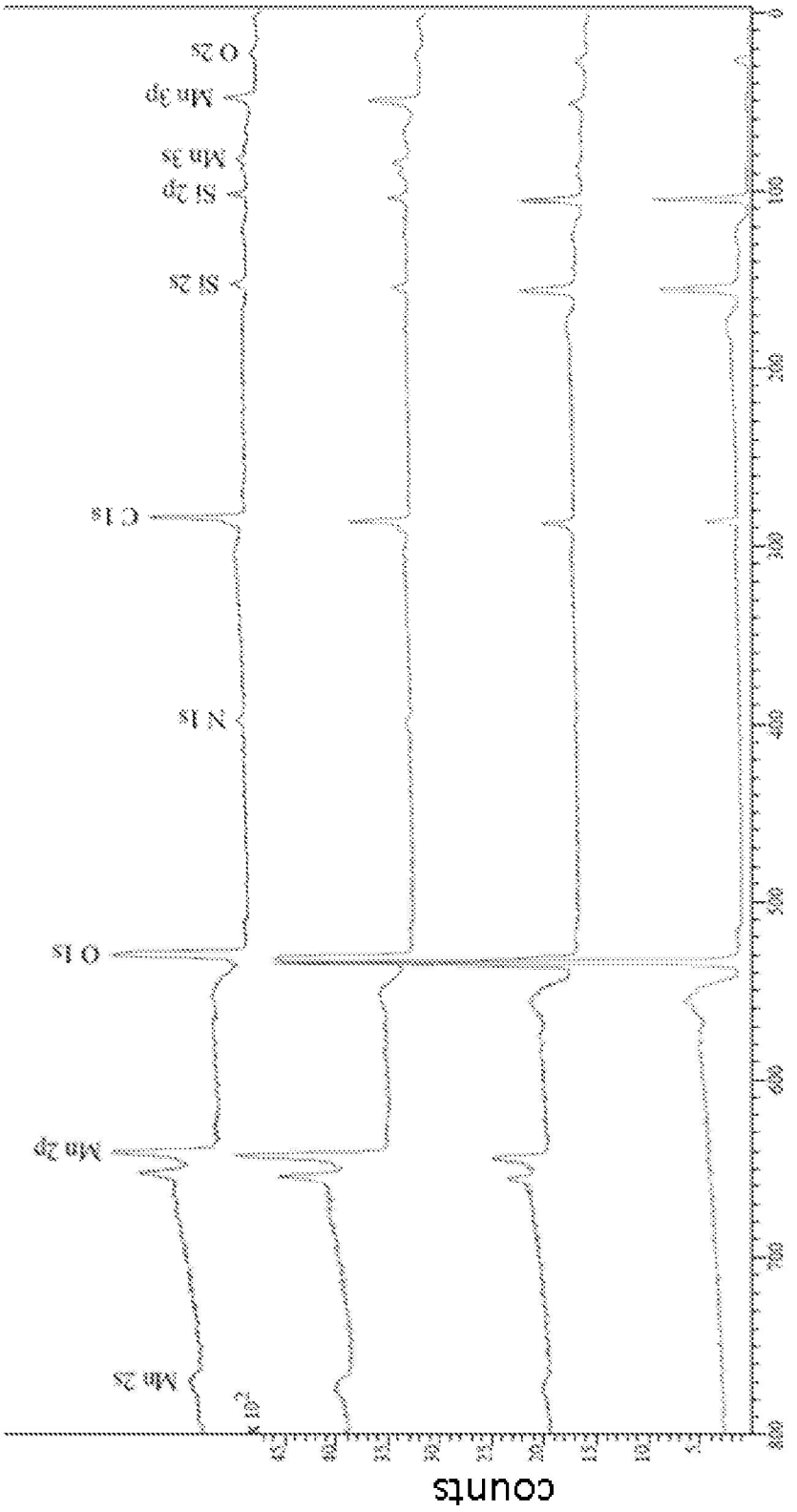

counts
Binding Energy, eV
Mn 3s
Mn 3p
O 1s
N 1s
C 1s
Si 2s
Si 2p
Mn 3s
Mn 3p
O 2s

