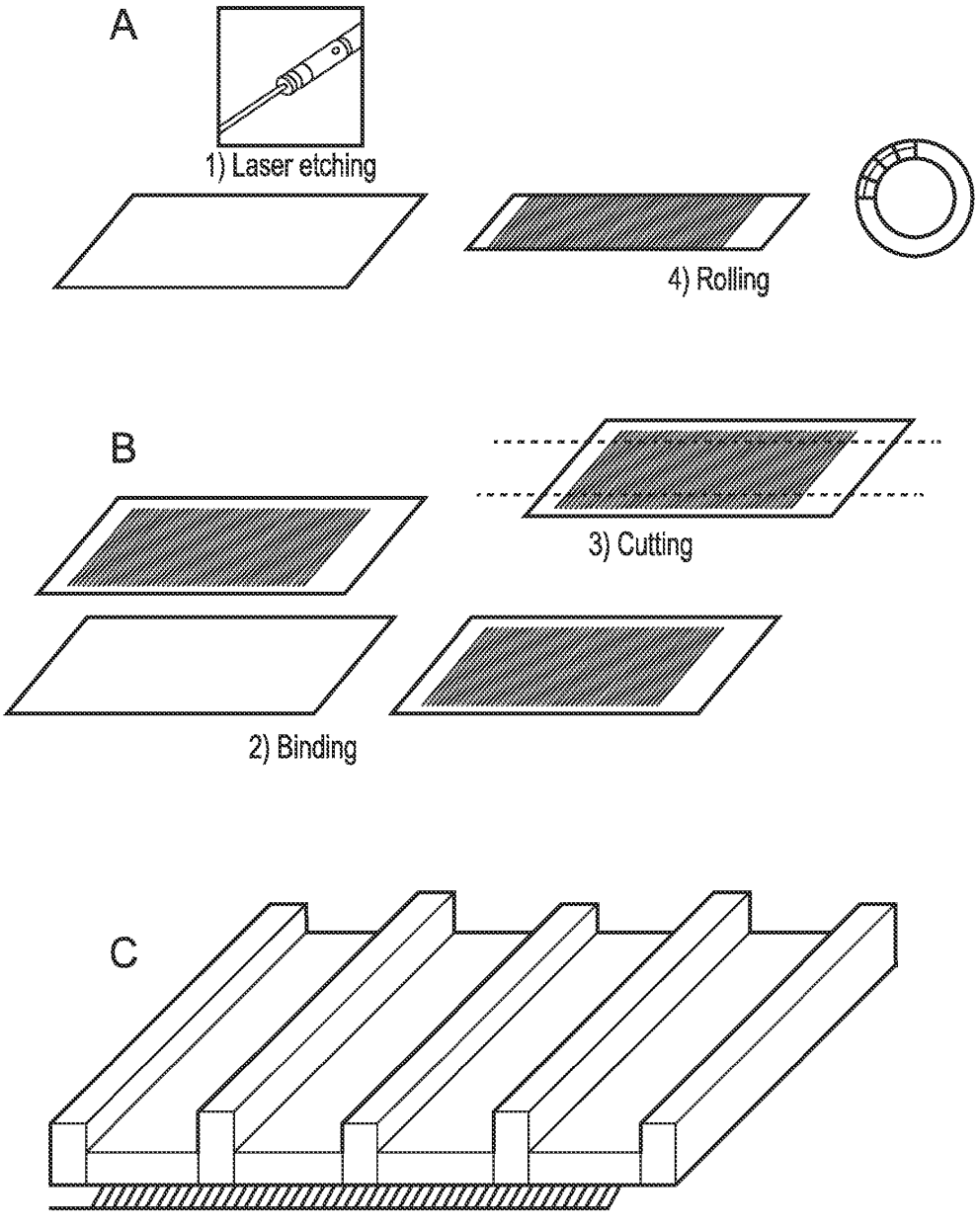


FIG. 1

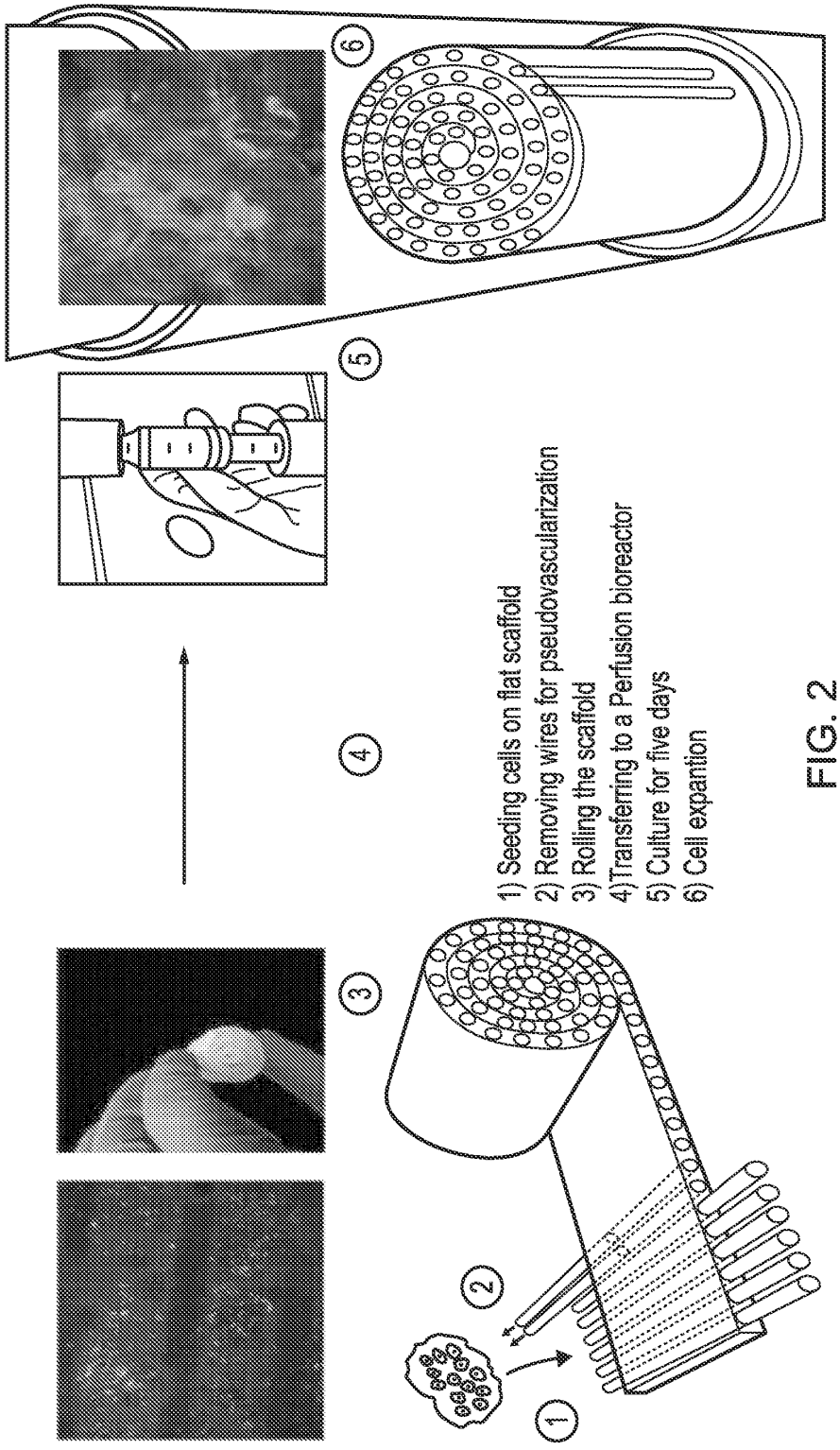

1) Seeding cells on flat scaffold
2) Removing wires for pseudovascularization
3) Rolling the scaffold
4)Transferring to a Perfusion bioreactor
5) Culture for five days
6) Cell expantion

