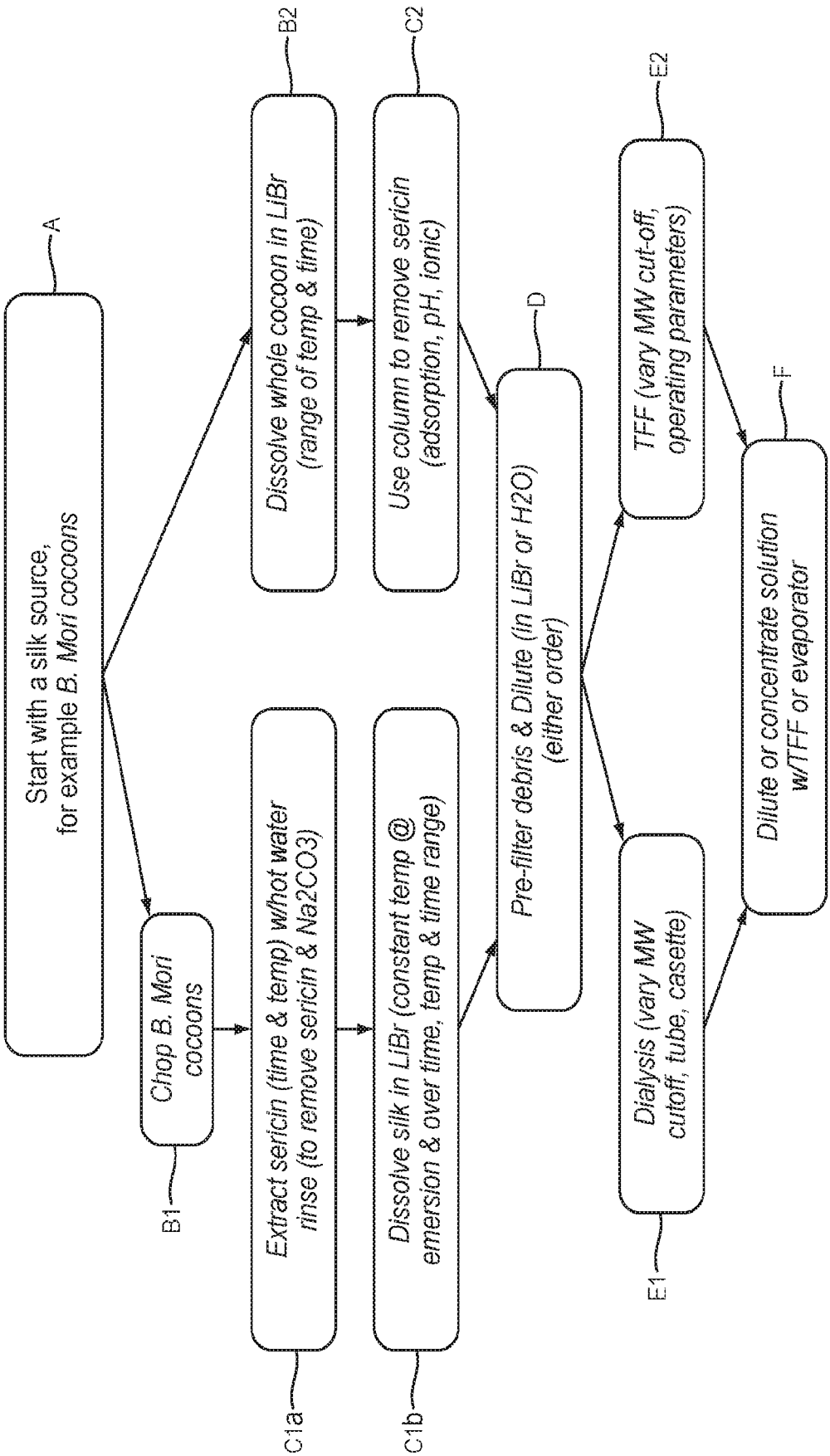

Start with a silk source, for example B. Mori cocoons
A
Chop B. Mori cocoons
B1
Dissolve whole cocoon in LiBr (range of temp & time)
B2
Extract sericin (time & temp) w/hot water rinse (to remove sericin & Na2CO3)
C1a
Dissolve silk in LiBr (constant temp @ emersion & over time, temp & time range)
C1b
Use column to remove sericin (adsorption, pH, ionic)
C2
Pre-filter debris & Dilute (in LiBr or H2O) (either order)
D
Dialysis (vary MW cutoff, tube, casette)
E1
TFF (vary MW cut-off, operating parameters)
E2
Dilute or concentrate solution w/TFF or evaporator
F

FIG. 1

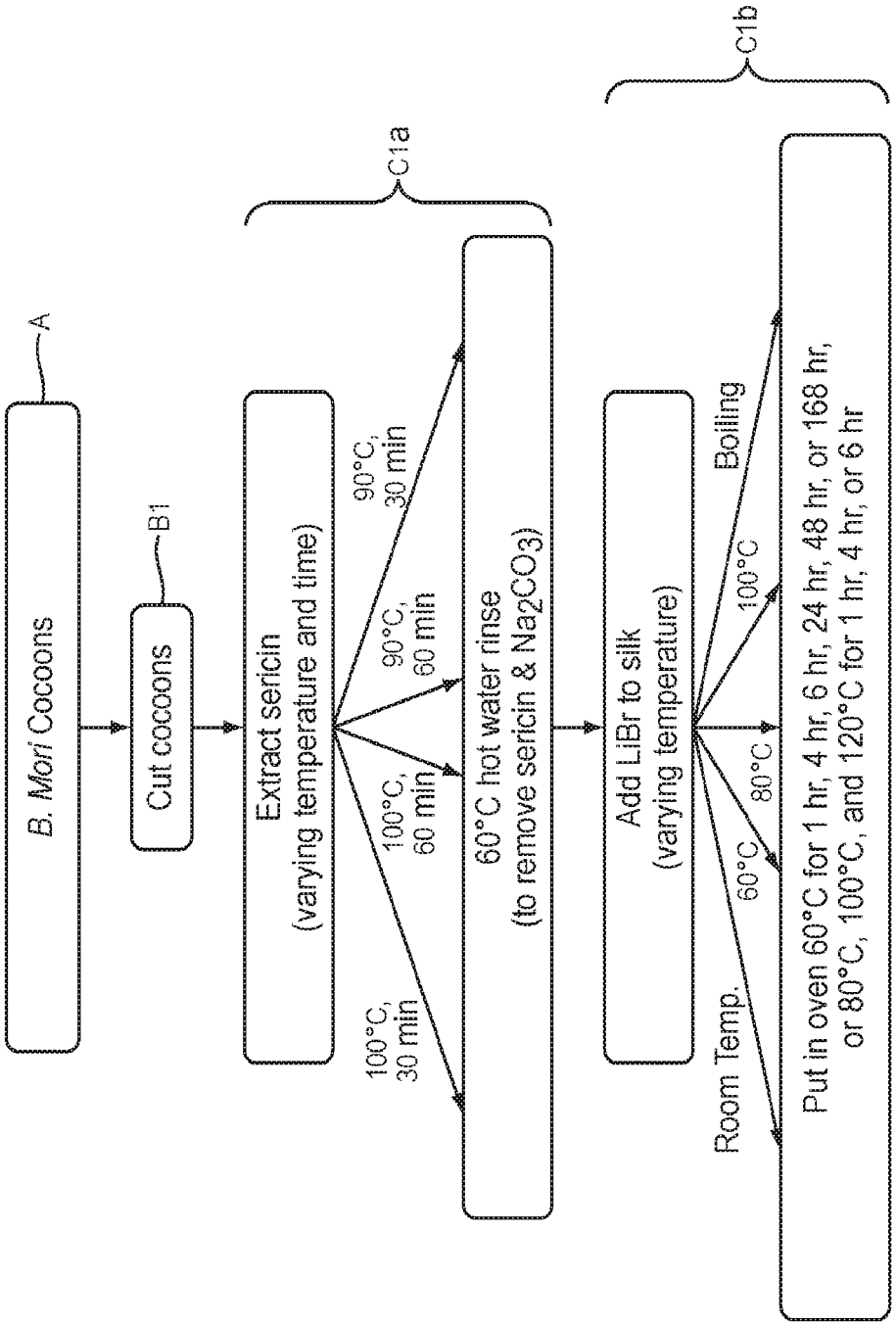

A
B. Mori Cocoons
B1
Cut cocoons
C1a
Extract sericin
(varying temperature and time)
90°C, 30 min
90°C, 60 min
100°C, 60 min
100°C, 30 min
60°C hot water rinse
(to remove sericin & Na2CO3)
C1b
Add LiBr to silk
(varying temperature)
Boiling
100°C
80°C
60°C
Room Temp.
Put in oven 60°C for 1 hr, 4 hr, 6 hr, 24 hr, 48 hr, or 168 hr,
or 80°C, 100°C, and 120°C for 1 hr, 4 hr, or 6 hr

FIG. 2



FIG. 3

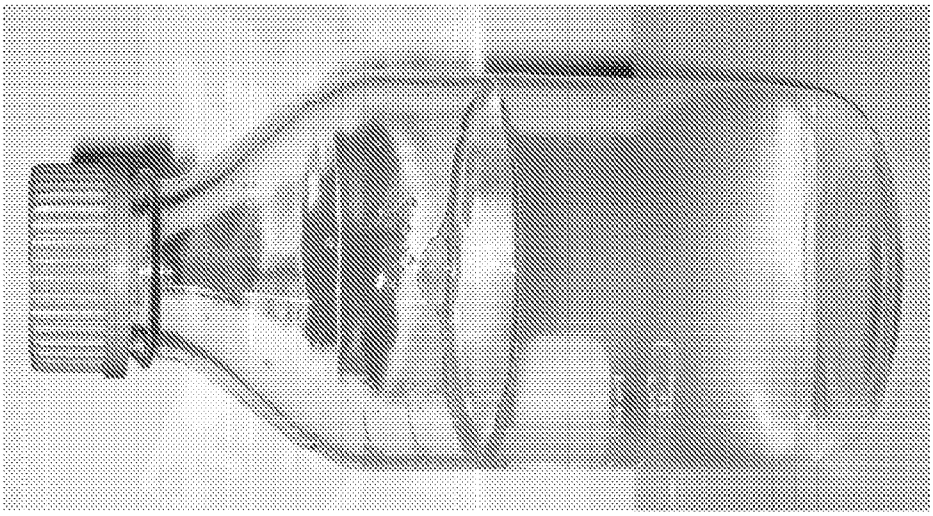


FIG. 4

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
4 Hours	Some undissolved silk	Some undissolved silk	Significant amount of undissolved silk	Significant amount of undissolved silk