Figure 19

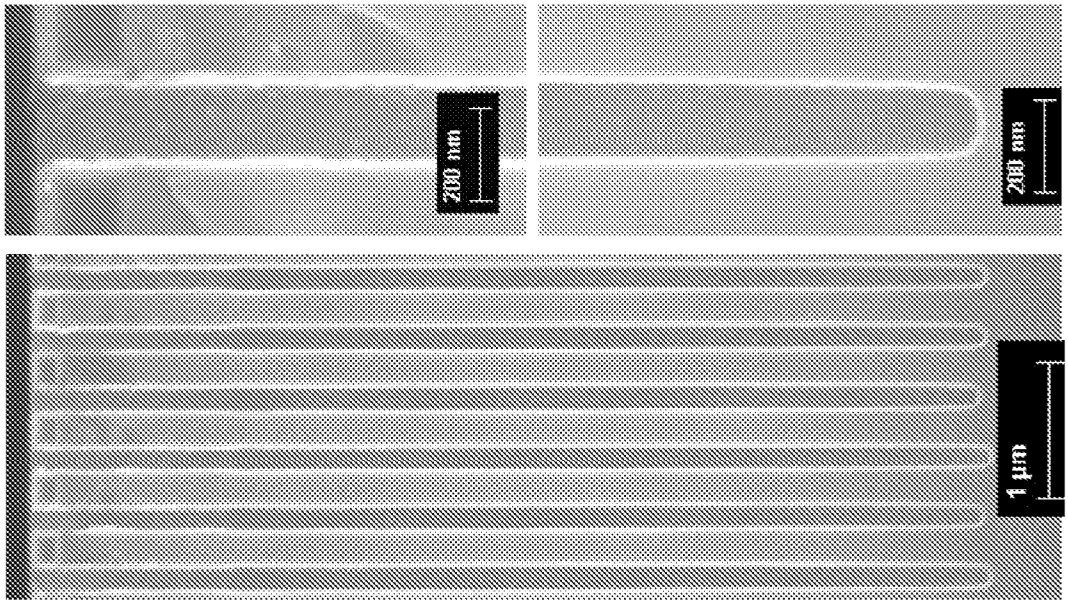


Figure 20

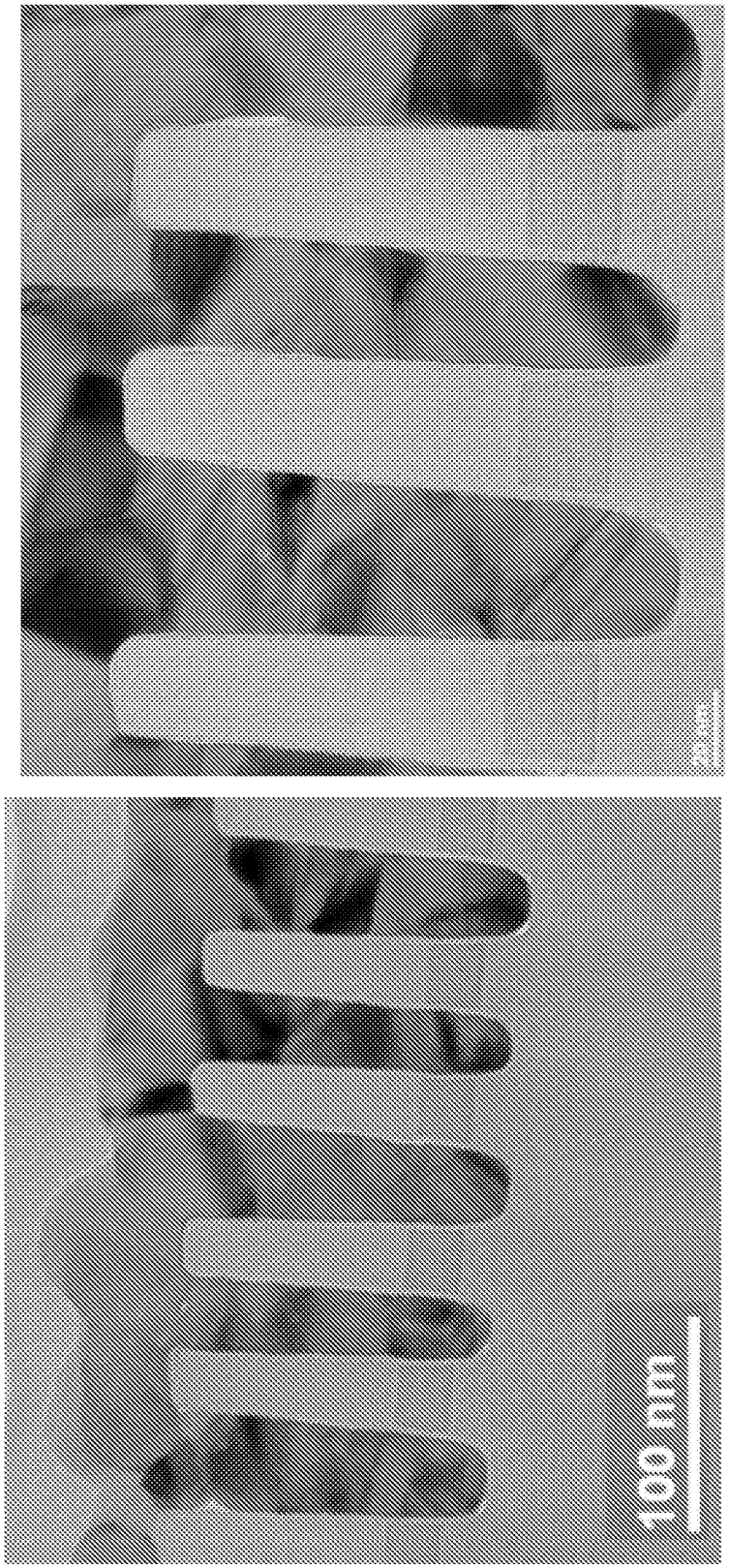


Figure 21

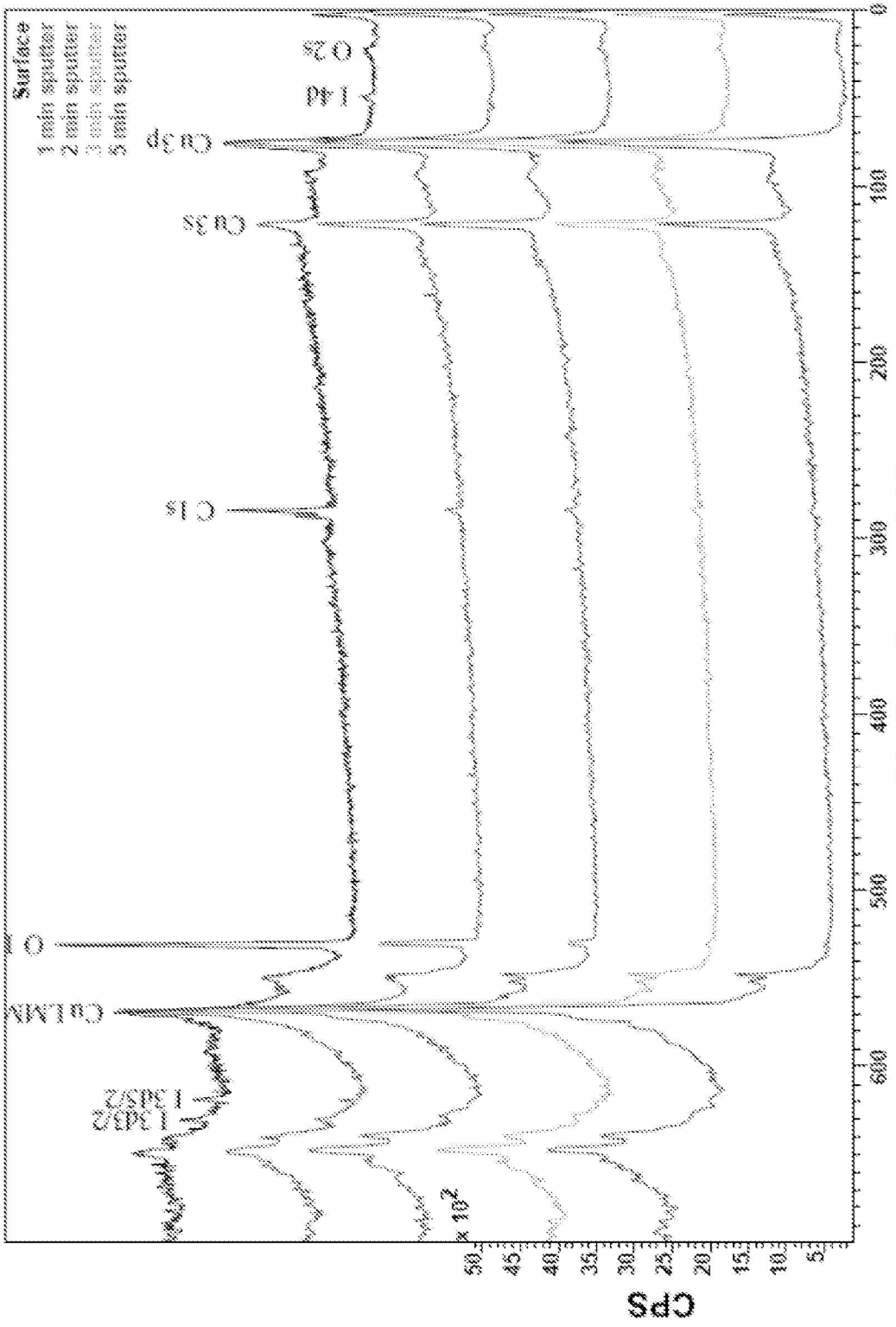

Surface
1 min sputter
2 min sputter
3 min sputter
5 min sputter
O 2s
1s
Cu 3p
Cu 3s
C 1s
O 1s
Cu LMM
Cu 2p3/2
Cu 2p1/2
x 10²
CPS
Binding Energy (eV)