FIG. 2

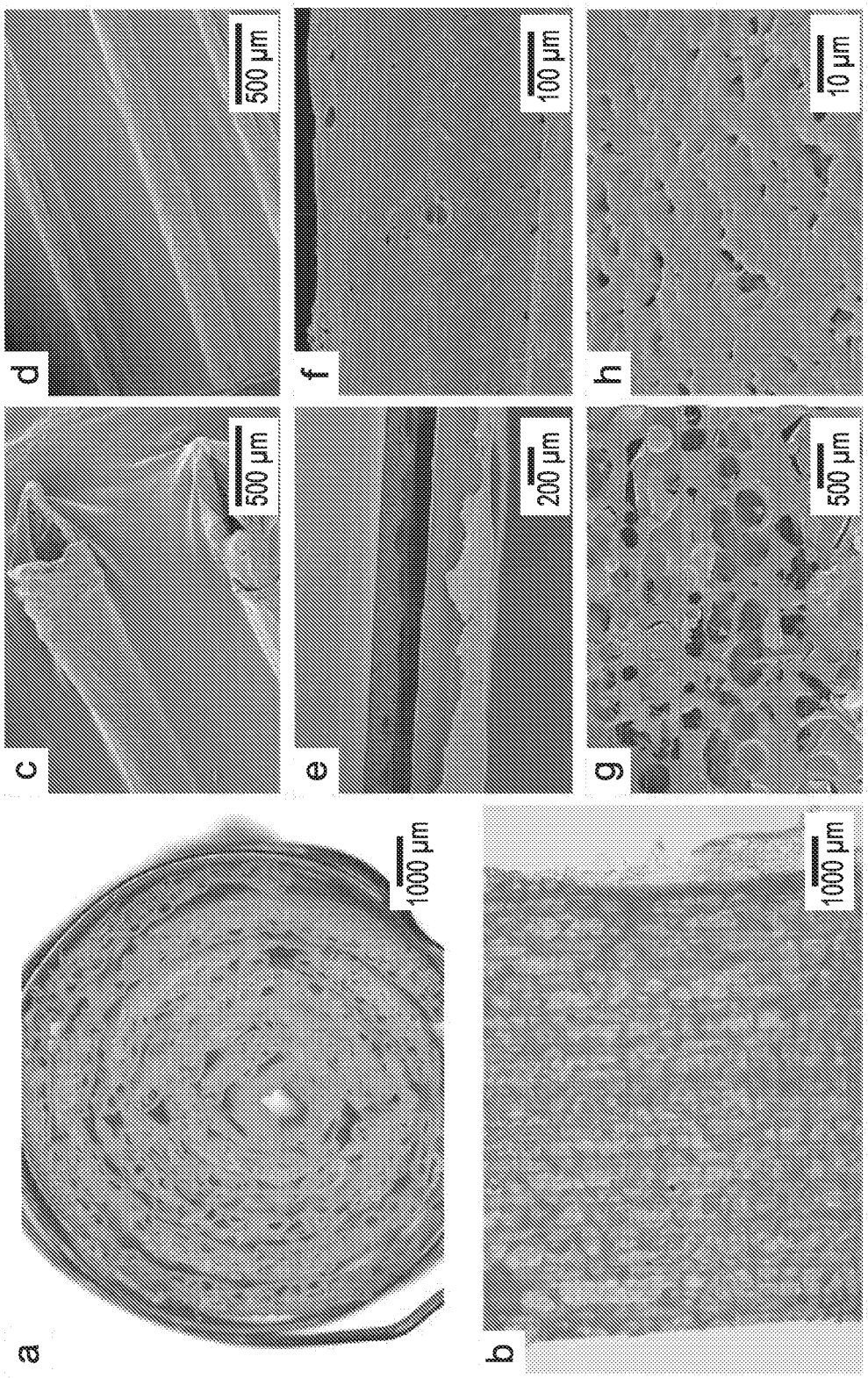


FIG. 3

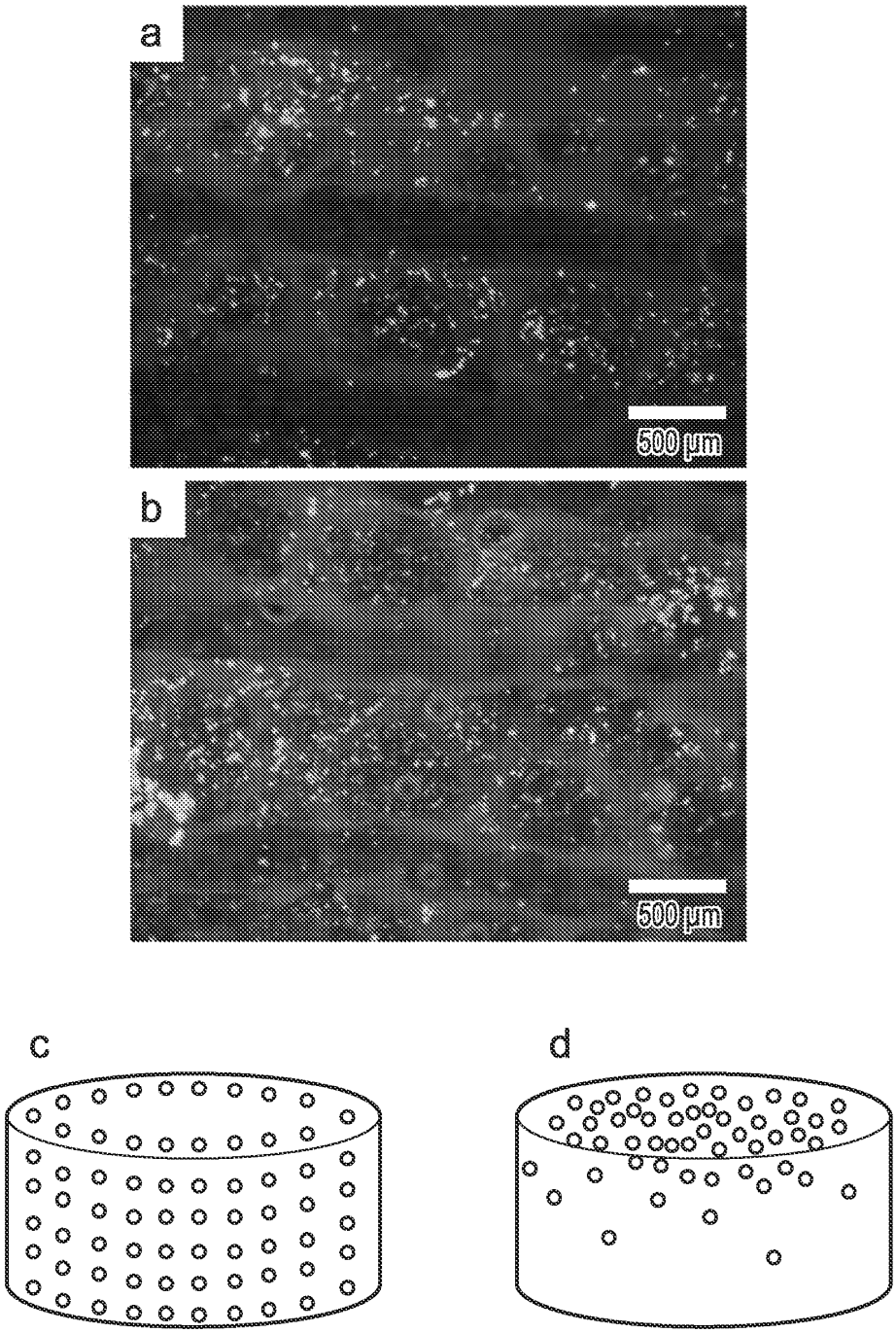


FIG. 4

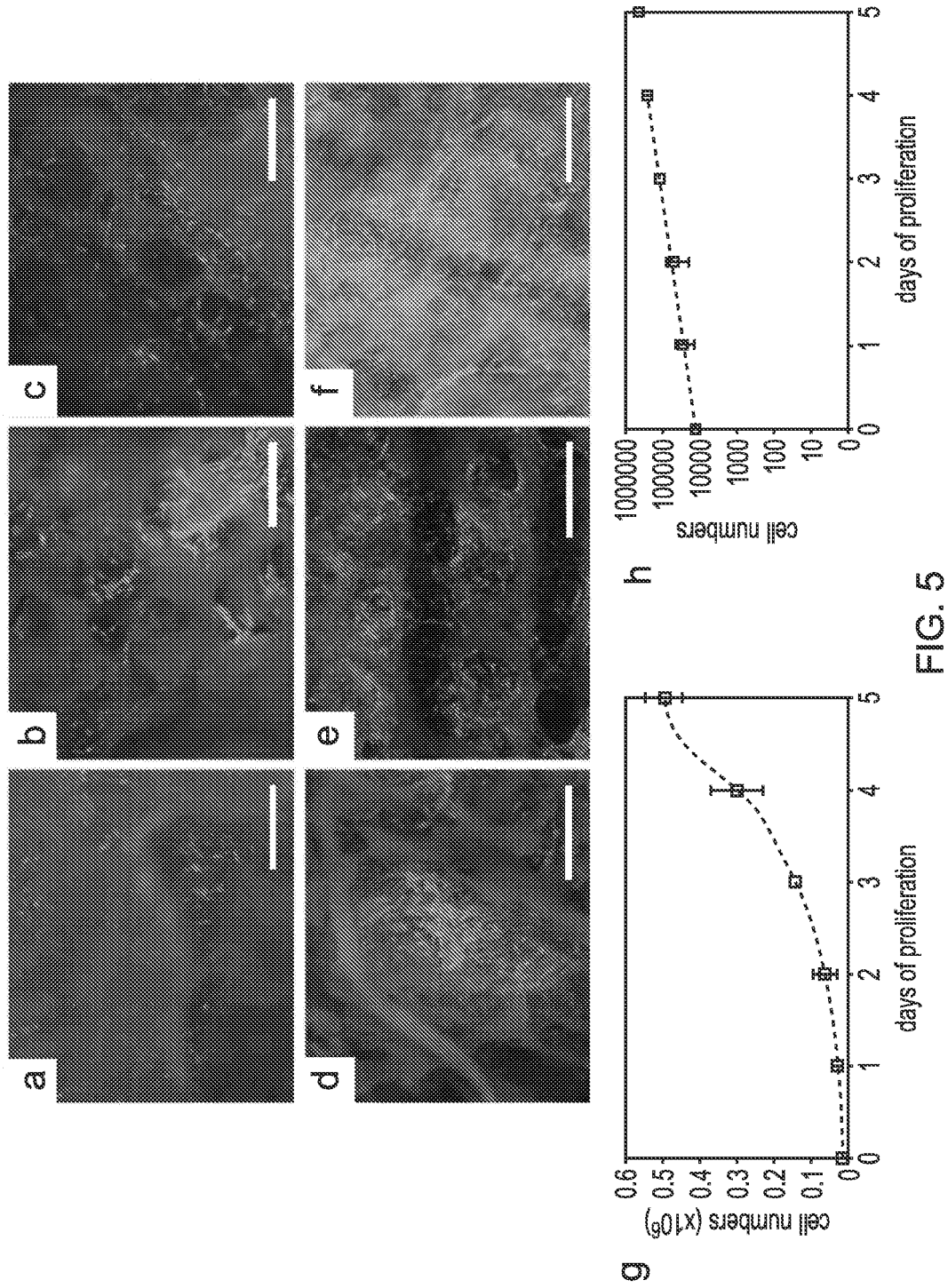

a
b
c
d
e
f
g
cell numbers (x10^5)
0.6
0.5
0.4
0.3
0.2
0.1
0
0
1
2
3
4
5
days of proliferation
h
cell numbers
1000000
100000
10000
1000
100
10
0
0
1
2
3
4
5
days of proliferation

FIG. 5

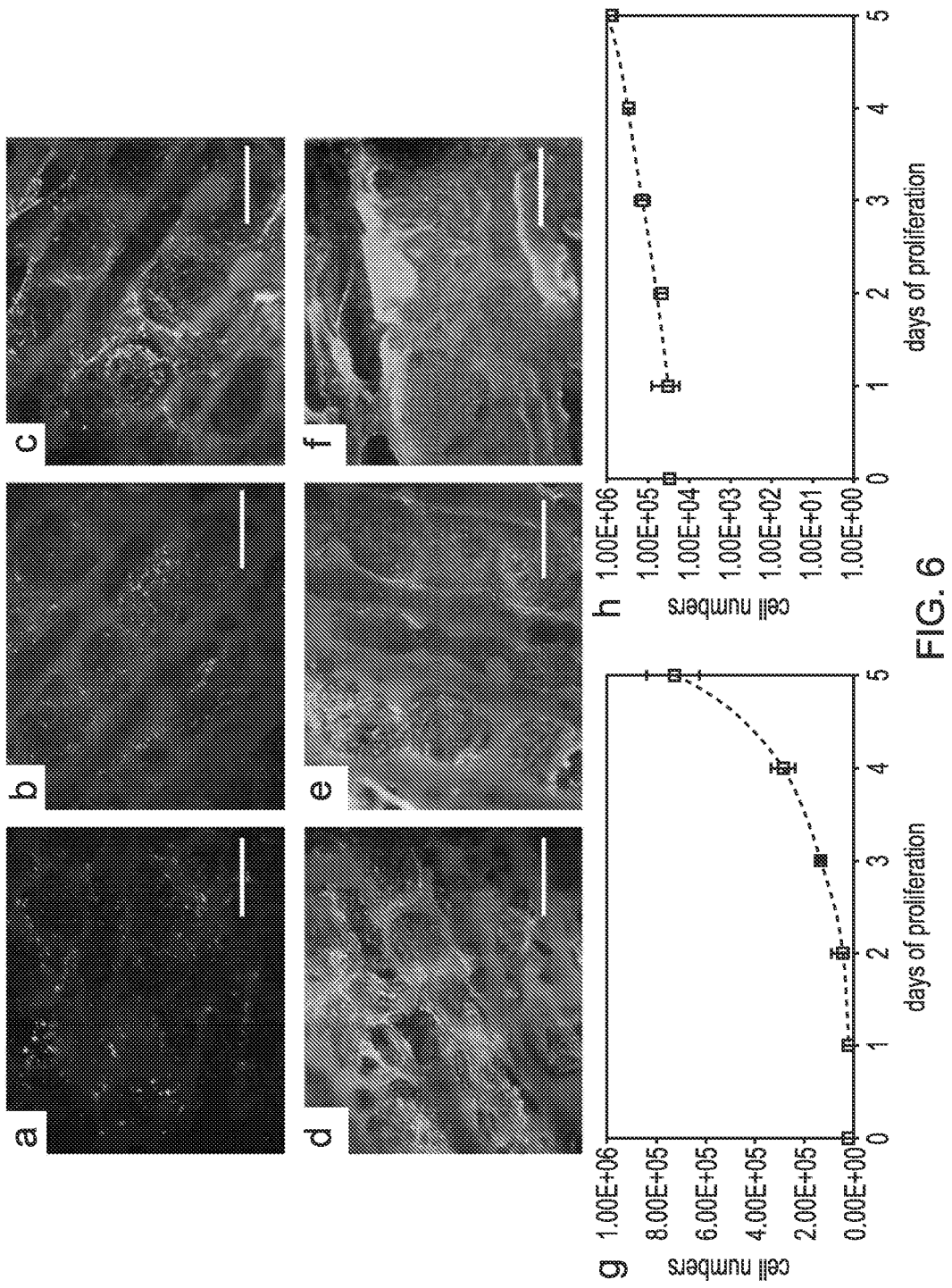

a
b
c
d
e
f
g
h
cell numbers
days of proliferation
0.00E+00
2.00E+05
4.00E+05
6.00E+05
8.00E+05
1.00E+06
1.00E+00
1.00E+01
1.00E+02
1.00E+03
1.00E+04
1.00E+05
1.00E+06
0
1
2
3
4
5