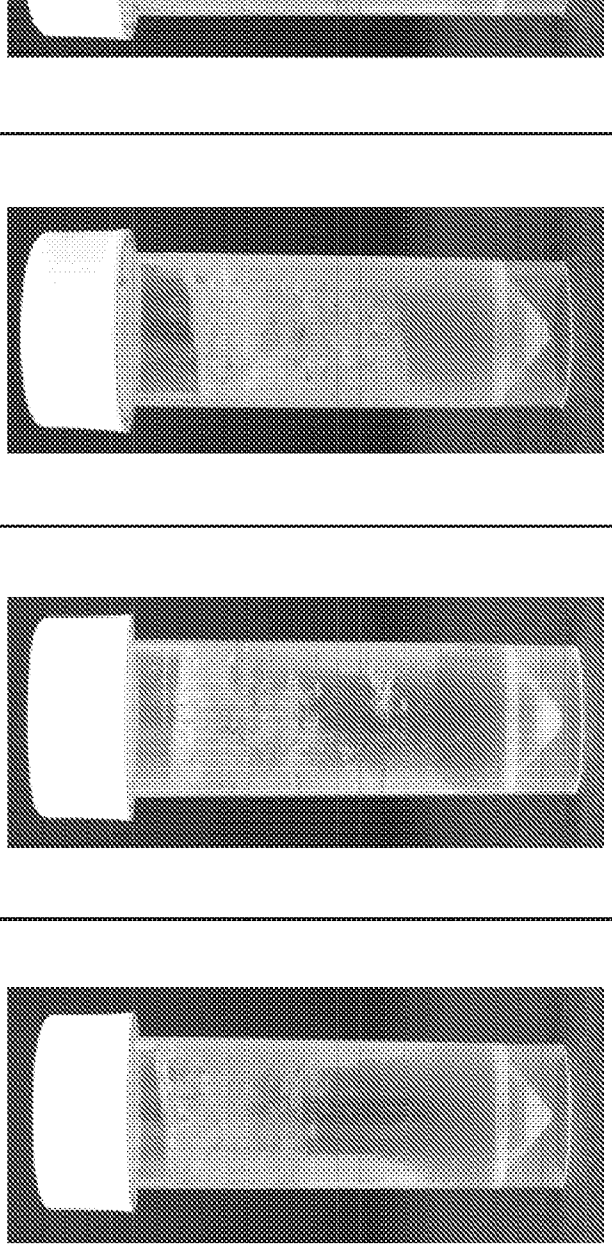


FIG. 5A FIG. 5B FIG. 5C FIG. 5D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
6 Hours	Some undissolved silk	Small amount of undissolved silk	Small amount of undissolved silk	Some undissolved silk

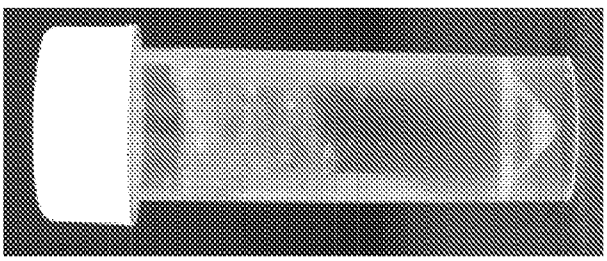


FIG. 6A

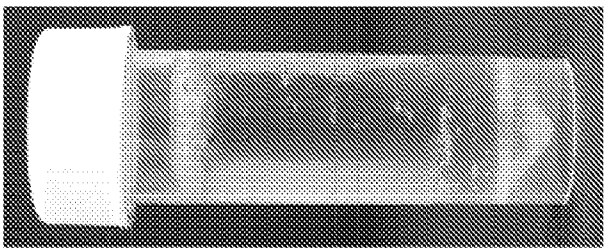


FIG. 6B

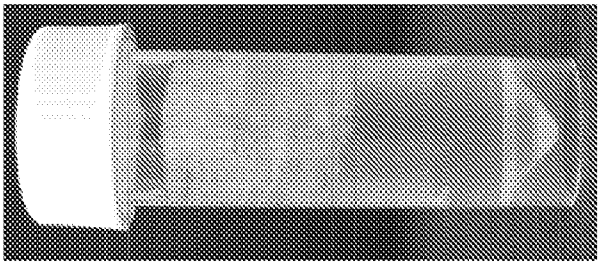


FIG. 6C

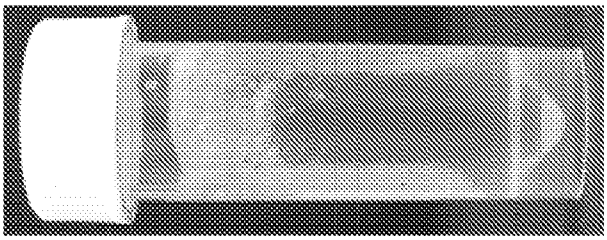


FIG. 6D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
8 Hours	Small amount of undissolved silk	Little to no undissolved silk	Significant amount of undissolved silk	Some undissolved silk

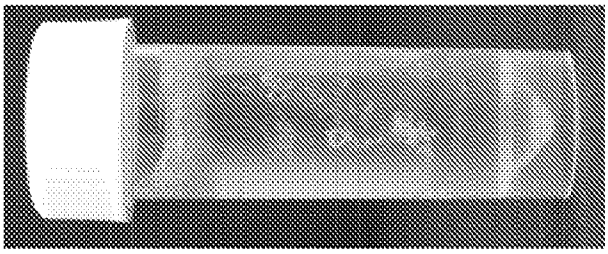


FIG. 7A

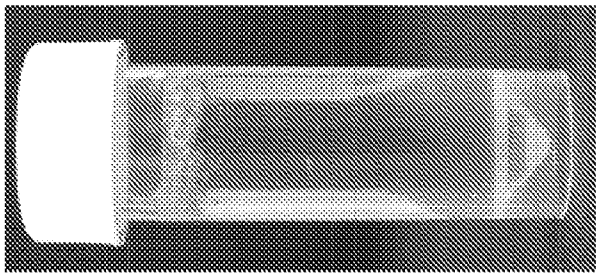


FIG. 7B

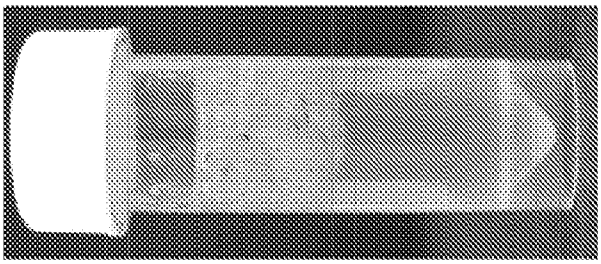


FIG. 7C

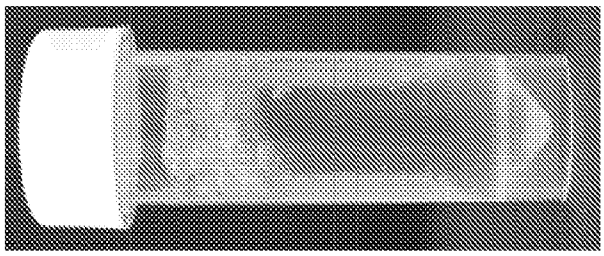


FIG. 7D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
12 Hours	Small amount of undissolved silk	Little to no undissolved silk	Some undissolved silk	All but small amount of silk undissolved

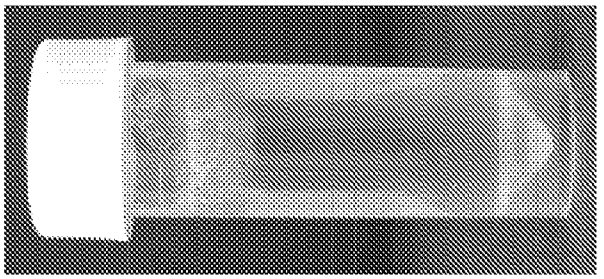


FIG. 8A

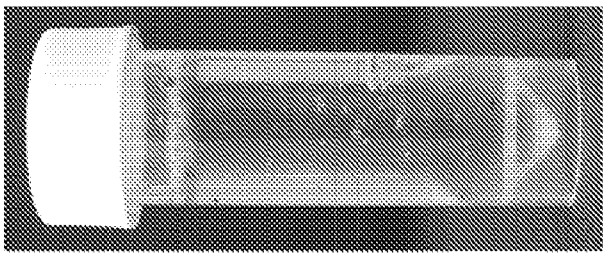


FIG. 8B

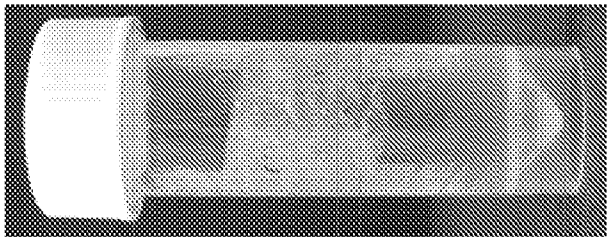


FIG. 8C

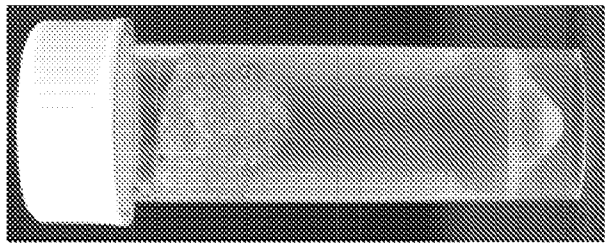


FIG. 8D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
24 Hours	Small amount of undissolved silk	Little to no undissolved silk	Some undissolved silk	All but small amount of silk undissolved

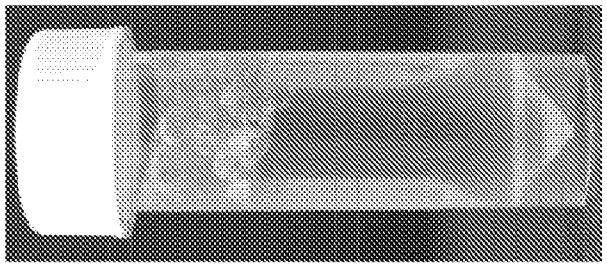


FIG. 9A

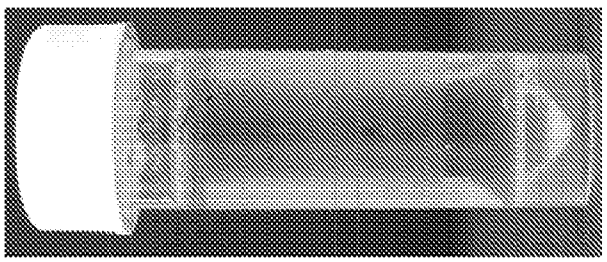


FIG. 9B

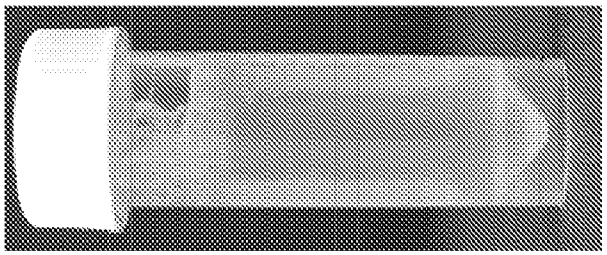


FIG. 9C

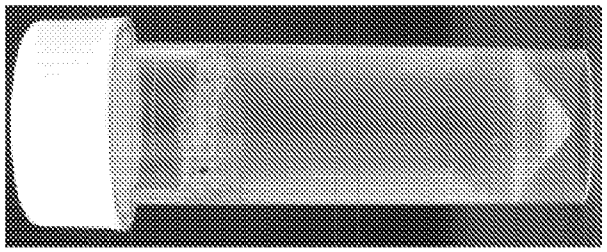


FIG. 9D

Time Point	1 Sericin was extracted at 100°C, 30 min	2 Sericin was extracted at 100°C, 30 min	3 Sericin was extracted at 90°C, 30 min	4 Sericin was extracted at 90°C, 60 min
168 Hours (1&2) 192 Hours (3&4)	No undissolved silk, only slightly cloudy	No undissolved silk, completely clear	Some undissolved silk	Slight amount of undissolved silk

FIG. 10A FIG. 10B FIG. 10C FIG. 10D

Sericin was extracted at 100°C, 60 min

Hour 1	Hour 4	Hour 6
Large amount of undissolved silk	Small amounts of undissolved silk and debris	Small amounts of floating debris