Figure 22

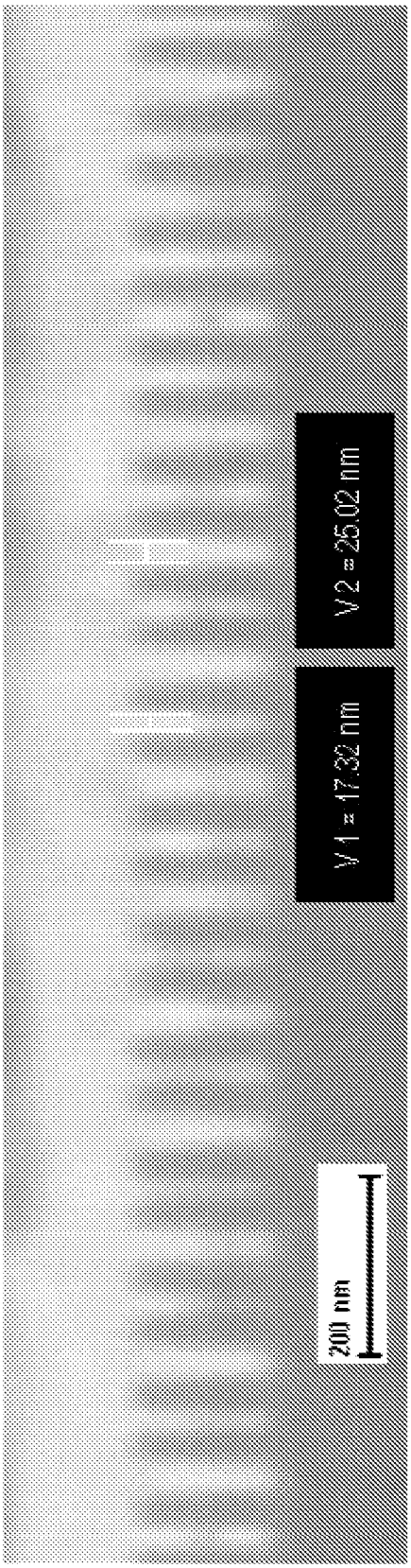


Figure 23

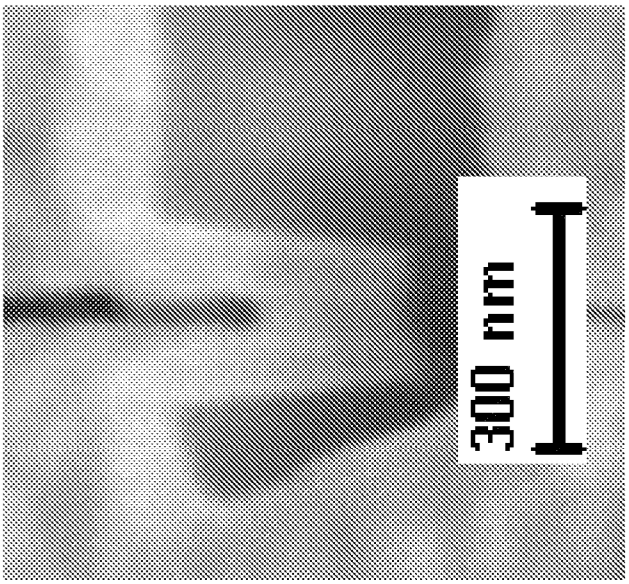


Figure 24

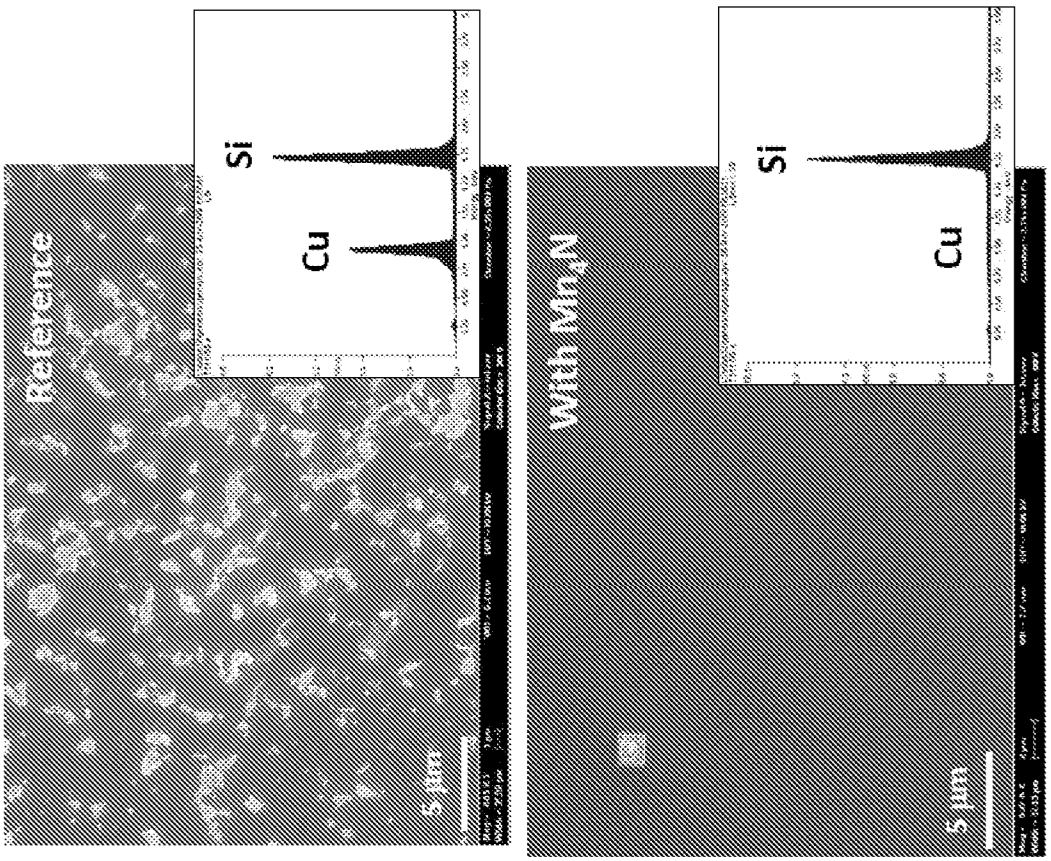


Figure 25