FIG. 6

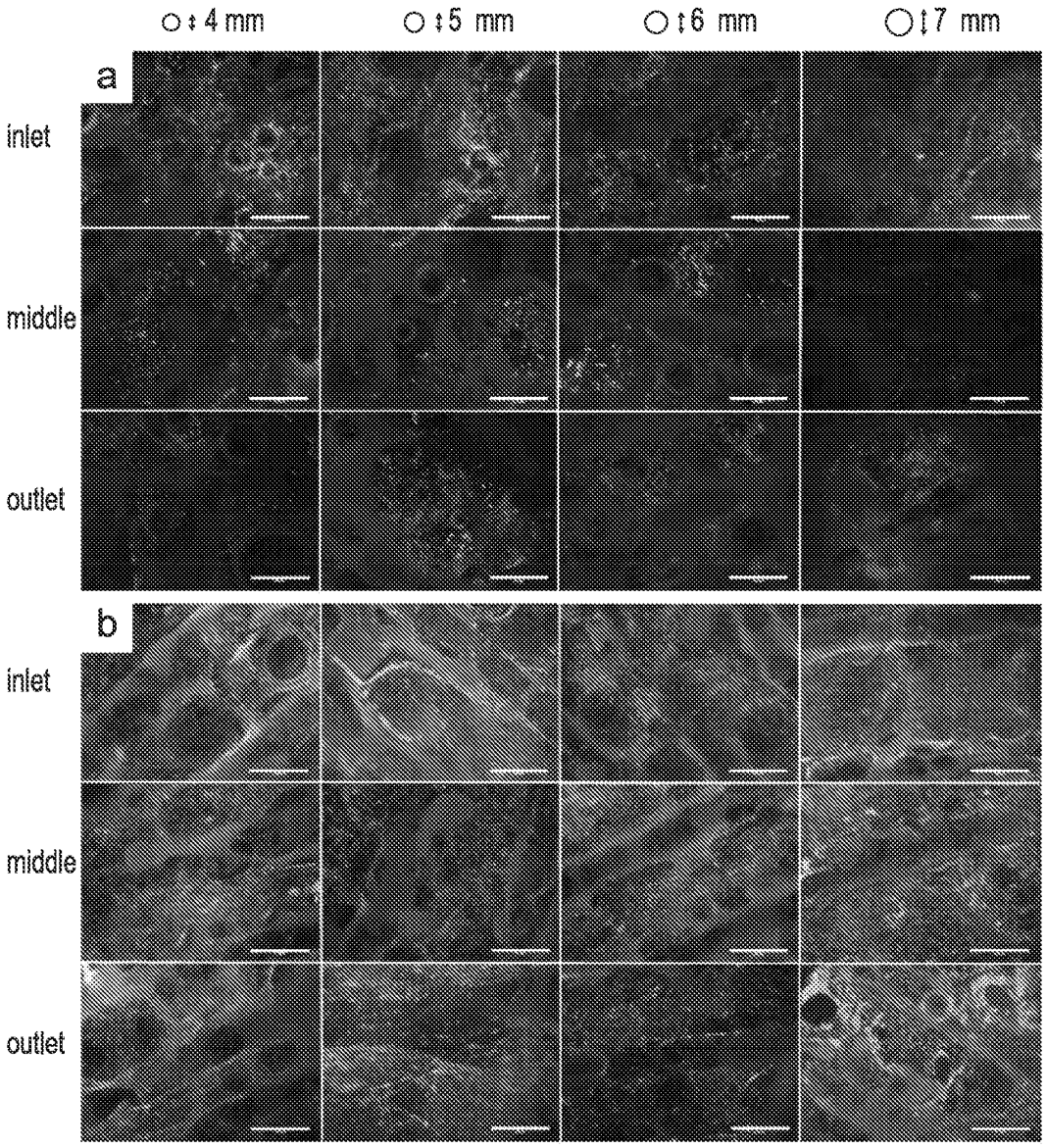


FIG. 7

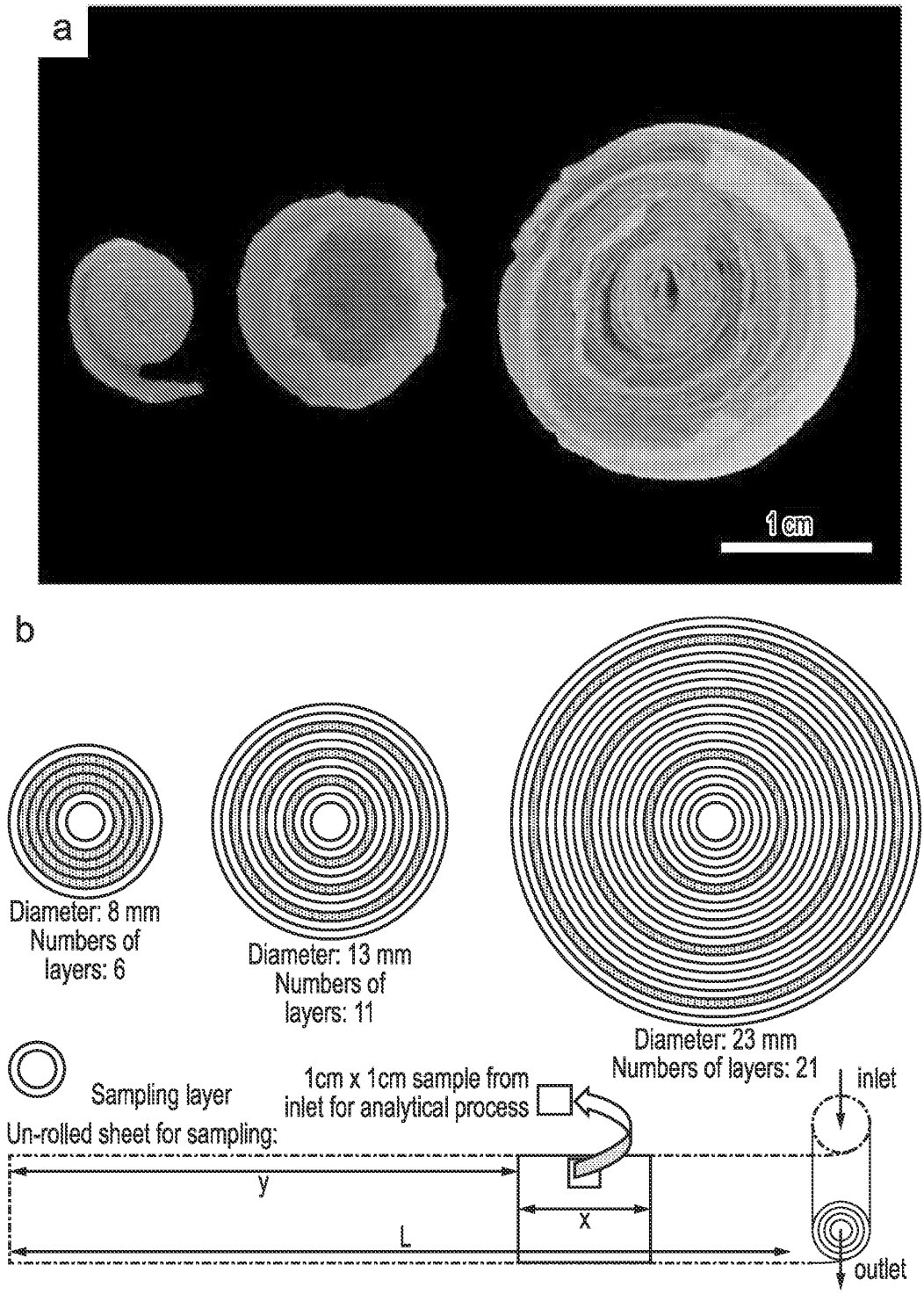

a
1 cm
b
Diameter: 8 mm
Numbers of
layers: 6
Diameter: 13 mm
Numbers of
layers: 11
Diameter: 23 mm
Numbers of layers: 21
Sampling layer
1cm x 1cm sample from
inlet for analytical process
inlet
Un-rolled sheet for sampling:
y
x
L
outlet