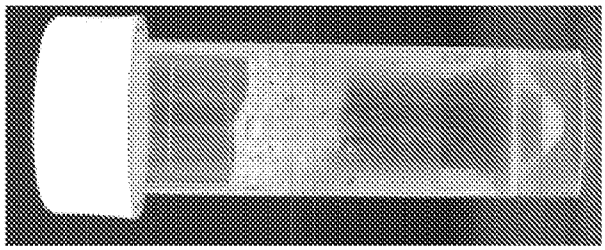


FIG. 11A

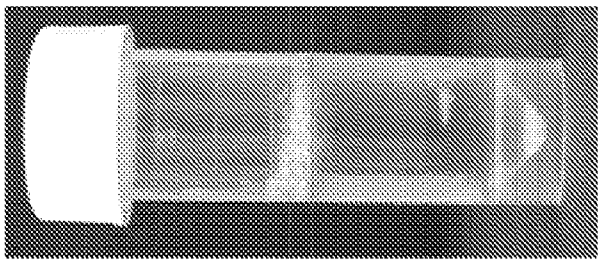


FIG. 11B

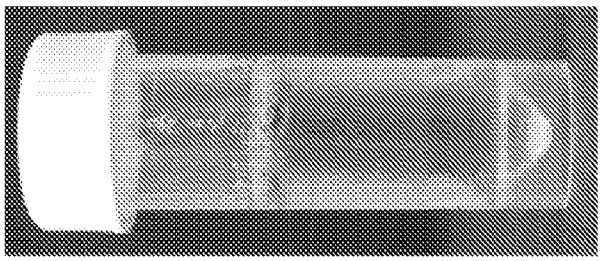


FIG. 11C

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
1 Hour	Significant amount of undissolved silk	Significant amount of undissolved silk and debris	Significant amount of undissolved silk, highly viscous	Significant amount of undissolved silk

FIG. 12A FIG. 12B FIG. 12C FIG. 12D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
4 Hours	Some undissolved silk	Some undissolved silk	Significant amount of undissolved silk, highly viscous	Some undissolved silk

FIG. 13A FIG. 13B FIG. 13C FIG. 13D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
6 Hours	Small amount of undissolved silk	Small amount of silk undissolved	Some undissolved silk	Some undissolved silk

FIG. 14A FIG. 14B FIG. 14C FIG. 14D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
1 Hour	Very small amount of undissolved silk, quire viscous, precipitate formed from bubbles	Less viscous than set 1, no undissolved silk	Highly viscous, some undissolved silk	Less viscous than set 3, some undissolved silk

FIG. 15A FIG. 15B FIG. 15C FIG. 15D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
4 Hours	Extremely small amount of undissolved silk	No undissolved silk	Highly viscous, some undissolved silk	Some undissolved silk

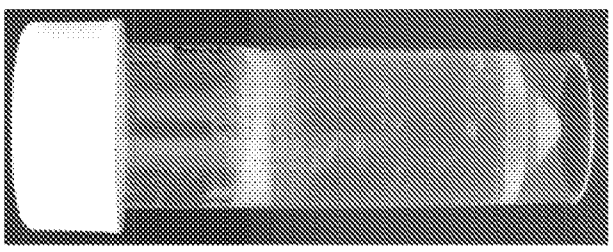


FIG. 16A

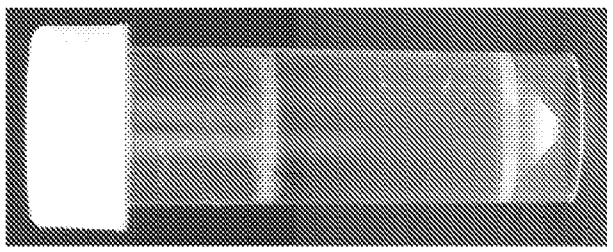


FIG. 16B

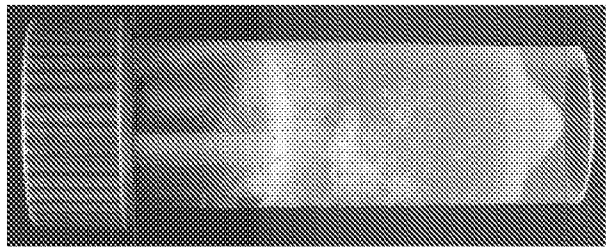


FIG. 16C

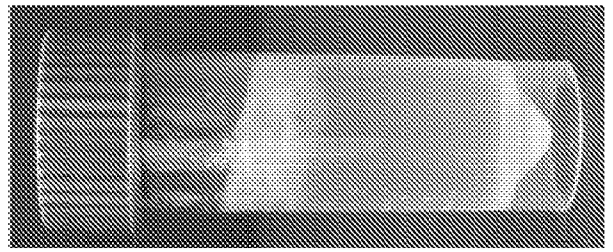


FIG. 16D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
6 Hours	Extremely small amount of undissolved silk	No undissolved silk	Highly viscous, some undissolved silk	Almost no undissolved silk

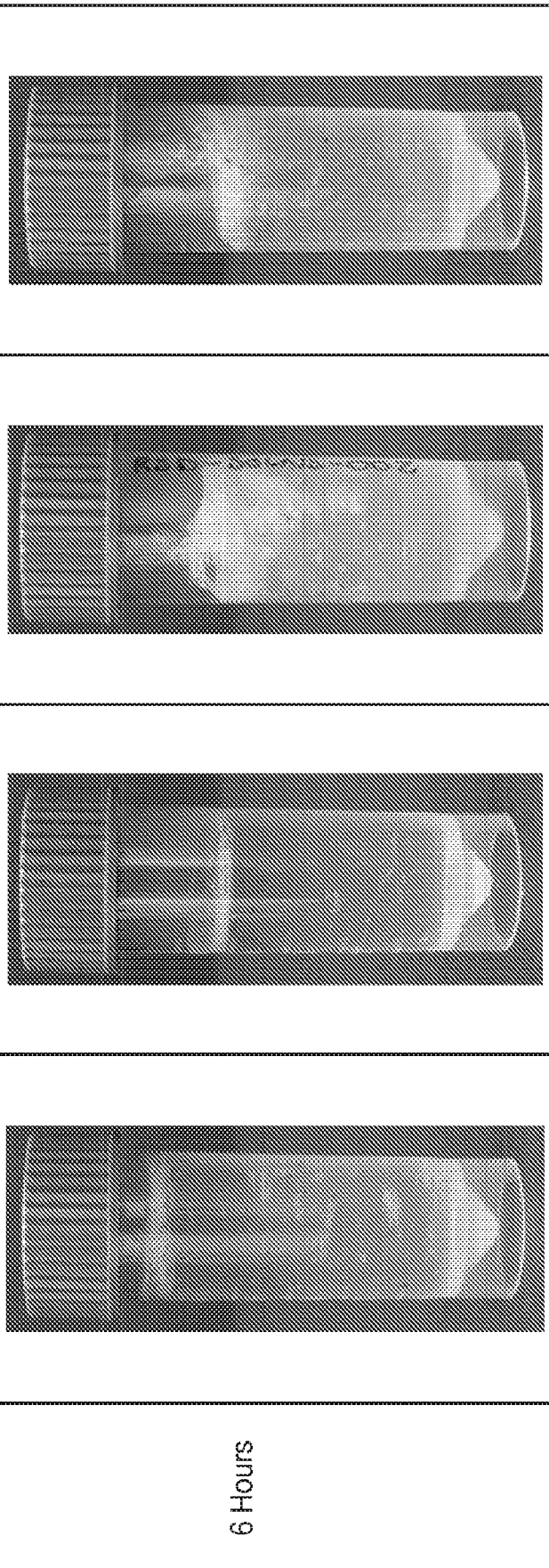
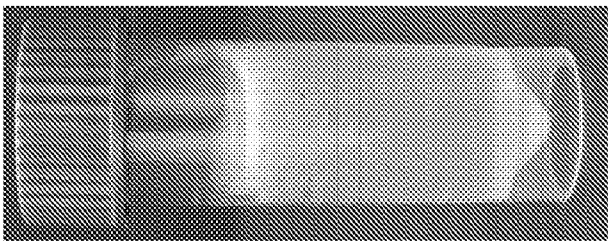
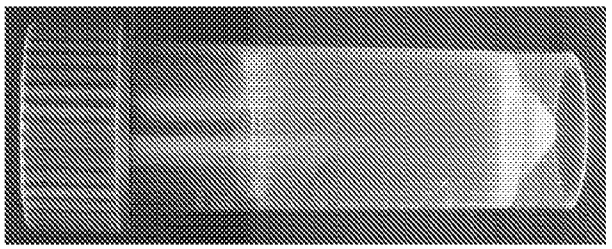
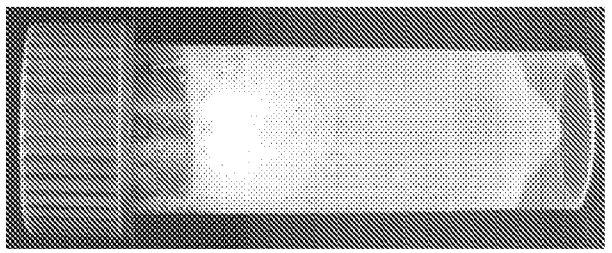


FIG. 17A FIG. 17B FIG. 17C FIG. 17D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
1 Hour	Small amount of undissolved silk, some precipitate from bubbles	All silk dissolved, some precipitate from bubbles	Some precipitate from bubbles and undissolved silk	Some precipitate from bubbles and undissolved silk







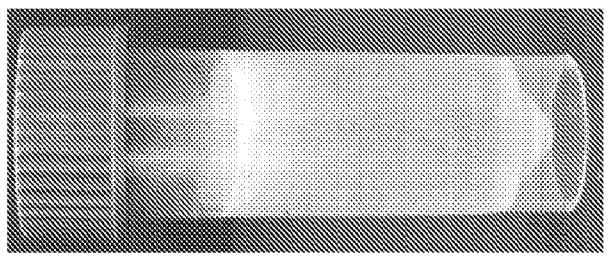


FIG. 18A FIG. 18B FIG. 18C FIG. 18D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
4 Hours	All silk dissolved, some precipitate from bubbles	Completely clear with no precipitate	Some undissolved silk	Some precipitate from bubbles, mostly clear solution

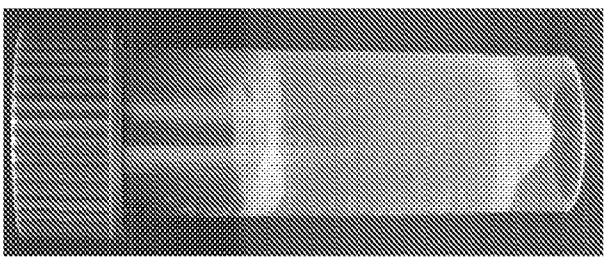


FIG. 19A

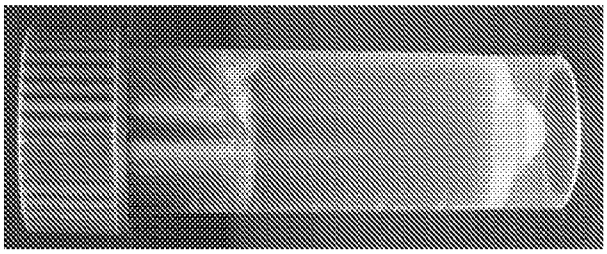


FIG. 19B

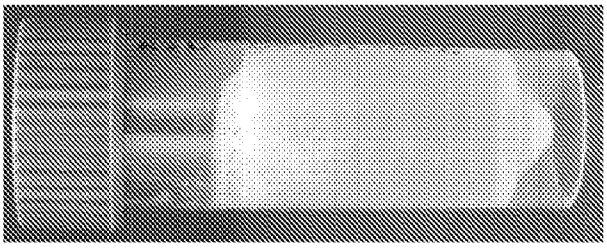


FIG. 19C

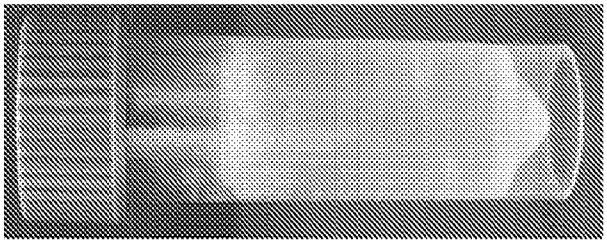


FIG. 19D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
6 Hours	Some precipitate from bubbles, no undissolved silk	Clear with no precipitate or silk	Some undissolved silk	Clear and no undissolved silk