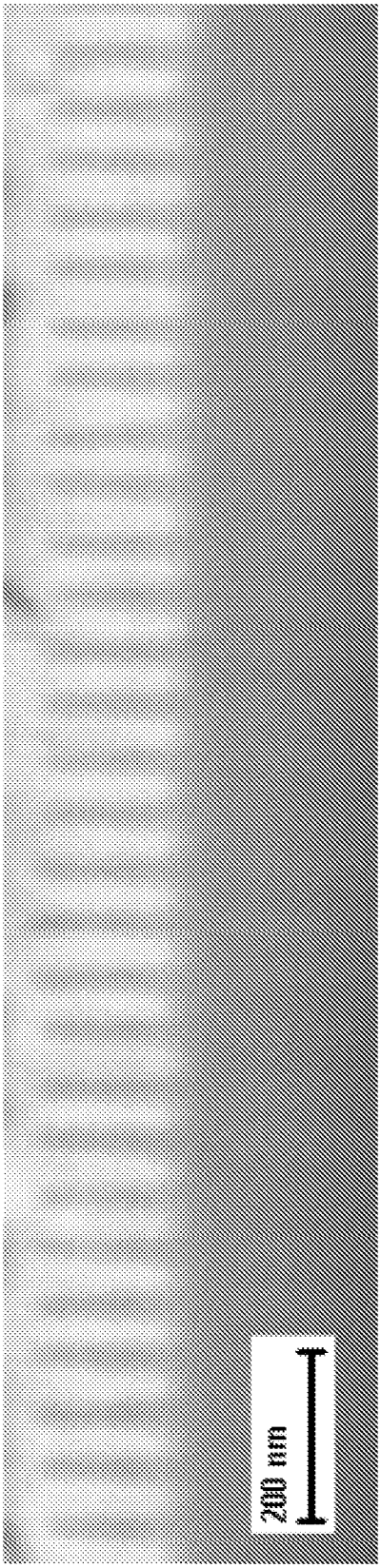


Figure 26

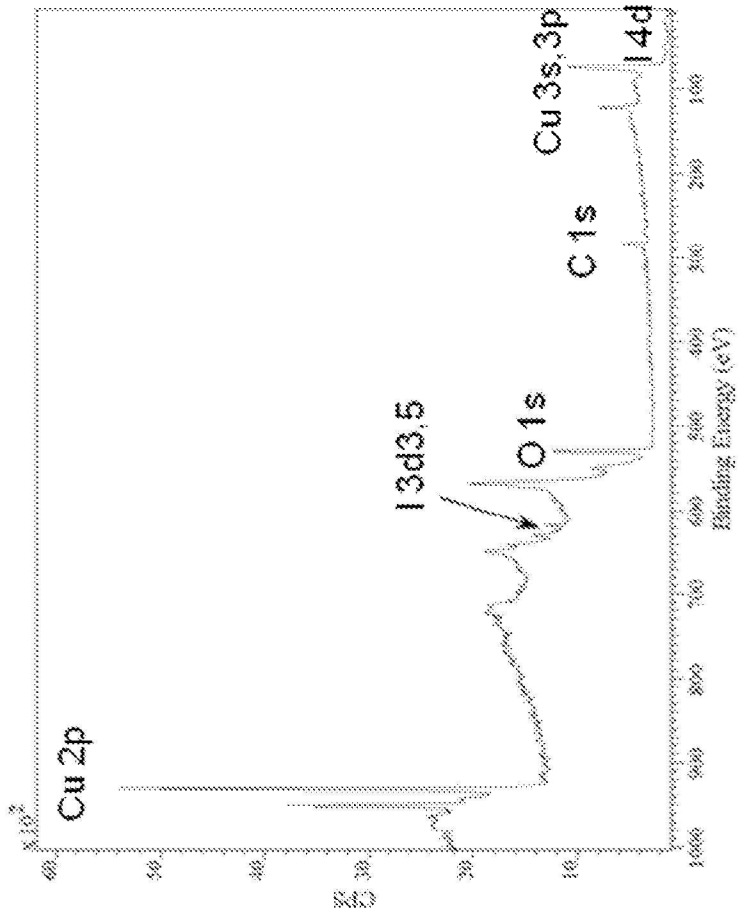


Figure 27

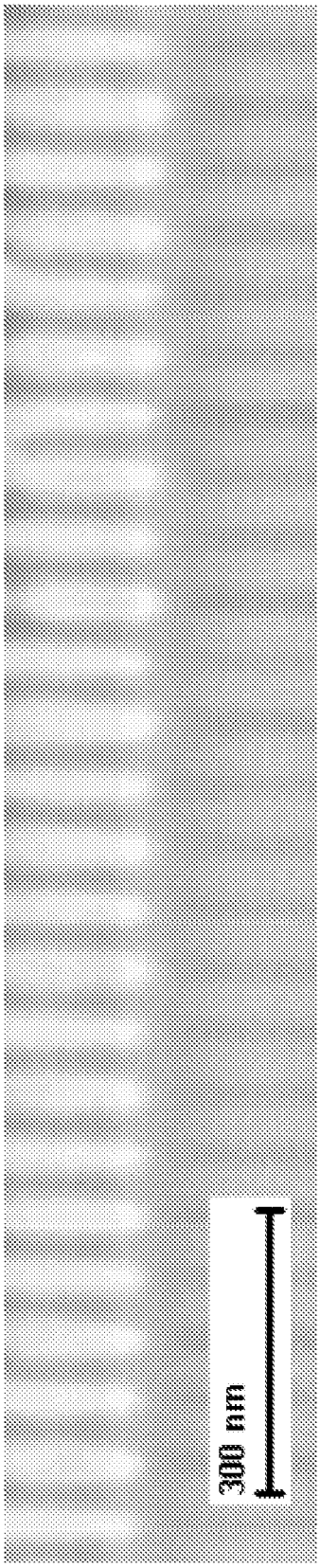


Figure 28

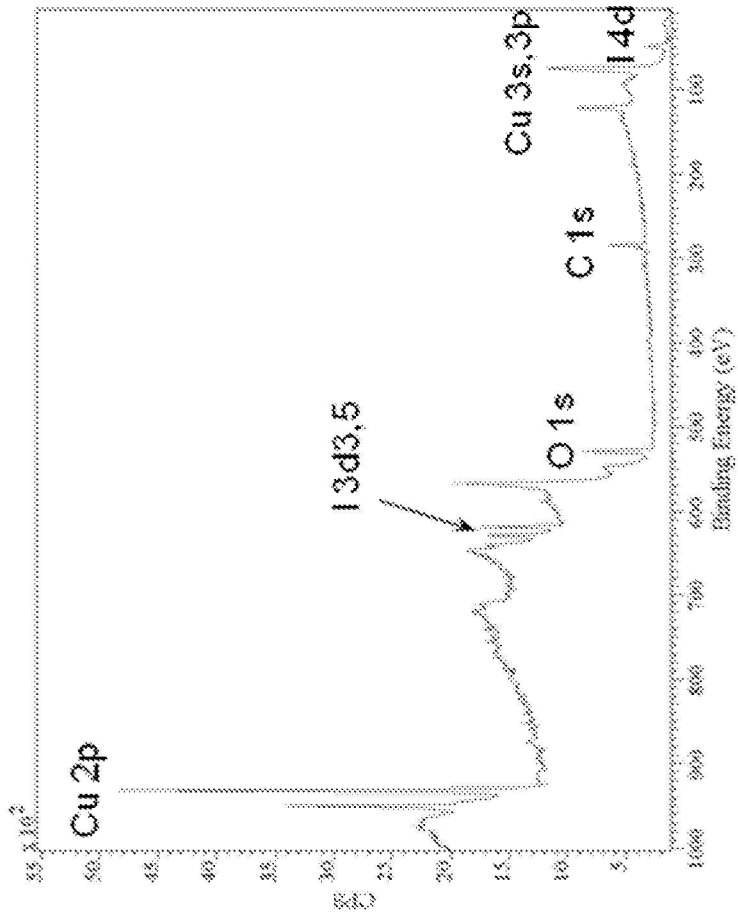