FIG. 8

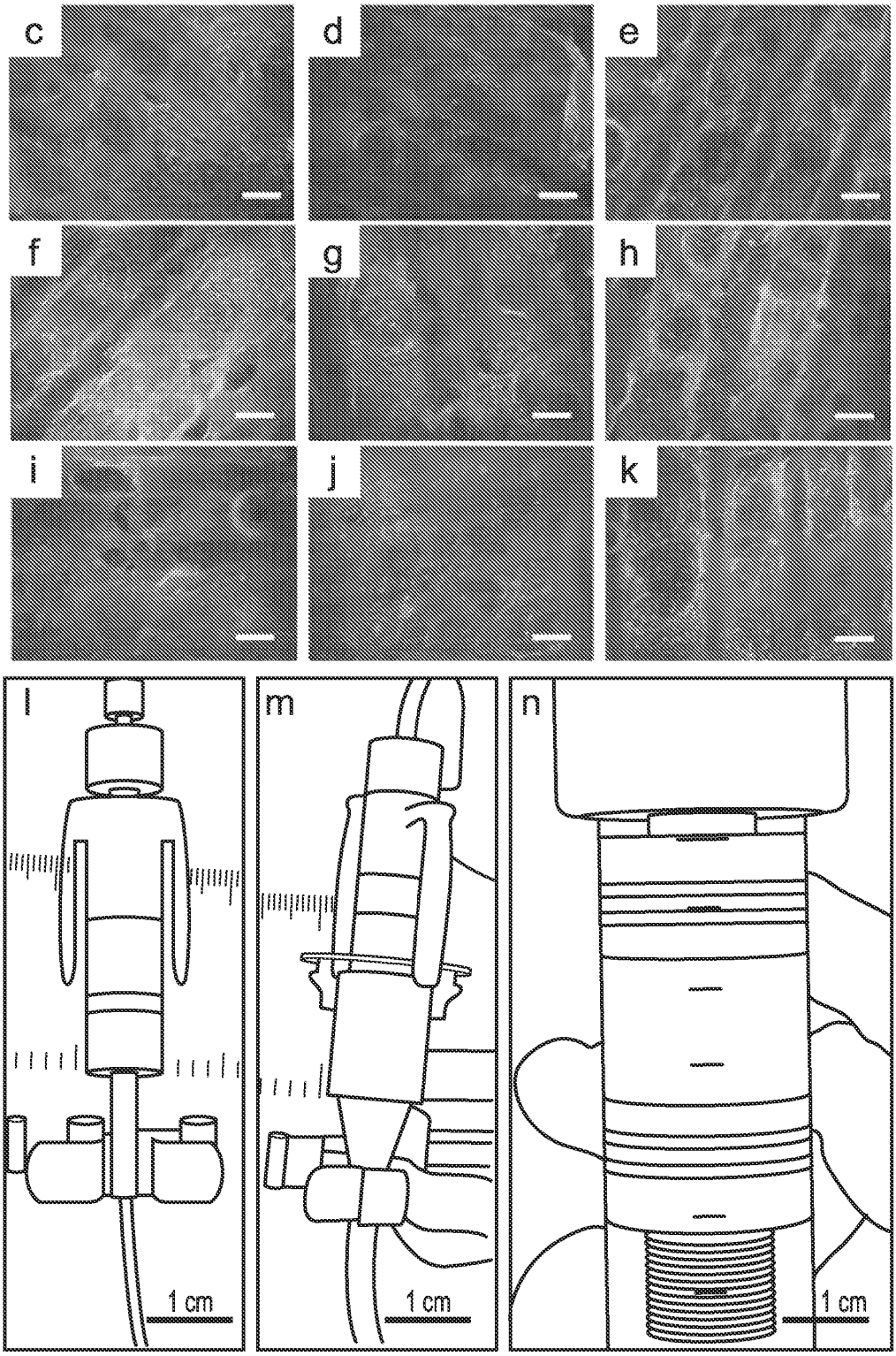


FIG. 8 continued

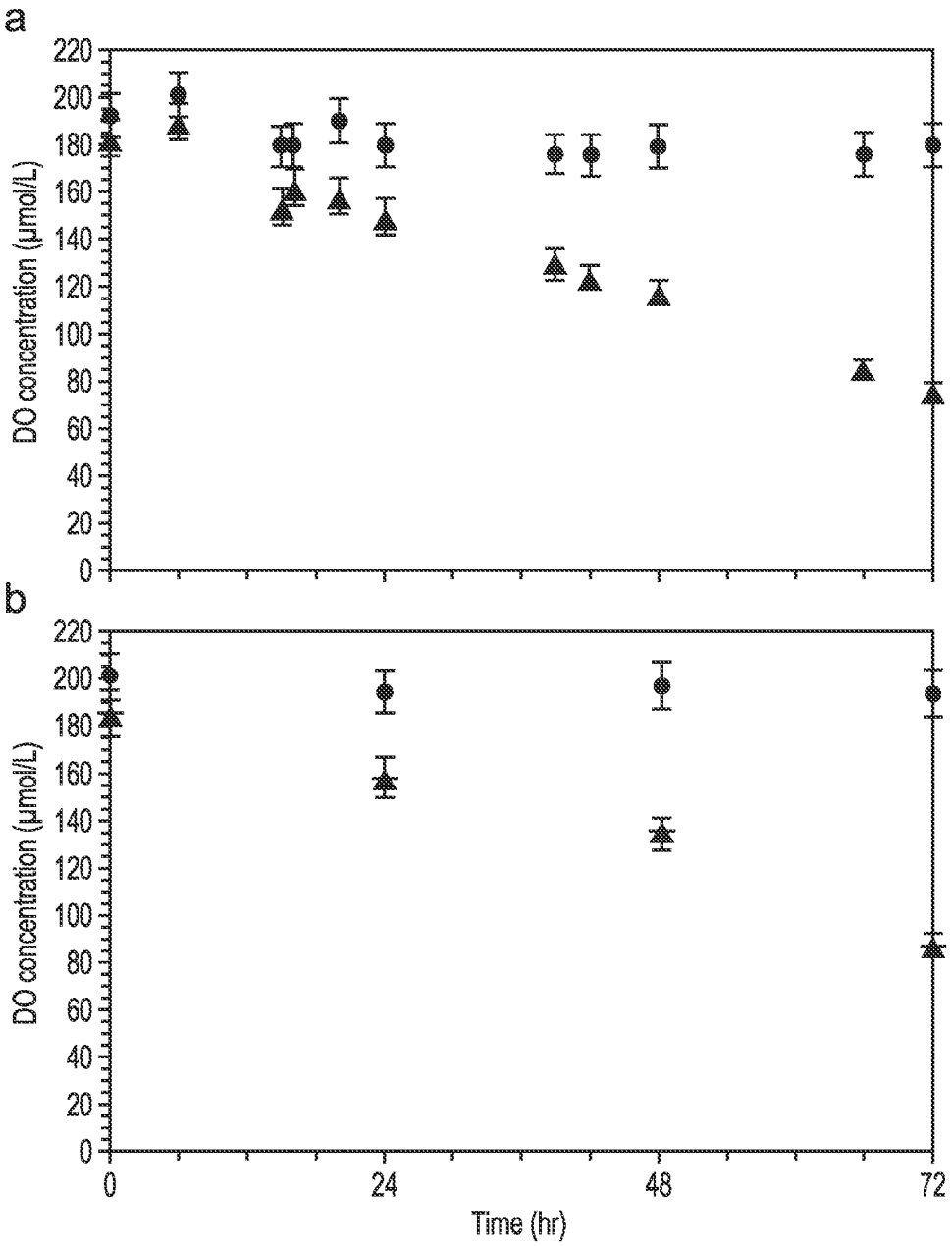

a
b
DO concentration (µmol/L)
DO concentration (µmol/L)
0
20
40
60
80
100
120
140
160
180
200
220
0
24
48
72
Time (hr)