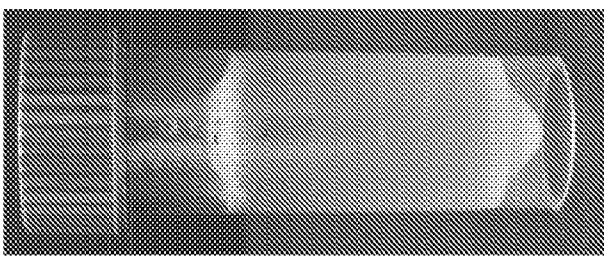


FIG. 20A

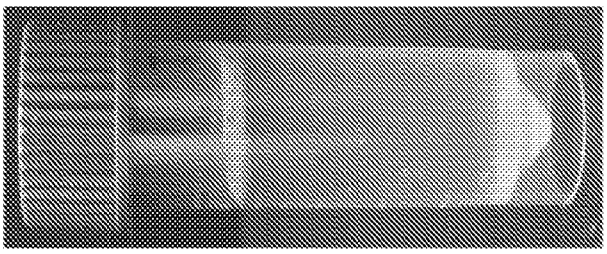


FIG. 20B

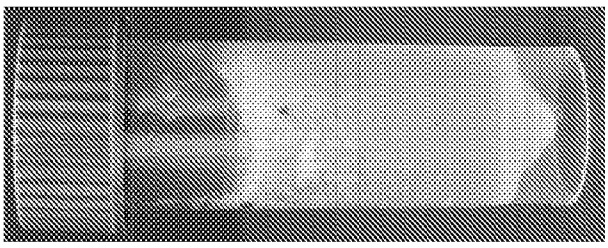


FIG. 20C

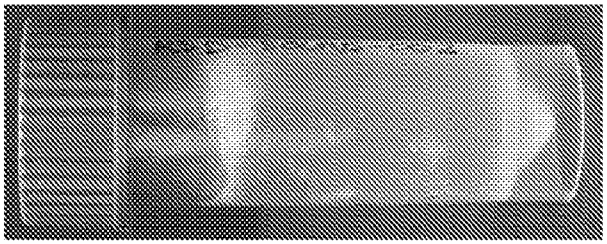


FIG. 20D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
1 Hour	Most silk dissolved, some precipitate from bubbles	Most silk dissolved, some slight precipitate from bubbles	Some precipitate from bubbles and significant amount of dissolved silk	Significant amount of undissolved silk

FIG. 21A FIG. 21B FIG. 21C FIG. 21D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
4 Hours	Completely clear, no silk or precipitate	Some precipitate from bubbles	Cloudy with some undissolved silk	Very viscous with some undissolved silk

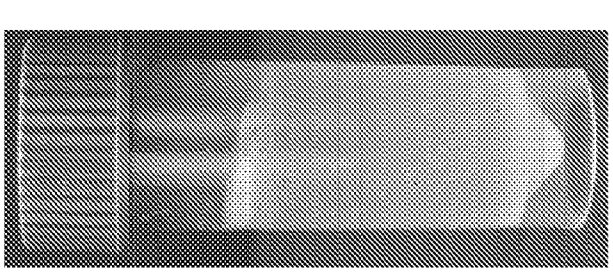


FIG. 22A

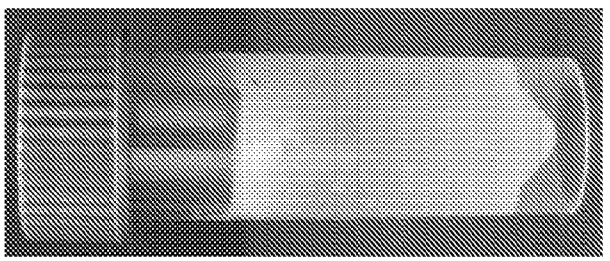


FIG. 22B

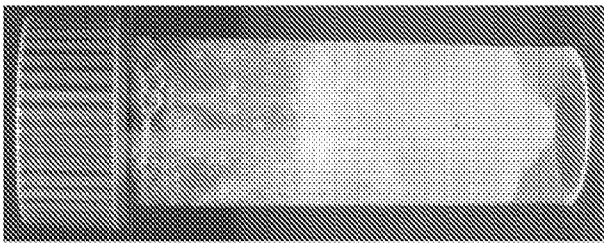


FIG. 22C

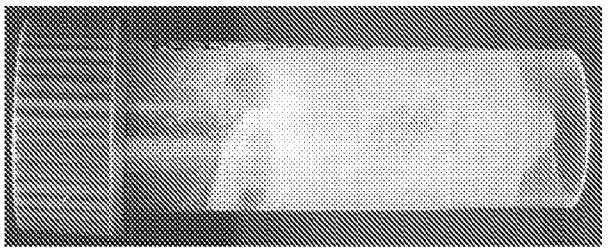
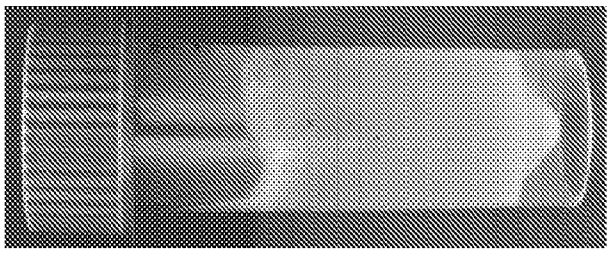
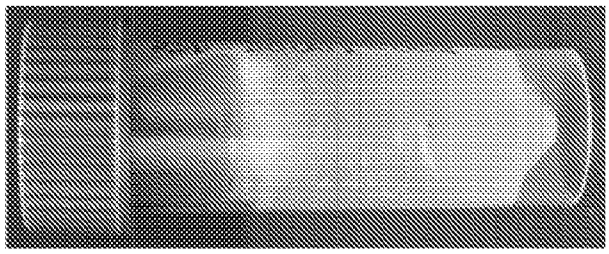
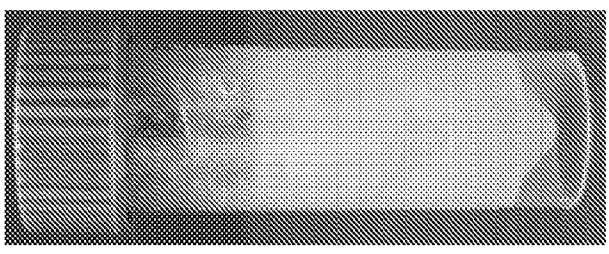


FIG. 22D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
6 Hours	Slightly cloudy with silk particles on top	Cloudy with precipitate from bubbles	Highly viscous, cloudy, almost solid	Highly viscous, cloudy, almost solid







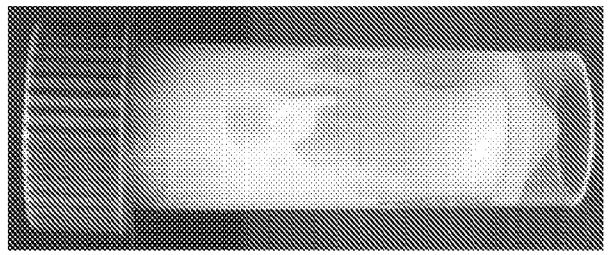


FIG. 23A FIG. 23B FIG. 23C FIG. 23D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
1 Hour	Some undissolved silk, viscosity slightly highter than set 2	Viscosity similar to water, nearly all silk completely dissolved and no precipitate, clear orange/yellow	Highly viscous, some undissolved silk and bubbles	Some undissolved silk but not too viscous

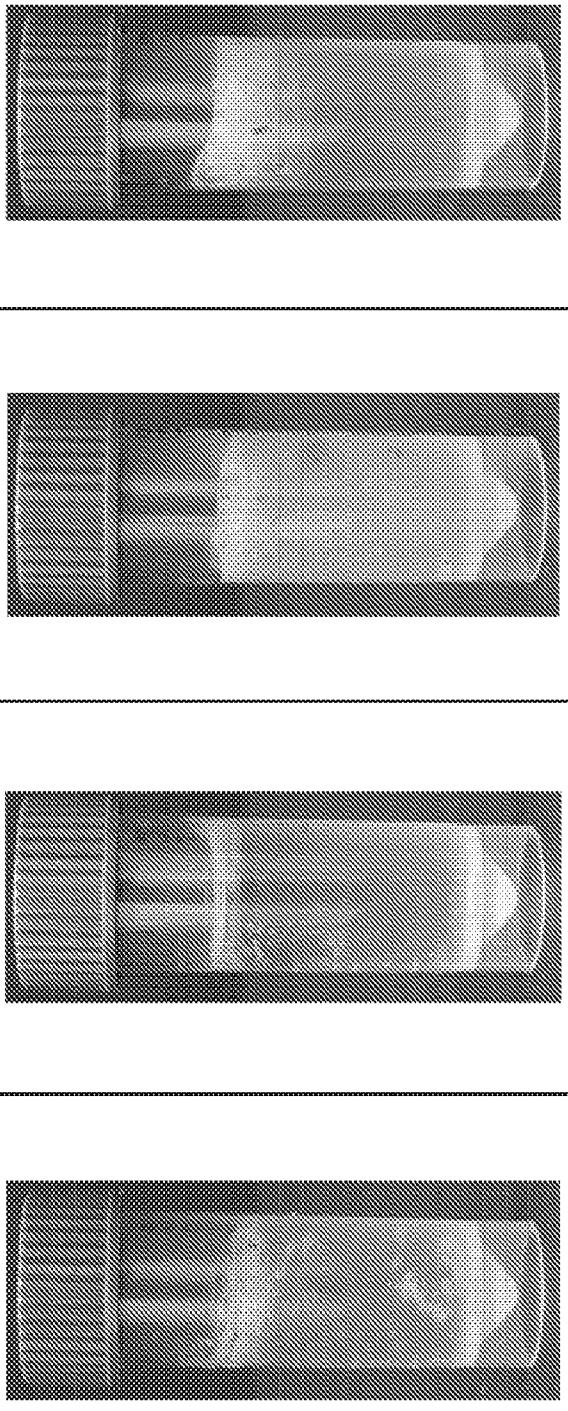


FIG. 24A FIG. 24B FIG. 24C FIG. 24D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
4 Hours	Some undissolved silk, cloudy, slightly viscous	Very slight amount of silk undissolved, clear with darker color	Some undissolved silk, highly viscous	Small amount of undissolved silk, not too viscous