Figure 29

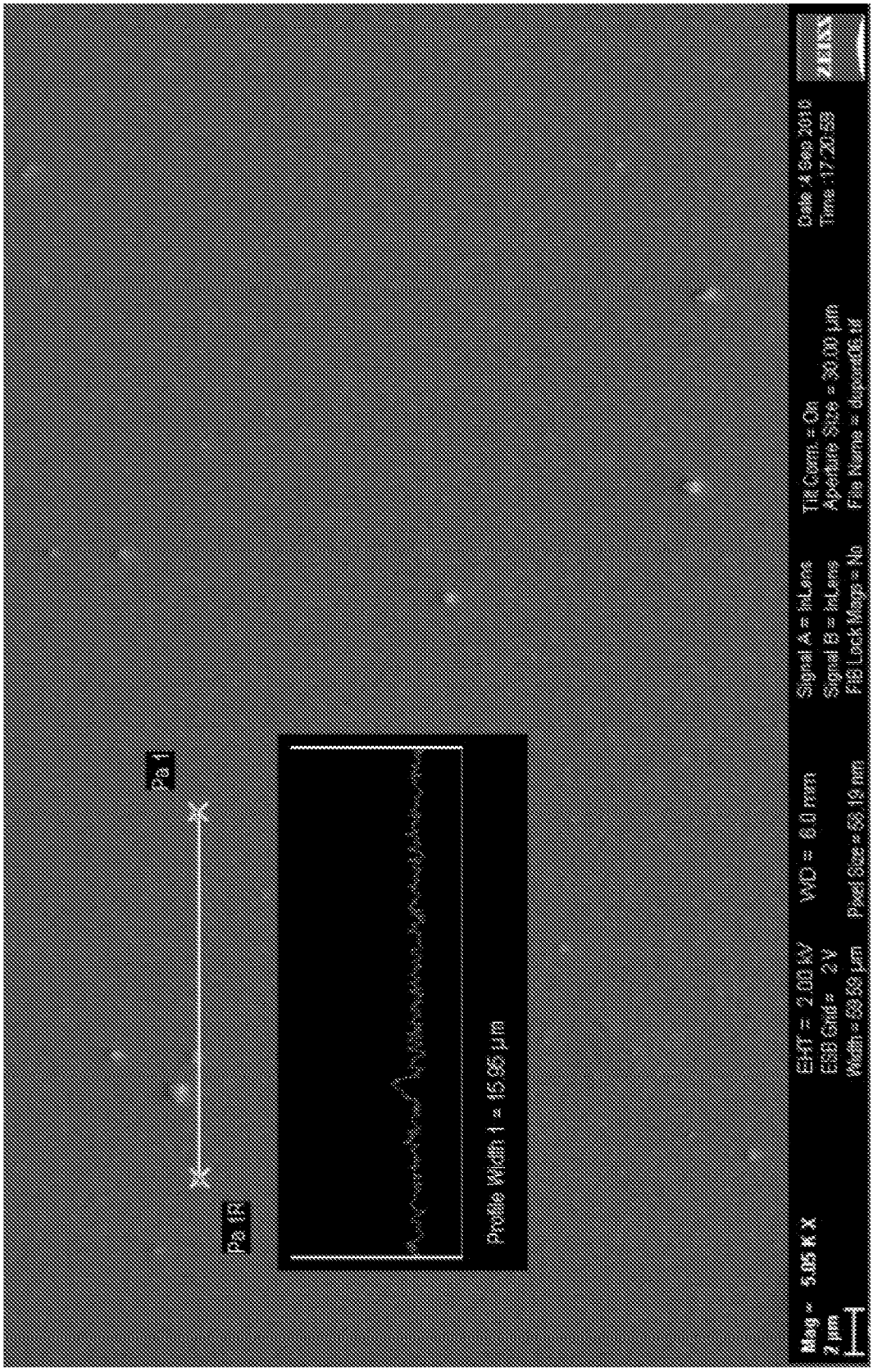

Pa 1
Pa 1R
Profile Width 1 = 15.95 µm
Mag = 5.05 K X
2 µm
EHT = 2.00 kV
ESB Grid = 2V
Width = 29.89 µm
WD = 6.0 mm
Pixel Size = 58.18 nm
Signal A = InLens
Signal B = InLens
FIB Lock Mags = No
Tilt Corrn = On
Aperture Size = 30.00 µm
File Name = dapon06.tif
Date :4 Dec 2010
Time :17:20:59