FIG. 9

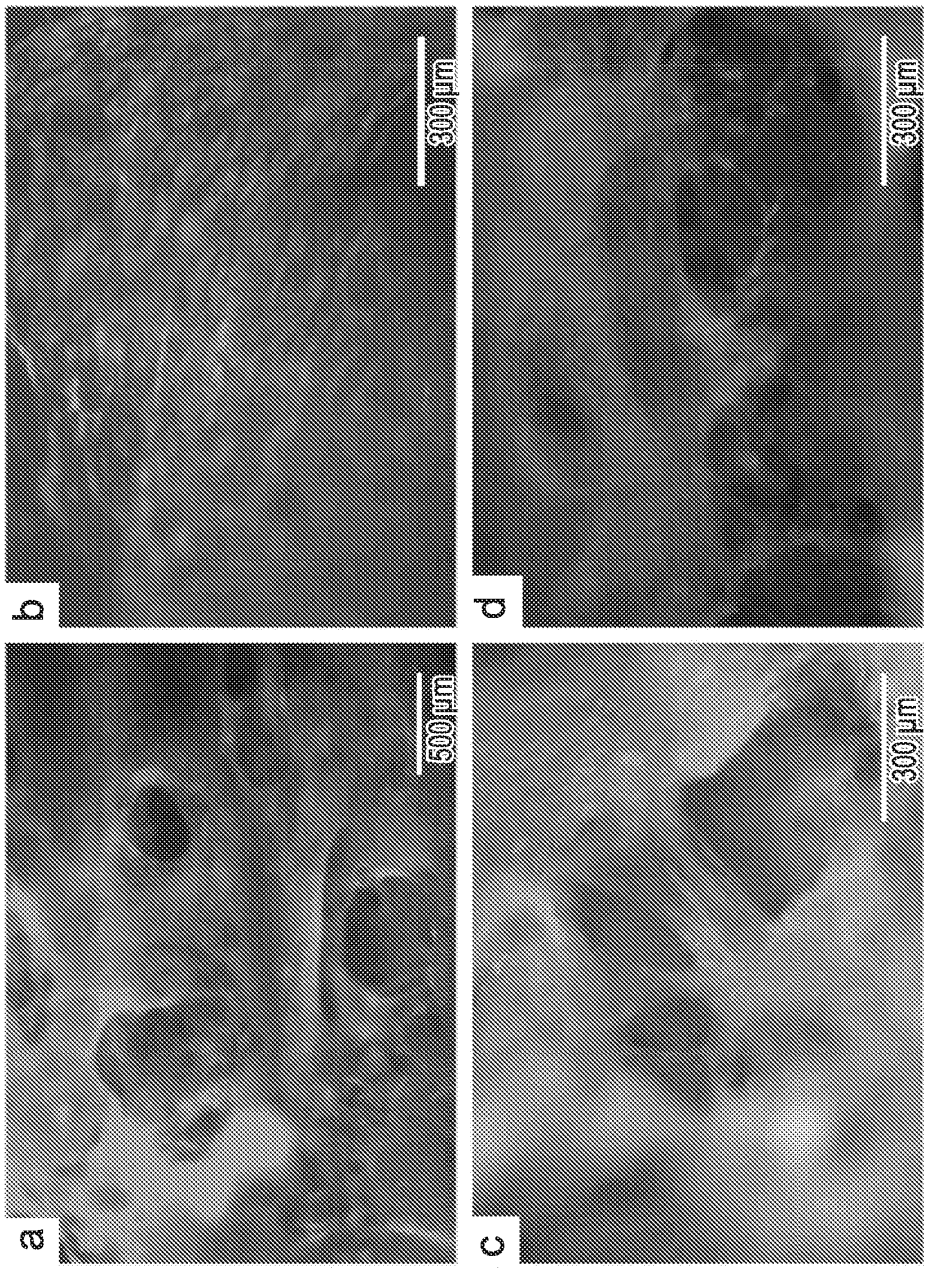


FIG. 10

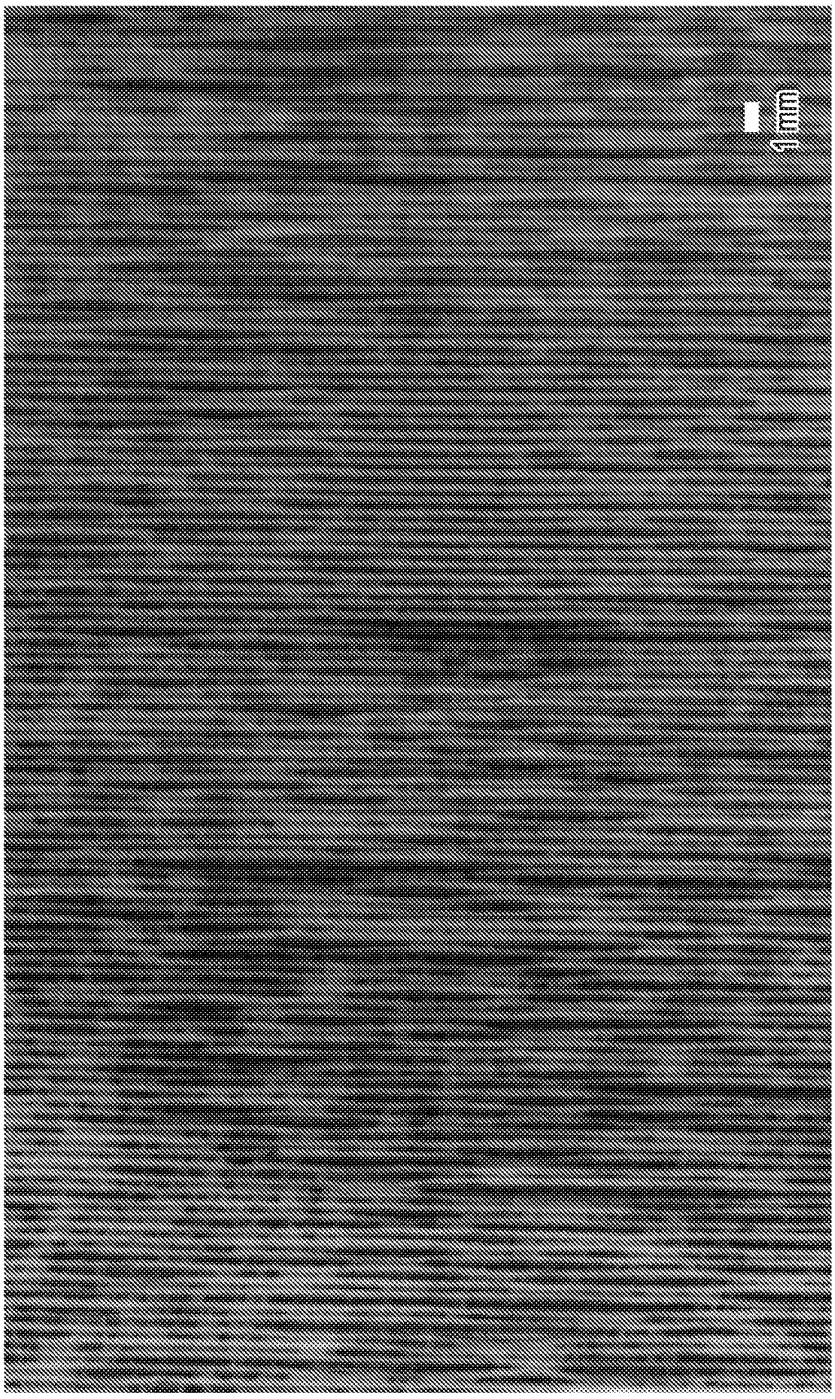


FIG. 11

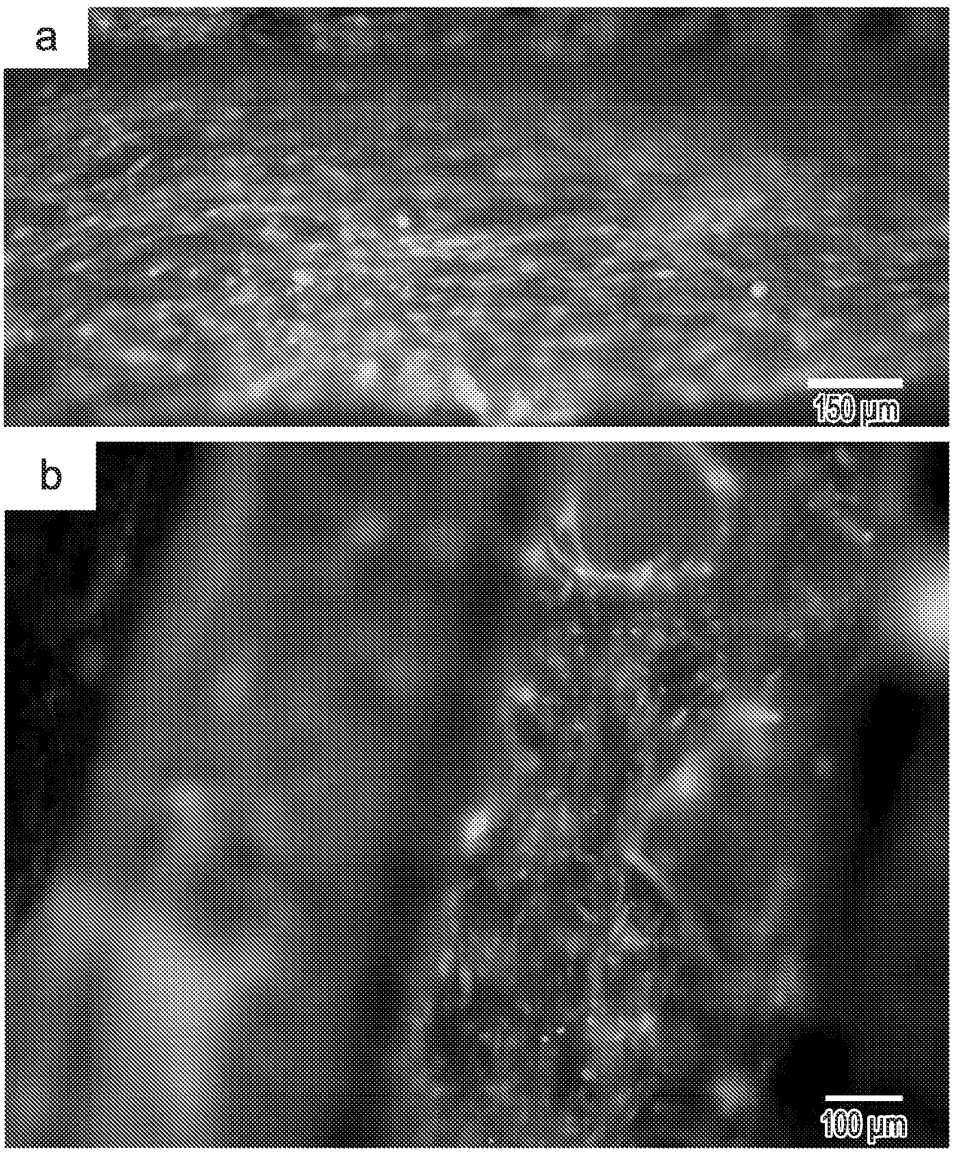


FIG. 12

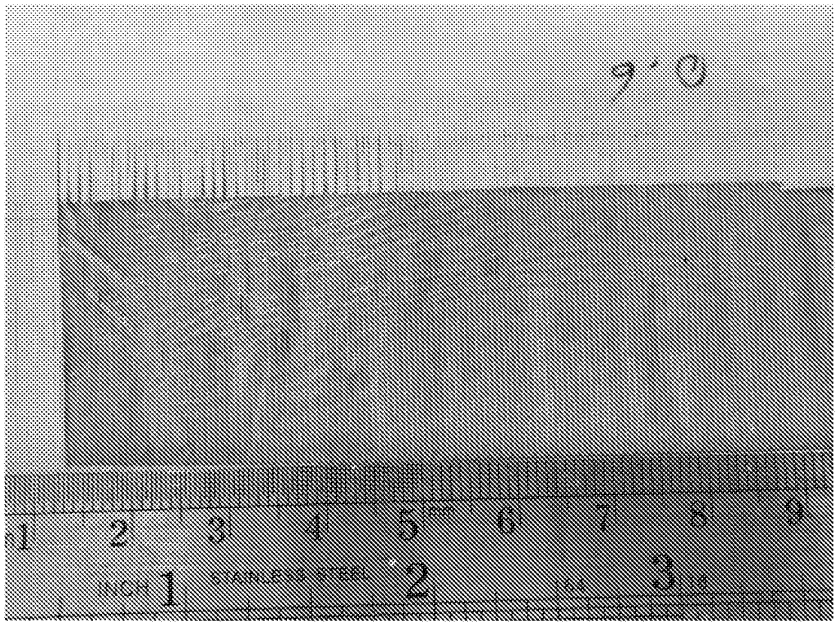


FIG. 13

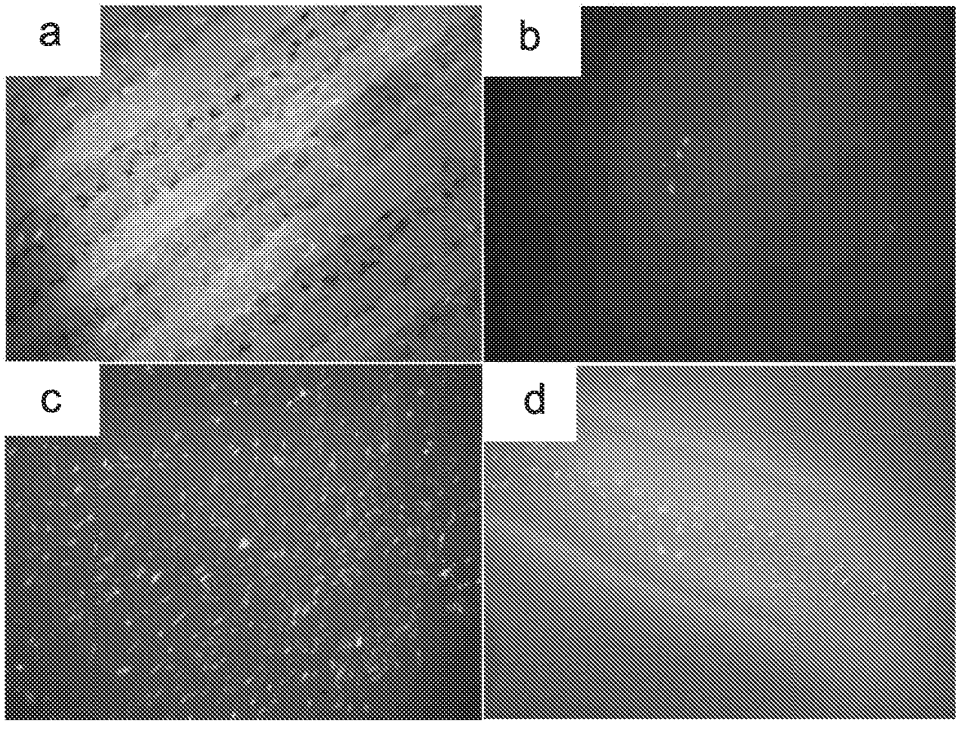


FIG. 14

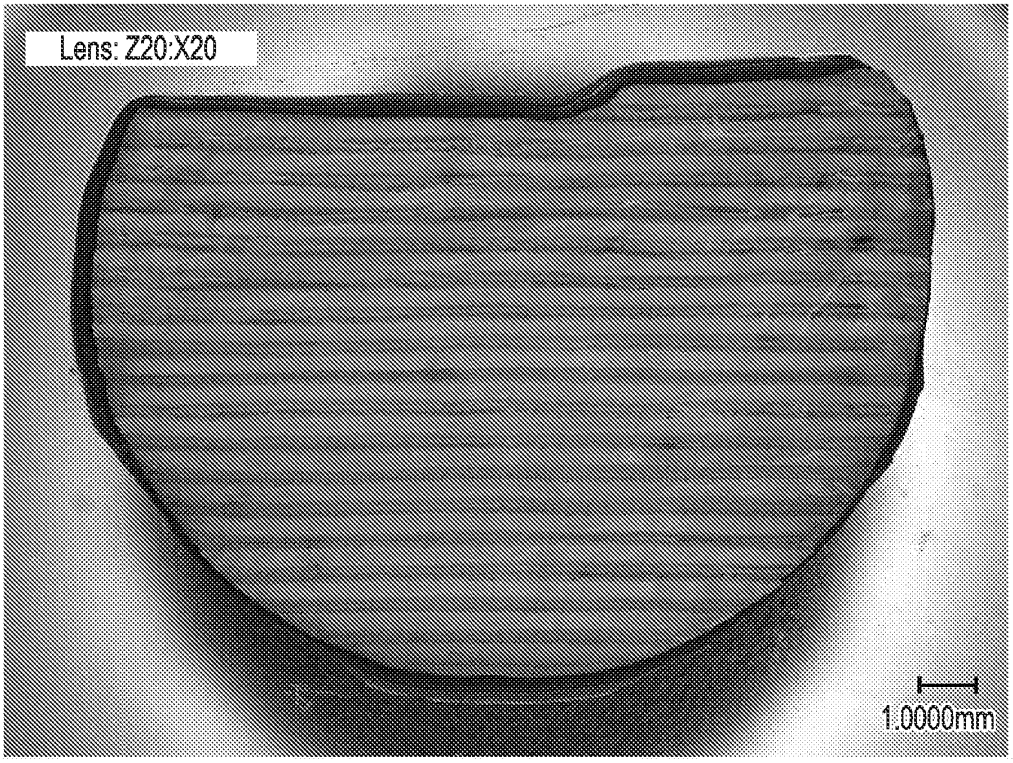


FIG. 15

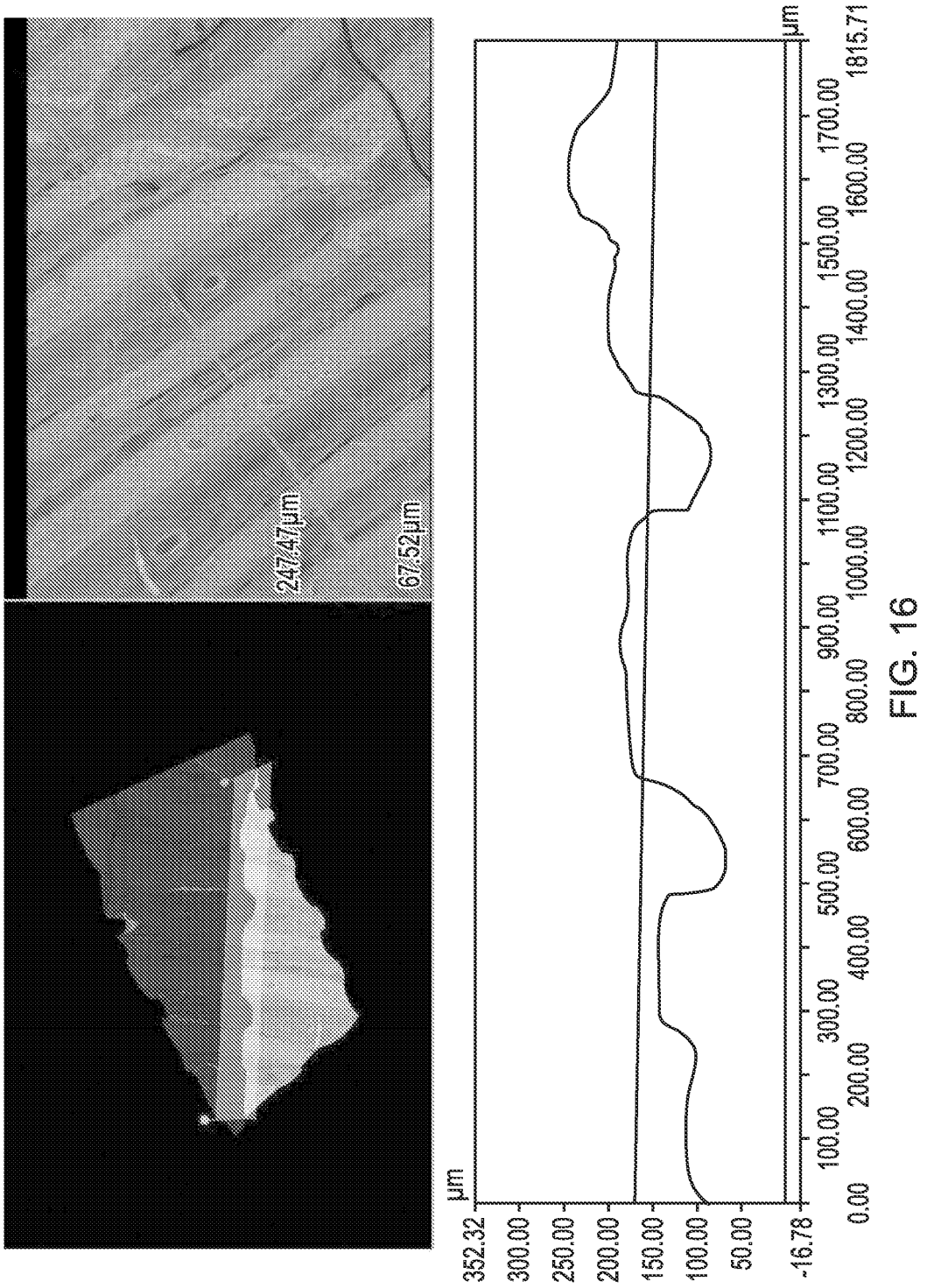

247.47µm
67.52µm
µm
352.32
300.00
250.00
200.00
150.00
100.00
50.00
-16.78
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
800.00
900.00
1000.00
1100.00
1200.00
1300.00
1400.00
1500.00
1600.00
1700.00
1815.71