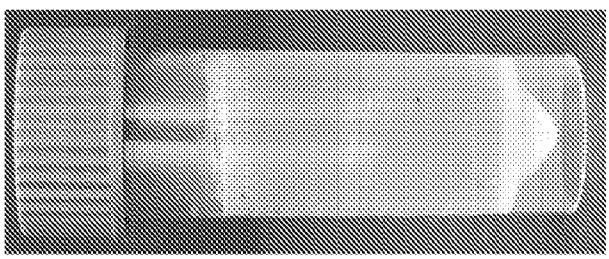


FIG. 25A

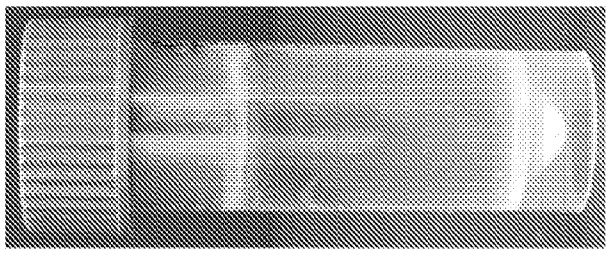


FIG. 25B

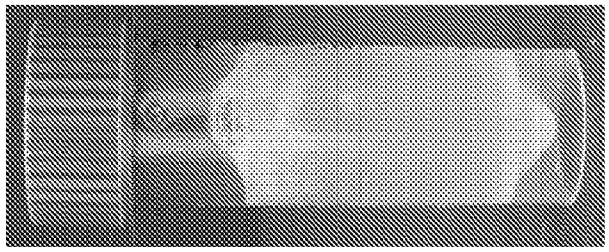


FIG. 25C

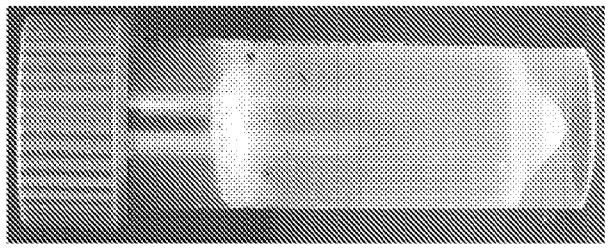


FIG. 25D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
6 Hours	Slightly cloudy with some undissolved silk	Clear with darker color	Some undissolved silk, viscous	Darker color, some undissolved silk, slightly cloudy

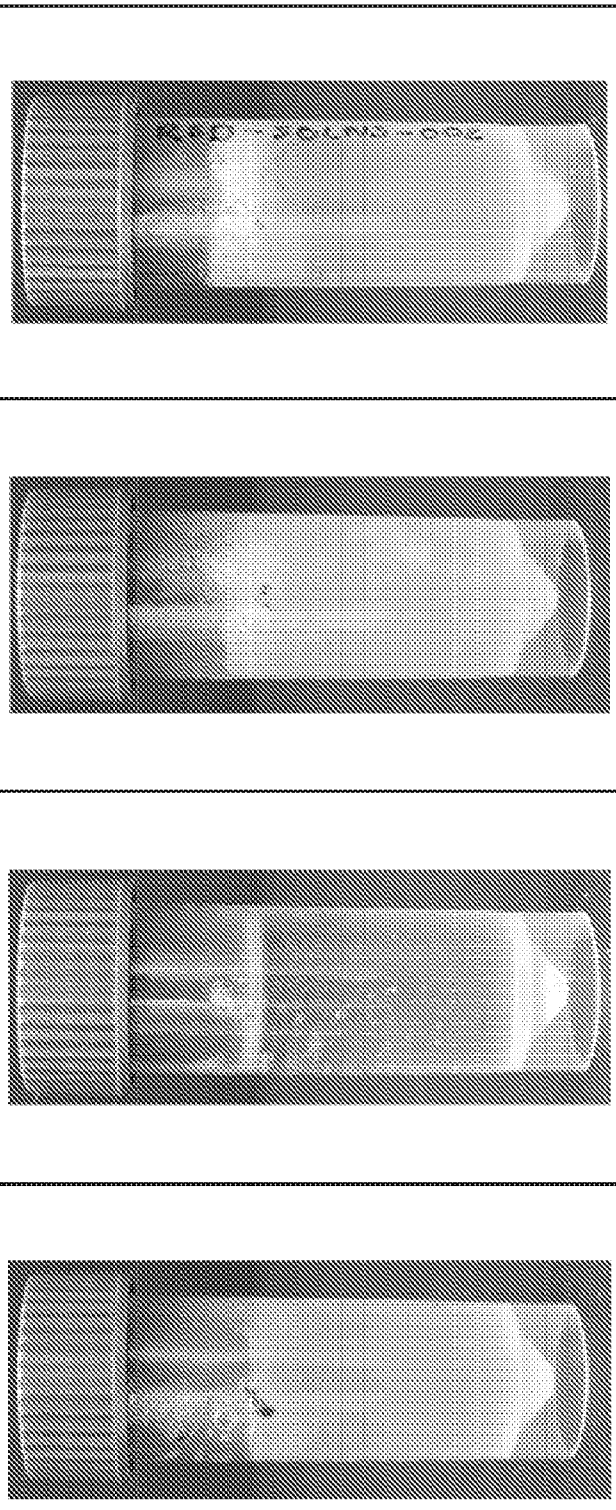


FIG. 26A FIG. 26B FIG. 26C FIG. 26D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
1 Hour	Somewhat cloudy with darker color, some silk particles	Completely clear with dark color, slight amount of silk particles	Cloudy, some undissolved silk, highly viscous	Small amount of undissolved silk, partially cloudy, darker color

FIG. 27A FIG. 27B FIG. 27C FIG. 27D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
4 Hours	Small amount of undissolved silk, highly cloudy	Little to no undissolved silk, deep auburn color	Some undissolved silk, highly cloudy	Slight amount of silk particles, dark color, less viscous

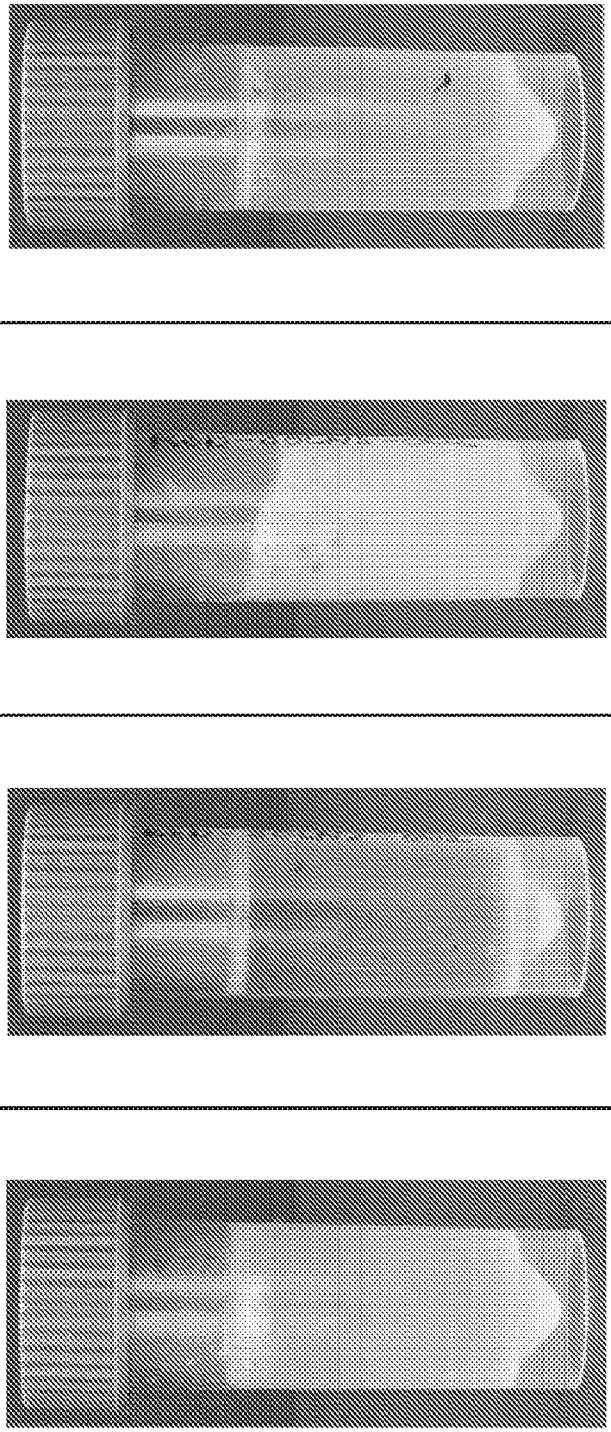


FIG. 28A FIG. 28B FIG. 28C FIG. 28D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
6 Hours	Slightly cloudy, slight amount of dissolved silk	No undissolved silk, completely clear, dark auburn	Cloudy, viscous, some undissolved silk	Slight amount of undissolved silk, slightly cloudy

FIG. 29A FIG. 29B FIG. 29C FIG. 29D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
1 Hour	All silk dissolved, cloudy	All silk dissolved, clear	All silk dissolved, viscous, cloudy	All silk dissolved, viscous, cloudy

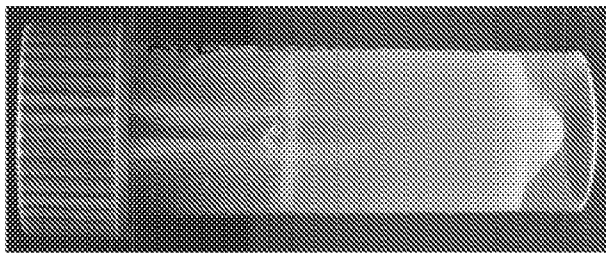


FIG. 30A

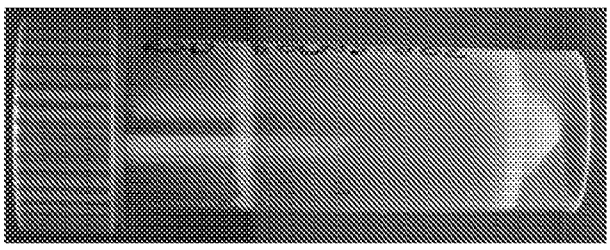


FIG. 30B

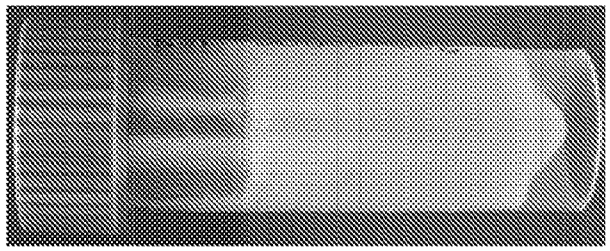


FIG. 30C

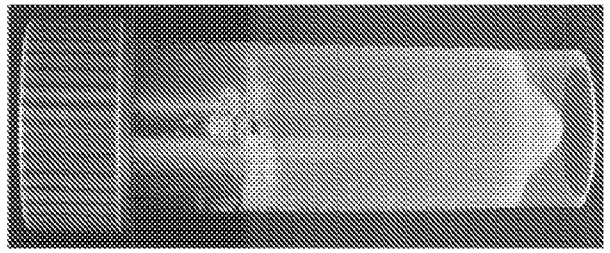


FIG. 30D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
4 Hours	All silk dissolved, slightly cloudy but mostly clear	All silk dissolved, clear, dark	All silk dissolved, cloudy	All silk dissolved, cloudy

FIG. 31A FIG. 31B FIG. 31C FIG. 31D

Time Point	Sericin was extracted at 100°C, 30 min	Sericin was extracted at 100°C, 60 min	Sericin was extracted at 90°C, 30 min	Sericin was extracted at 90°C, 60 min
6 Hours	All silk dissolved, cloudy	All silk dissolved, clear	All silk dissolved, cloudy	All silk dissolved, only slightly cloudy