Figure 30

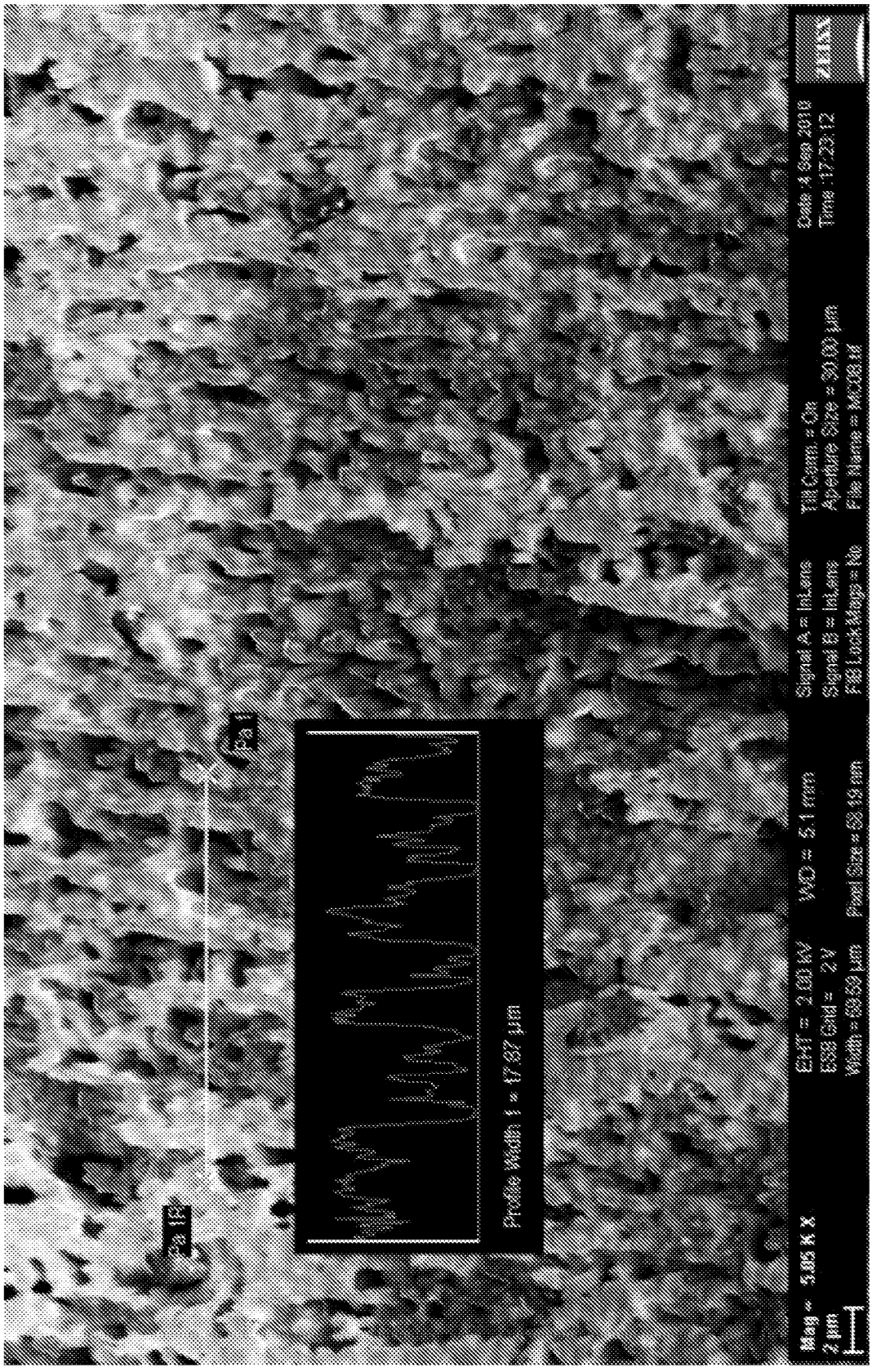

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2 µm
EHT = 2.00 kV
ESB Grid = 2V
Width = 69.59 µm
WD = 5.1 mm
Pixel Size = 68.19 nm
Signal A = InLens
Signal B = InLens
FIB Lock Maps = No
Tilt Corr. = On
Aperture Size = 30.00 µm
File Name = MC08.tif
Date 4 Sep 2010
Time 17:29:12
ZEISS
Probe Width 1 = 17.87 µm

Figure 31