FIG. 16

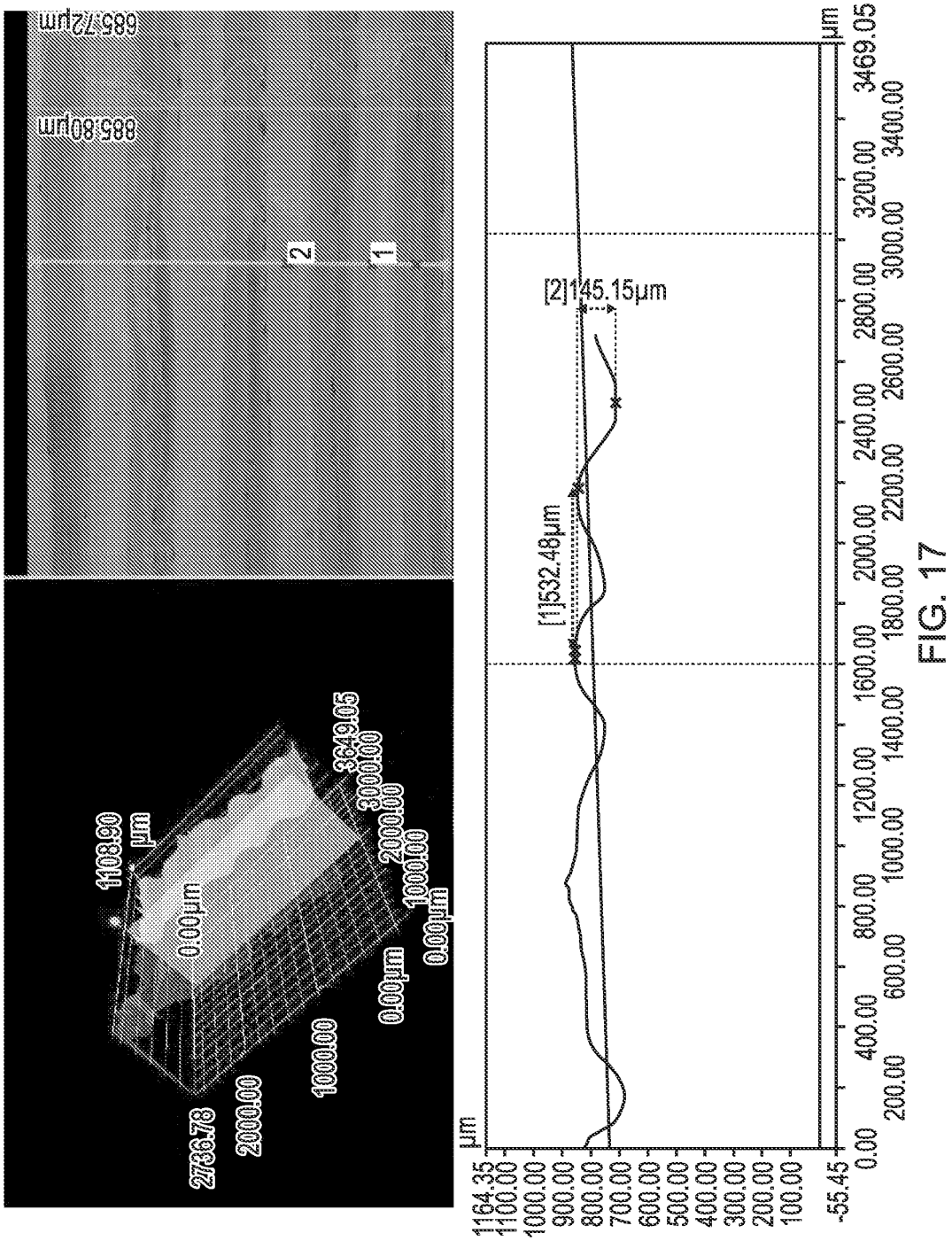

885.72μm
885.80μm
2
1
1108.90
μm
0.00μm
3349.05
3000.00
2000.00
1000.00
0.00μm
0.00μm
2736.78
2000.00
1000.00
μm
[2]145.15μm
[1]532.48μm
μm
1164.35
1100.00
1000.00
900.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
-55.45
0.00
200.00
400.00
600.00
800.00
1000.00
1200.00
1400.00
1600.00
1800.00
2000.00
2200.00
2400.00
2600.00
2800.00
3000.00
3200.00
3400.00
3469.05

FIG. 17

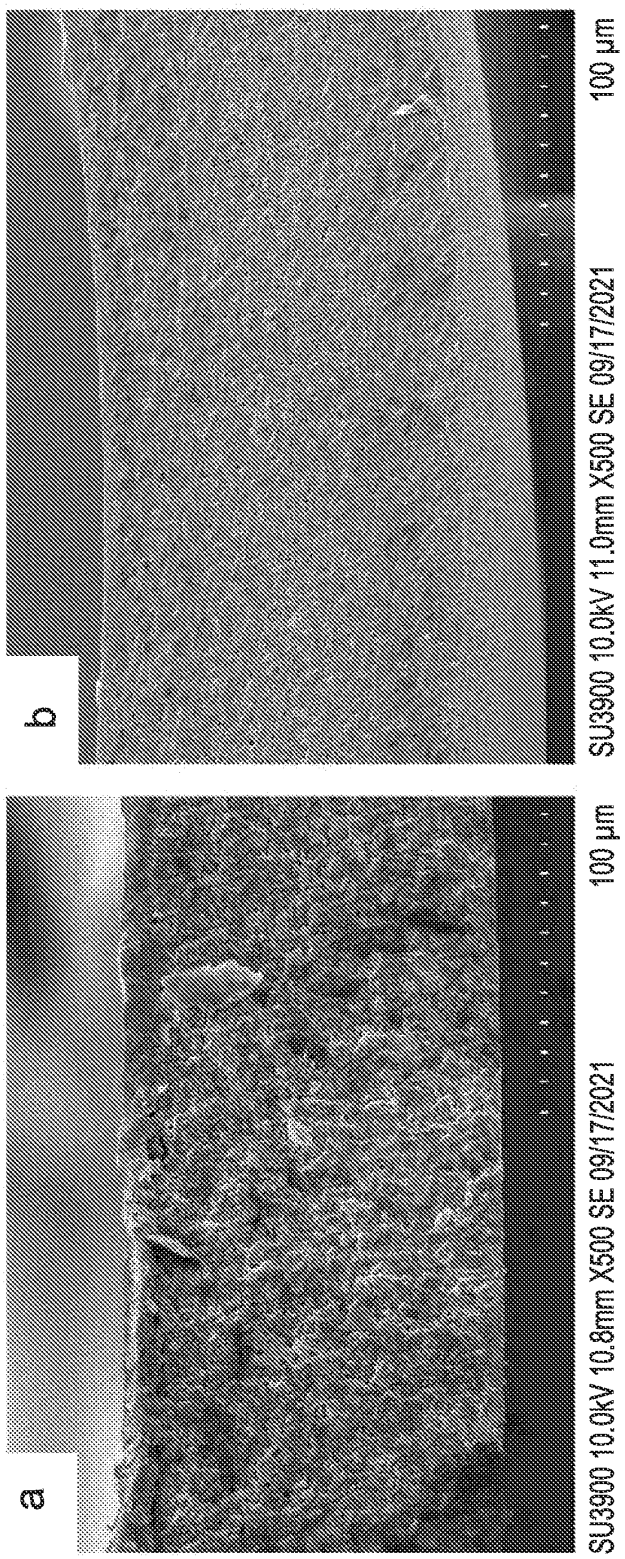

a
SU3900 10.0kV 10.8mm X500 SE 09/17/2021
100 µm
b
SU3900 10.0kV 11.0mm X500 SE 09/17/2021
100 µm