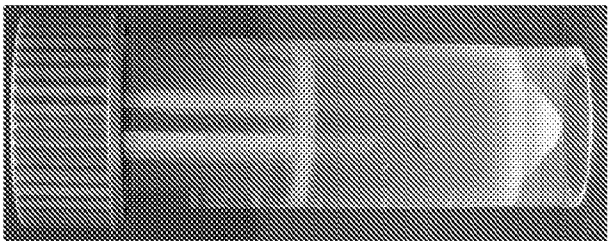


FIG. 32A

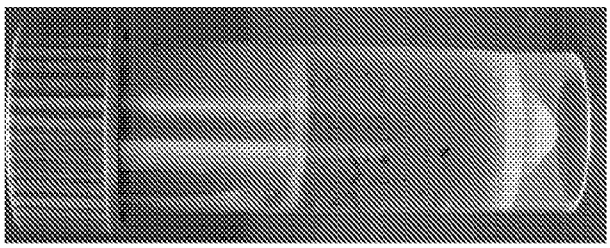


FIG. 32B

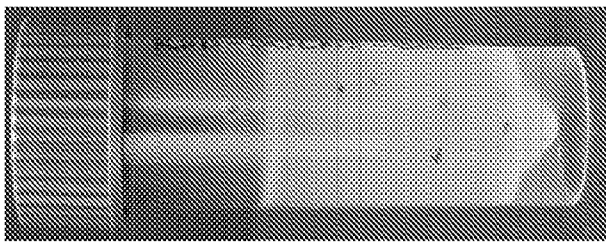


FIG. 32C

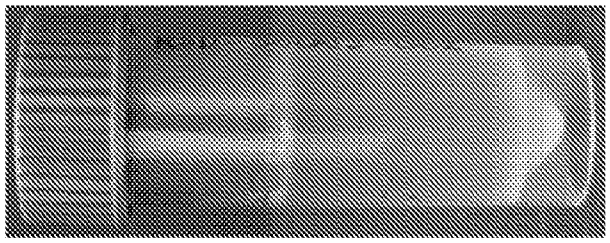


FIG. 32D

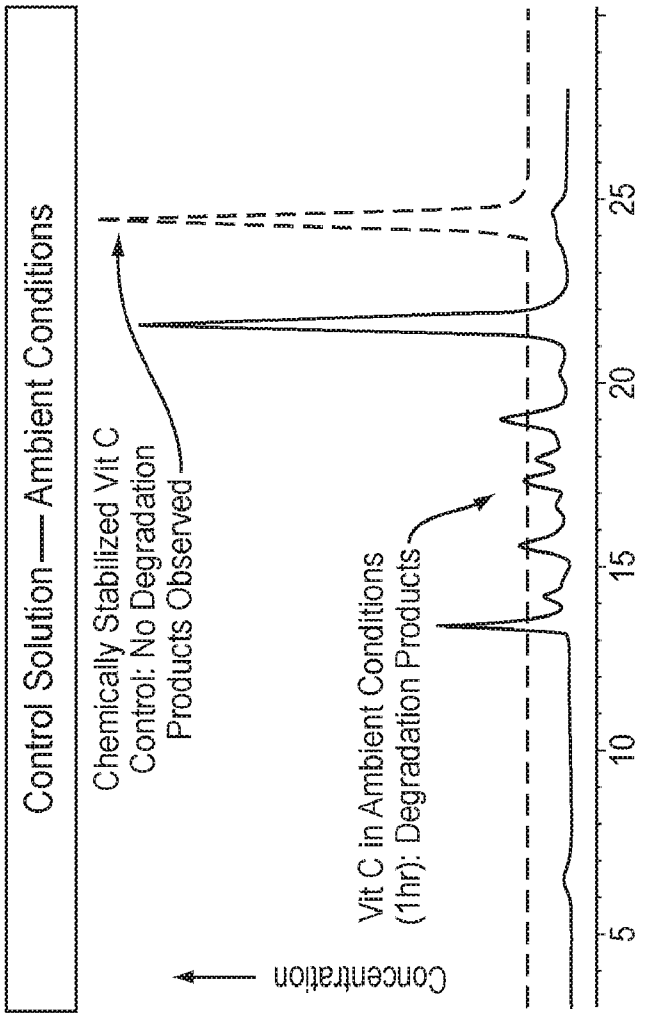

Control Solution — Ambient Conditions
Chemically Stabilized Vit C
Control: No Degradation
Products Observed
Vit C in Ambient Conditions
(1hr): Degradation Products
Concentration
5
10
15
20
25

FIG. 33

Lithium Bromide and Sodium Carbonate Concentration in Silk Protein Solution

Sample ID	Sample Description	Average Concentration of Na2CO3 (ppm)	Average Concentration of LiBr (ppm)
A	TFF 5kDa	32.13	90.85
B	TFF 10 kDa	42.91	107
C	TFF 10 kDa	49.06	78.55
D	STI 1(TFF-10-0019)	2.17	129.07
E	STI 2(TFF-10-0033)	2.63	196.2
F	STI 3(TFF-10-0034)	4.18	248.93

Method: 100C extraction for 60 min, 60C rinse, 100C LiBr in 100C oven for 60 min.
Note that TFF could be run for longer and/or at different flow rates (as varied between A-C and D-F) to alter ppm of Na2C2O3 and LiBr.

FIG. 34

Lithium Bromide and Sodium Carbonate content in Silk Protein Solution

Sample ID	Solution Volume Equivalent to (X) Films	Sample Weight (mg)	Concentration	
			Na2CO3	LiBr
1	6	0.171	ND	ND
2	8	0.228	ND	ND
3	10	0.285	ND	ND
4	12	0.342	ND	ND
5	Neat	-	ND	ND

*ND = None Detected

Method: 100C boil for 60 min, 60C rinse, LiBr in 60C oven for 4-6 hours

FIG. 35

Stability to Vitamin C in Solution

Sample ID	Time (hour)	Actual Conc. (µg/mL)	Area	Concentration Vit C (µg/mL)	Recovered (%)	Stability (%) After 24 hrs.
A	0	82.4	4277.9	80.53	97.73	
B	26	82.4	4088.94	77.62	94.2	
Average =			4183.42	79.07	95.96	96.39
Std. Dev. =			133.62	2.06	2.49	
% Error			3%	3%	3%	

Method: Vitamin C solution (no silk)

FIG. 36

Molecular Weights of Silk Protein Solutions

Sample ID	Sample Description	Mn	Mw	Polydispersity (PD) (Mw/Mn)
A	TFF 5kDa	14,497	33,874	2.3366
B	TFF 10 kDa	14,542	33,455	2.3006
C	TFF 10 kDa	14,972	34,026	2.2726
D	Silk protein solution in water	12,055	26,531	2.2008

Method:
TFF: 100C extraction for 60 min, 60C rinse, 100C LiBr in 100C oven for 60 min.
Silk Protein: 100C extraction for 20 min, RT rinse, LiBr in 60C oven for 4-6 hours

FIG. 37

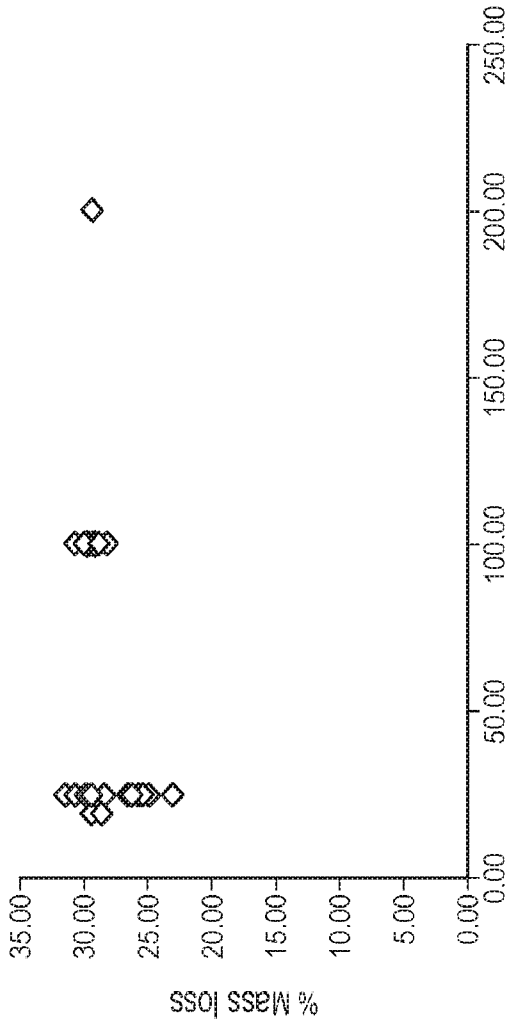


FIG. 38A

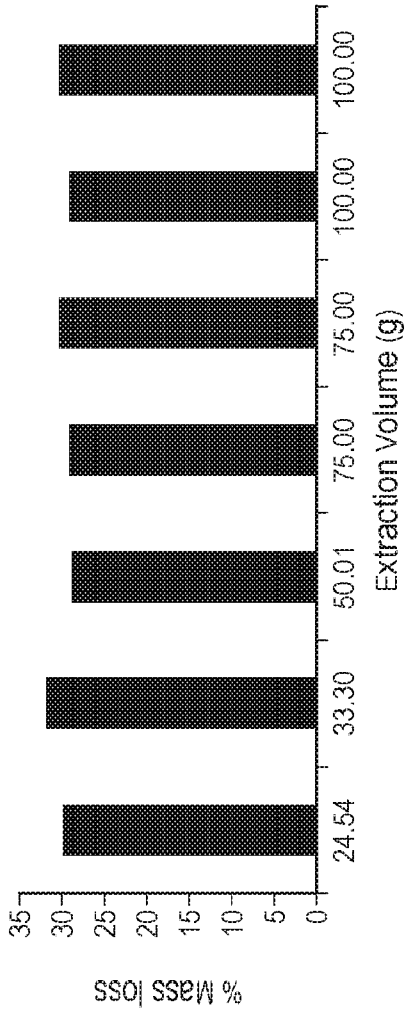


FIG. 38B

Sample	LiBr (M)	Avg MW	PD
STI 1(TFF-10-0019)	9.3	15727	2.033
STI 2(TFF-10-0033)	9.3	24587	2.3669
STI 3(TFF-10-0034)	9.3	25273	2.338
STI 9.3 M avg		21862	2.25
STI 1(TFF-10-0031)	~7.5	29645	3.0868
STI 2(TFF-10-0030)	~7.5	26856	2.9748
STI 7.5M avg		28250.5	3.0308

* TFF-10-0019 from 2 25g extraction/ 35g dissolution
* TFF-10-0034 from 100g extraction/ 17-35 g dissolution