FIG. 18

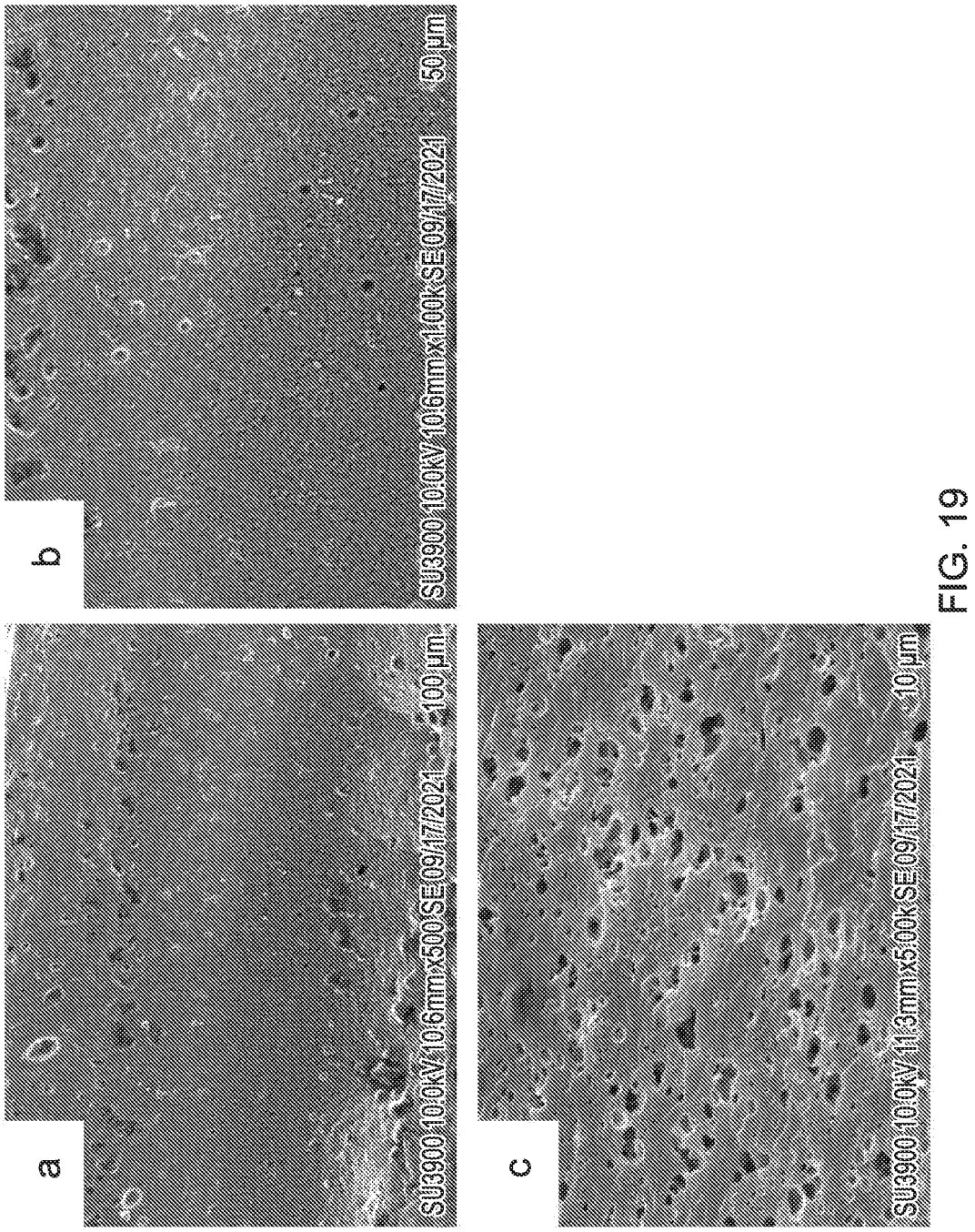

a
SU3900 10.0kV 10.6mm x500 SE 09/17/2021 100 µm
b
SU3900 10.0kV 10.6mm x1.00k SE 09/17/2021 50 µm
c
SU3900 10.0kV 11.3mm x5.00k SE 09/17/2021 10 µm

FIG. 19

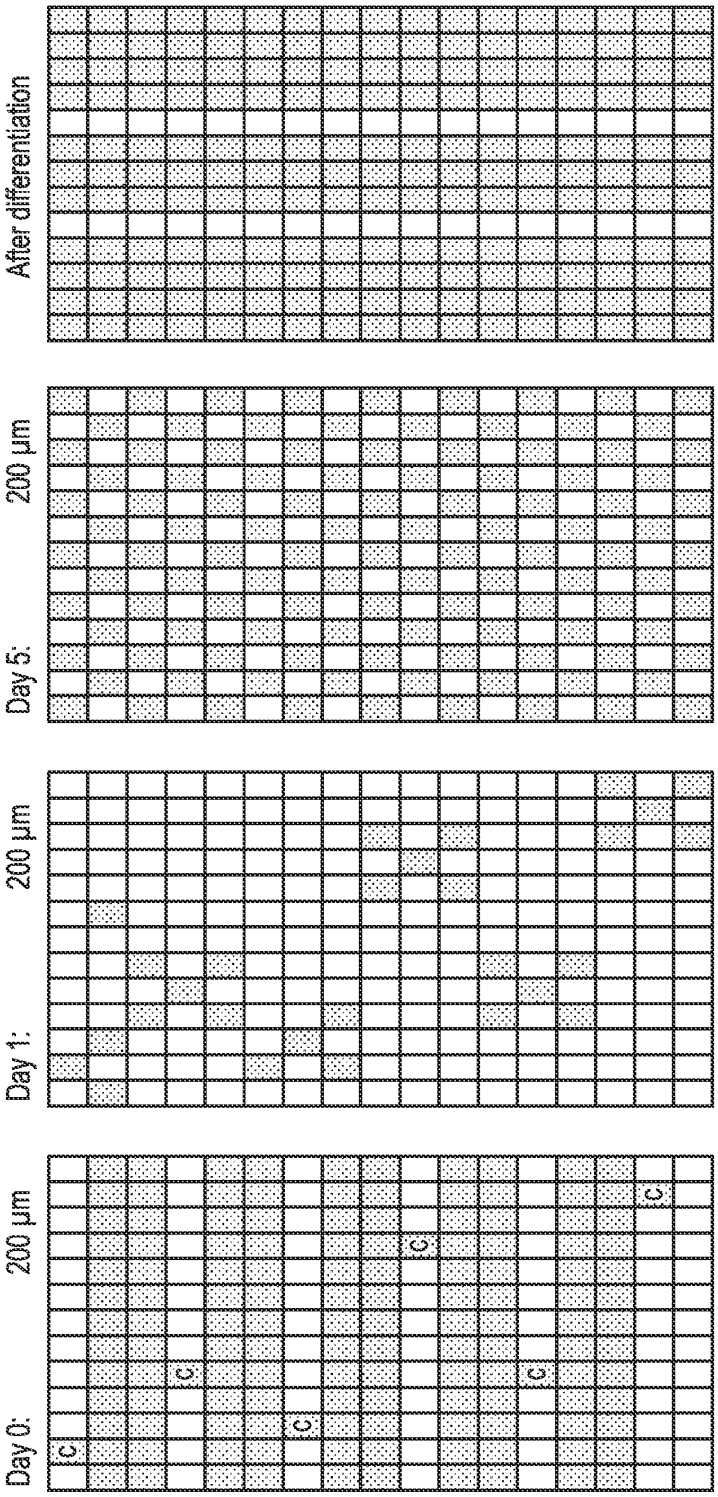


FIG. 20

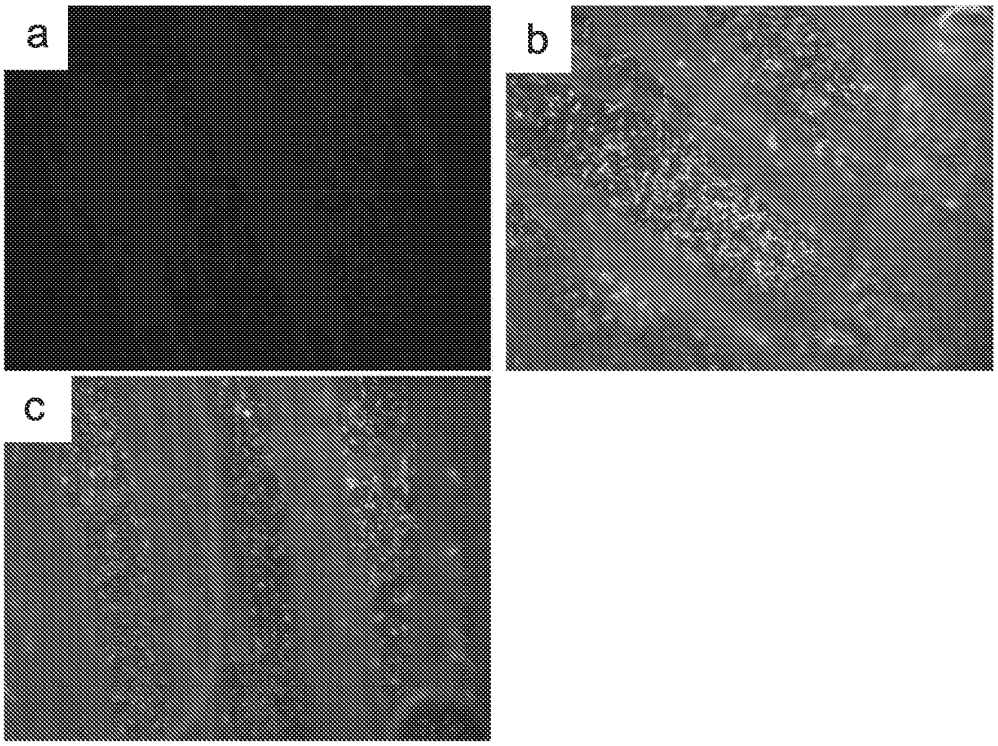


FIG. 21

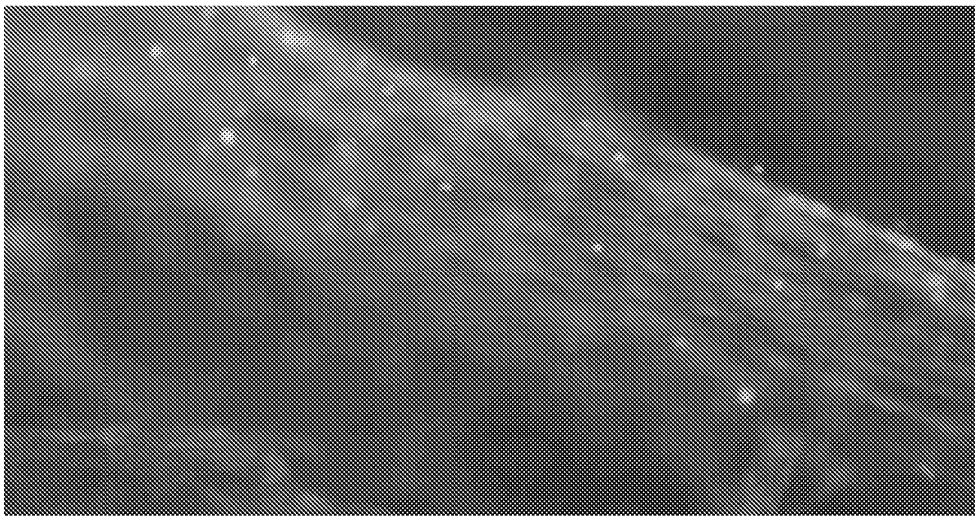


FIG. 22

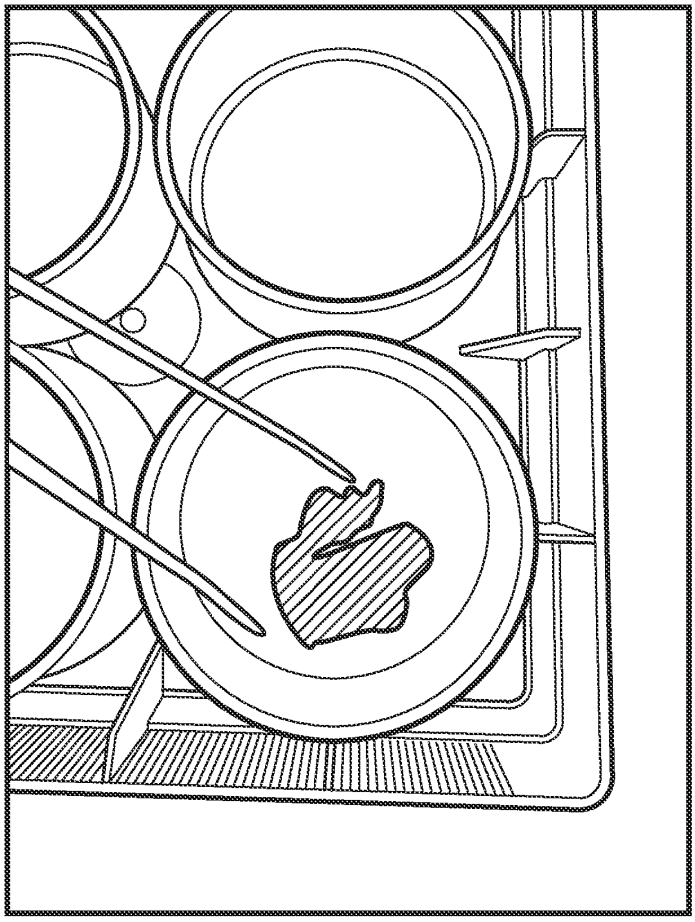


FIG. 23

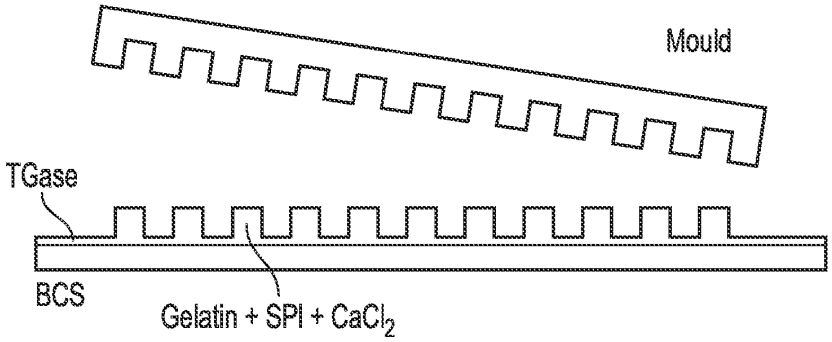
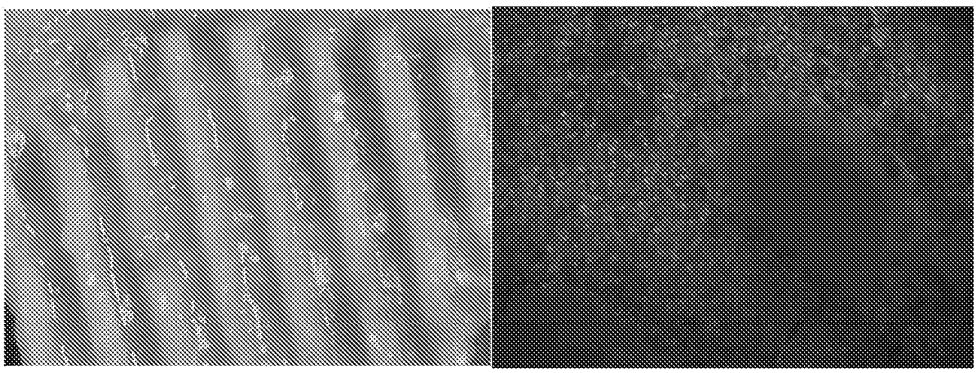


FIG. 24



a b

FIG. 25

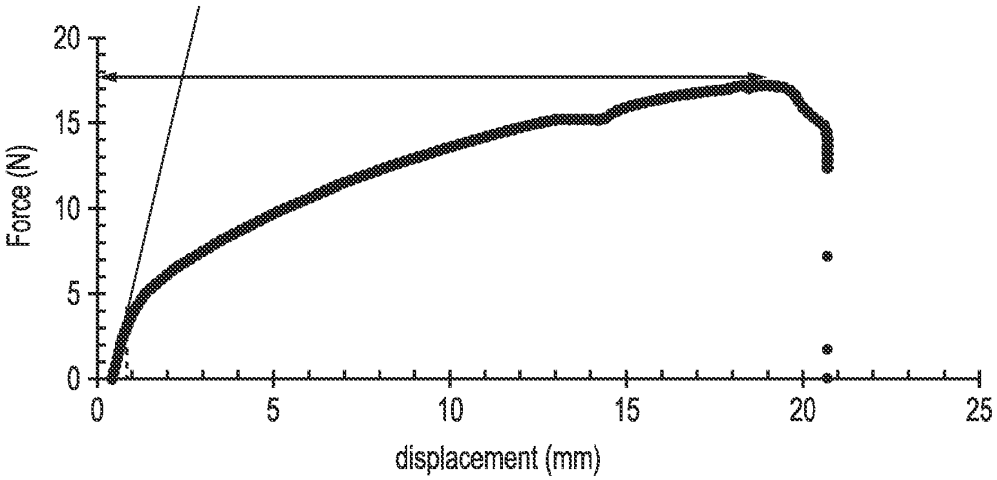

Force (N)
20
15
10
5
0
0
5
10
15
20
25
displacement (mm)

FIG. 26

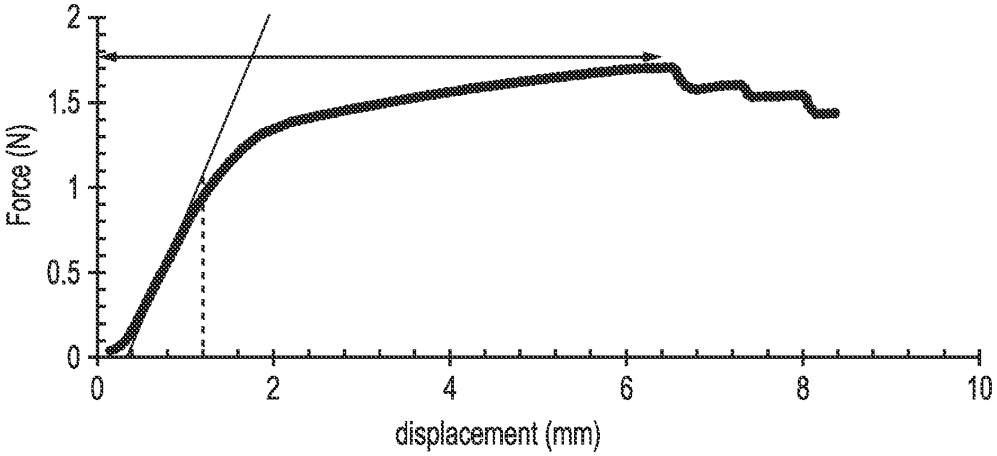

Force (N)
2
1.5
1
0.5
0
0
2
4
6
8
10
displacement (mm)

FIG. 27

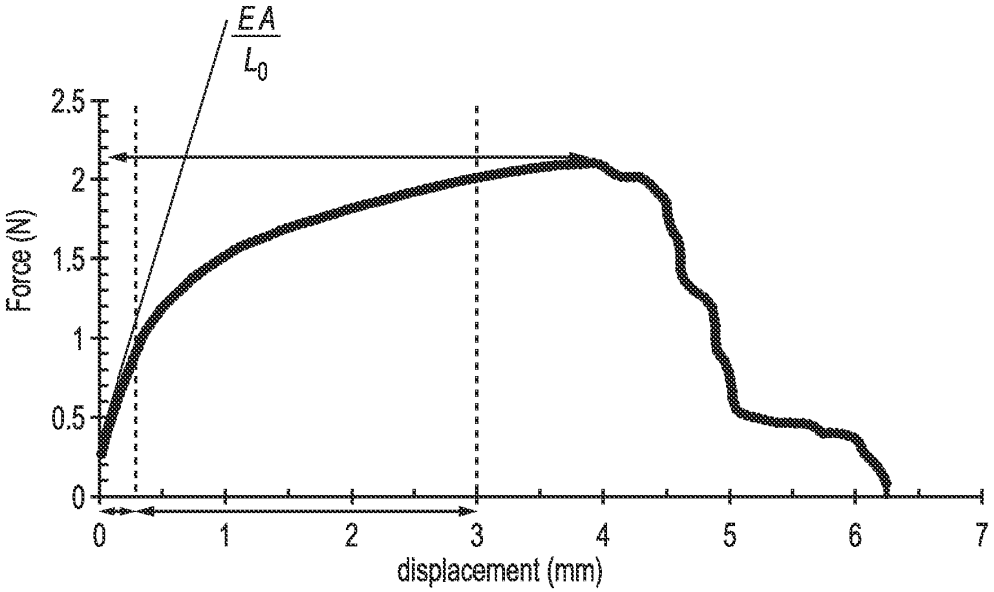

EA
L0
Force (N)
displacement (mm)
0
0.5
1
1.5
2
2.5
3
4
5
6
7

FIG. 28

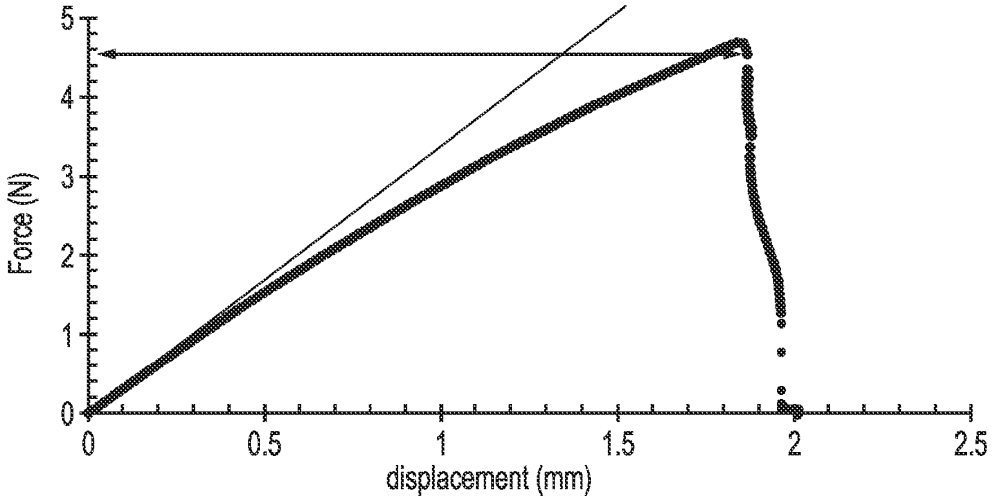

Force (N)
displacement (mm)
0
1
2
3
4
5
0.5
1.5
2.5

FIG. 29

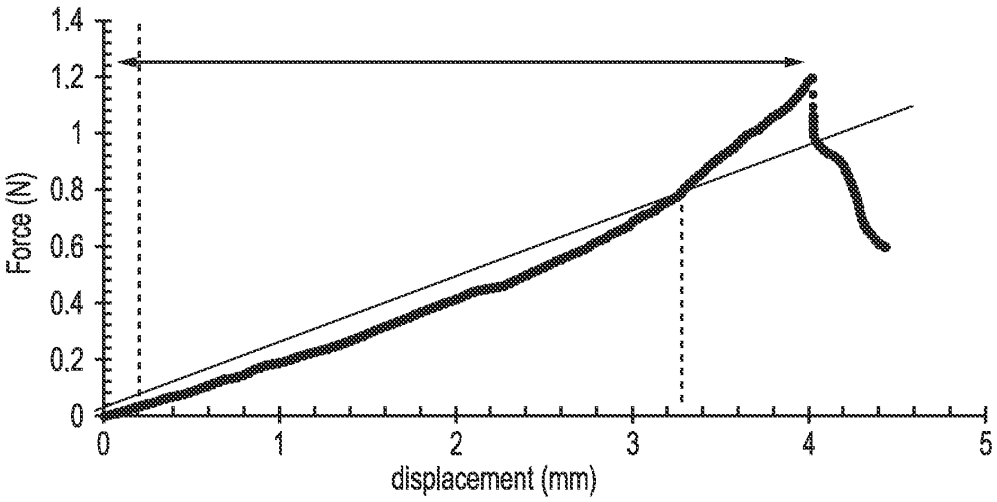


FIG. 30