* TFF-10-0033 from 100g extraction/ 100 g dissolution

FIG. 39

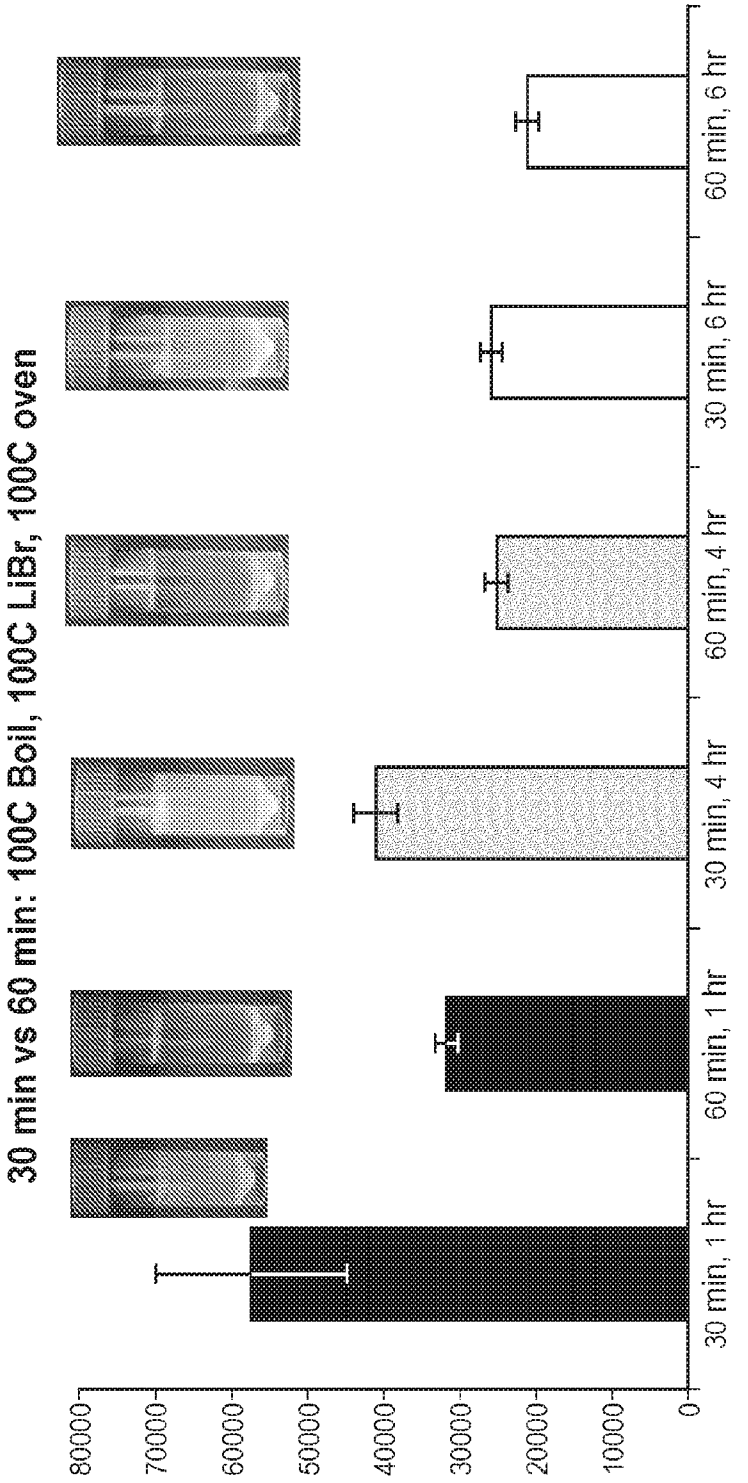

30 min vs 60 min: 100C Boil, 100C LiBr, 100C oven
80000
70000
60000
50000
40000
30000
20000
10000
0
30 min, 1 hr
60 min, 1 hr
30 min, 4 hr
60 min, 4 hr
30 min, 6 hr
60 min, 6 hr

FIG. 40

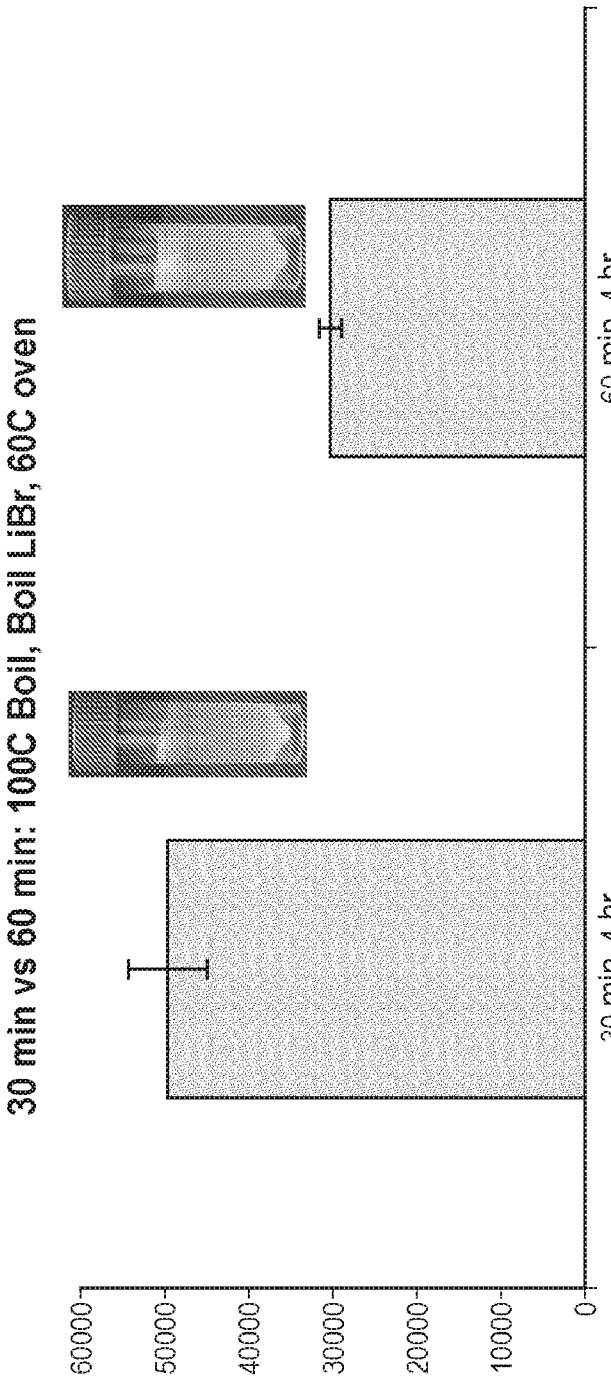

30 min vs 60 min: 100C Boil, Boil LiBr, 60C oven
60000
50000
40000
30000
20000
10000
0
30 min, 4 hr
60 min, 4 hr

FIG. 41

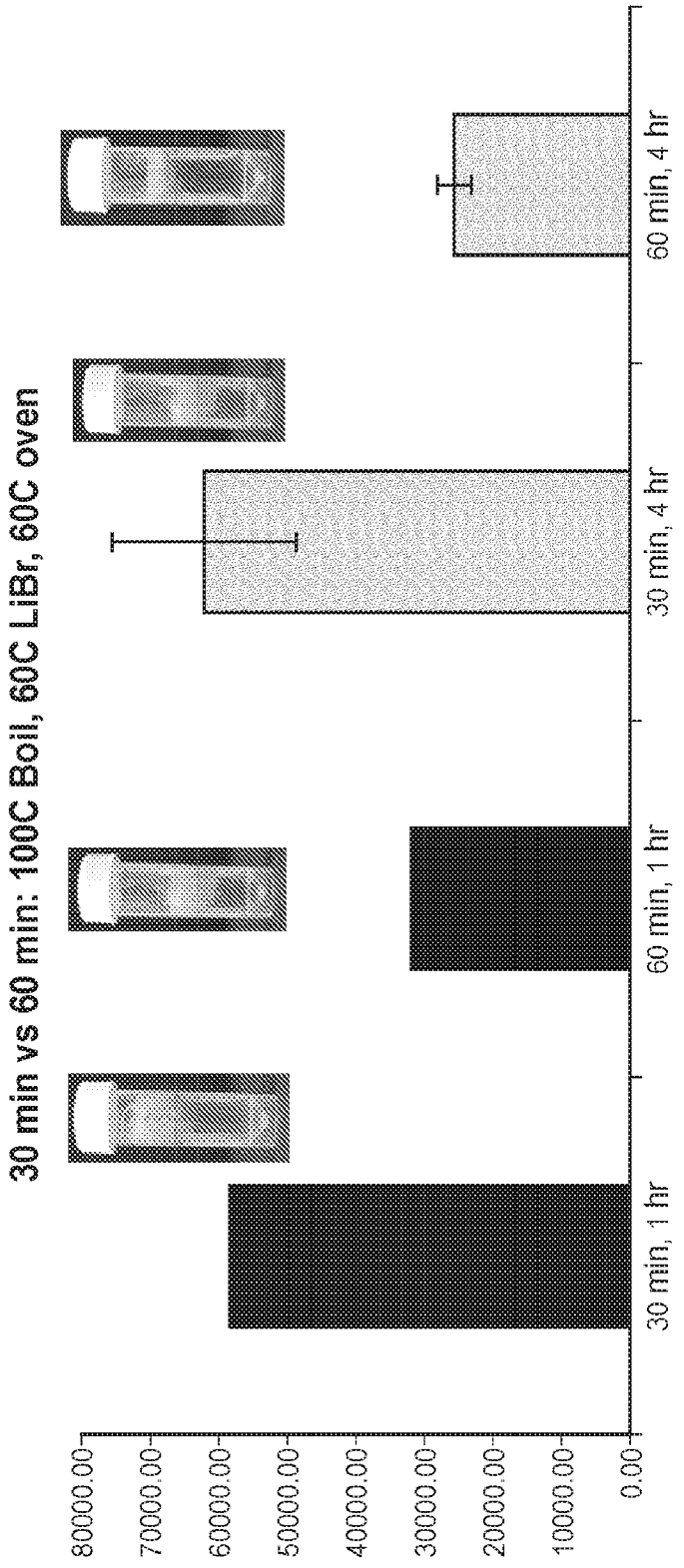

30 min vs 60 min: 100C Boil, 60C LiBr, 60C oven
80000.00
70000.00
60000.00
50000.00
40000.00
30000.00
20000.00
10000.00
0.00
30 min, 1 hr
60 min, 1 hr
30 min, 4 hr
60 min, 4 hr

FIG. 42

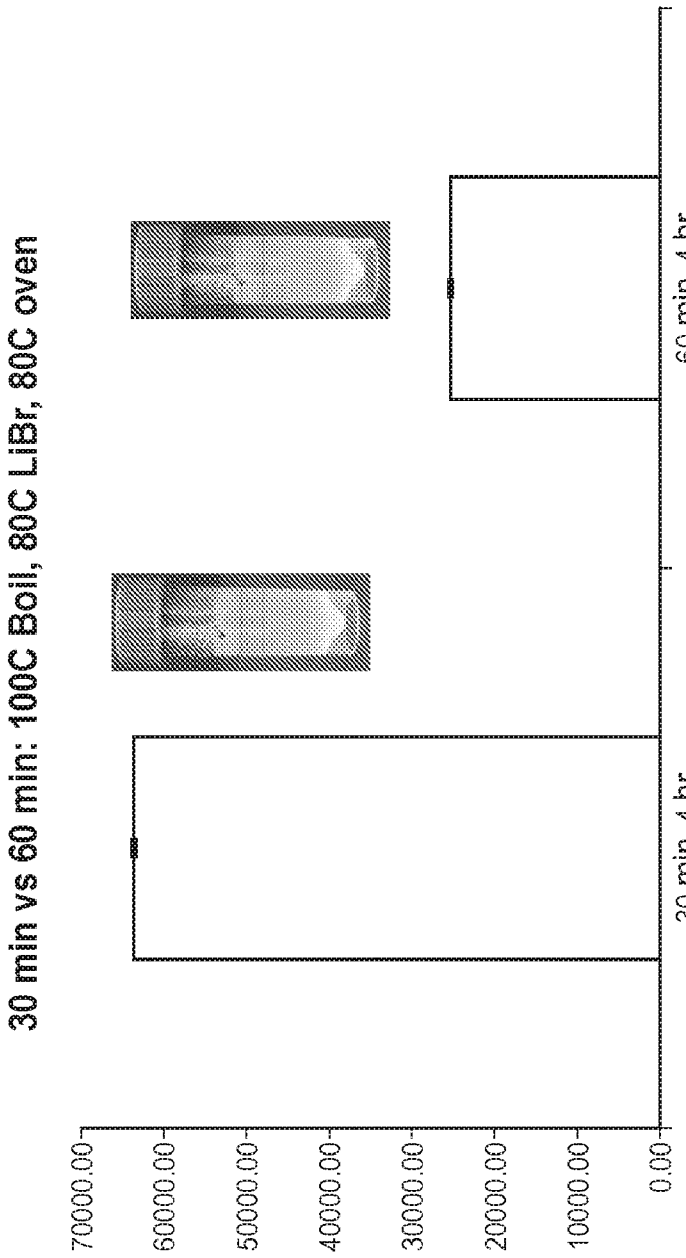

30 min vs 60 min: 100C Boil, 80C LiBr, 80C oven
70000.00
60000.00
50000.00
40000.00
30000.00
20000.00
10000.00
0.00
30 min, 4 hr
60 min, 4 hr

FIG. 43

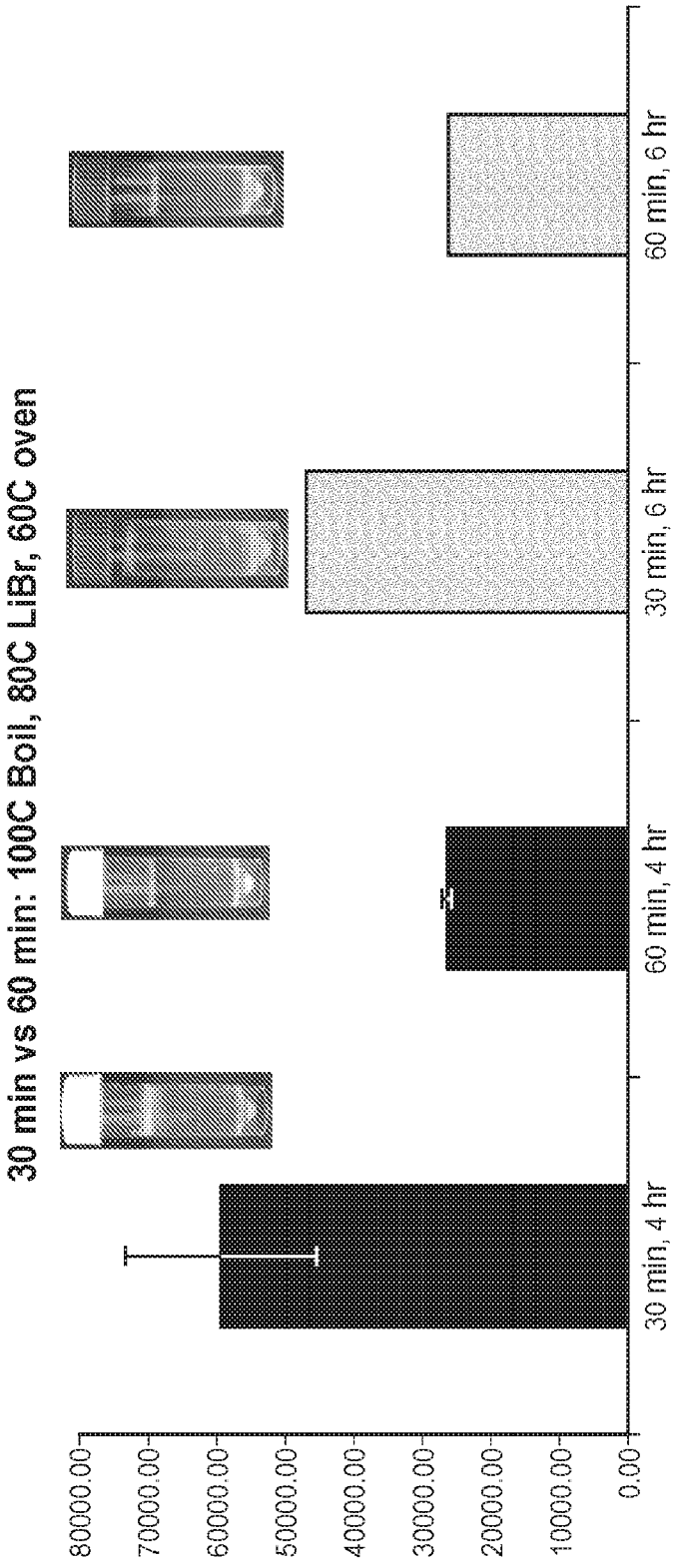

30 min vs 60 min: 100C Boil, 80C LiBr, 60C oven
80000.00
70000.00
60000.00
50000.00
40000.00
30000.00
20000.00
10000.00
0.00
30 min, 4 hr
60 min, 4 hr
30 min, 6 hr
60 min, 6 hr

FIG. 44

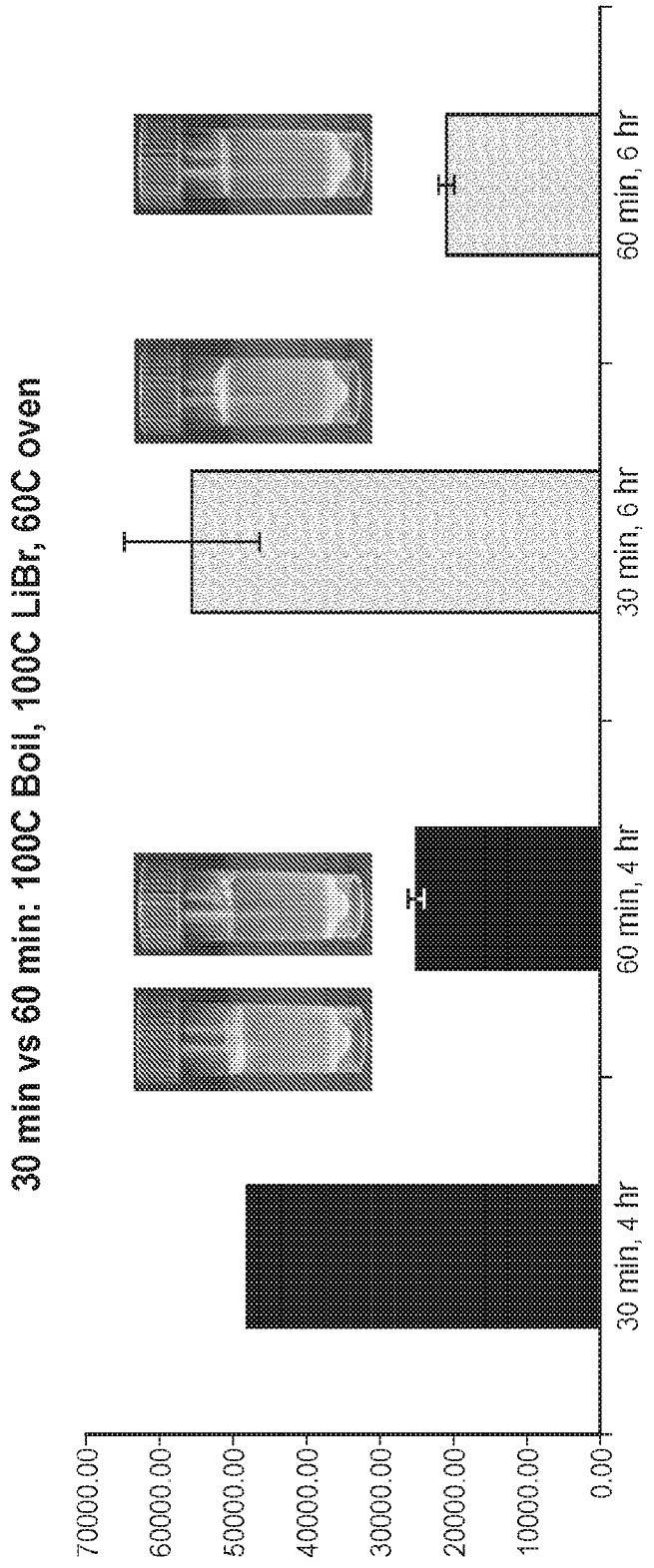

30 min vs 60 min: 100C Boil, 100C LiBr, 60C oven
70000.00
60000.00
50000.00
40000.00
30000.00
20000.00
10000.00
0.00
30 min, 4 hr
60 min, 4 hr
30 min, 6 hr
60 min, 6 hr

FIG. 45

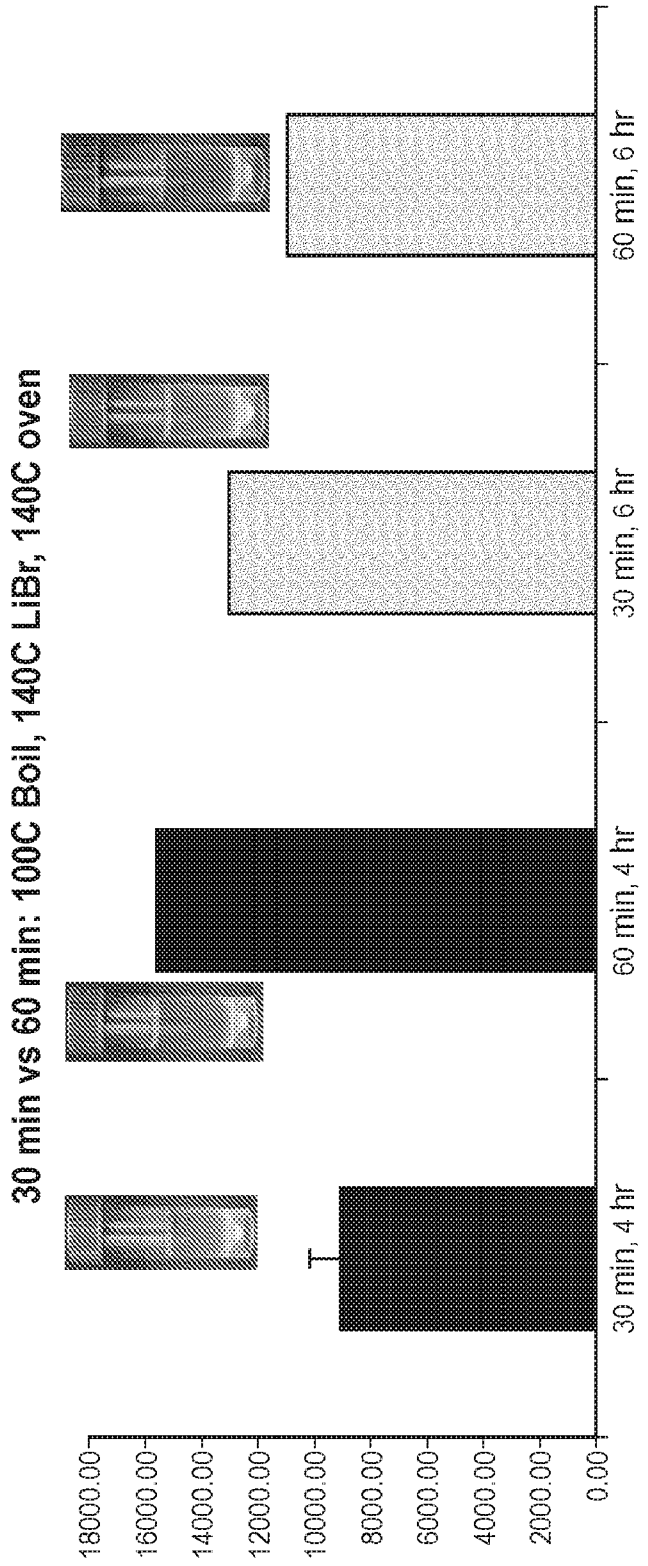

30 min vs 60 min: 100C Boil, 140C LiBr, 140C oven
18000.00
16000.00
14000.00
12000.00
10000.00
8000.00
6000.00
4000.00
2000.00
0.00
30 min, 4 hr
60 min, 4 hr
30 min, 6 hr
60 min, 6 hr

FIG. 46

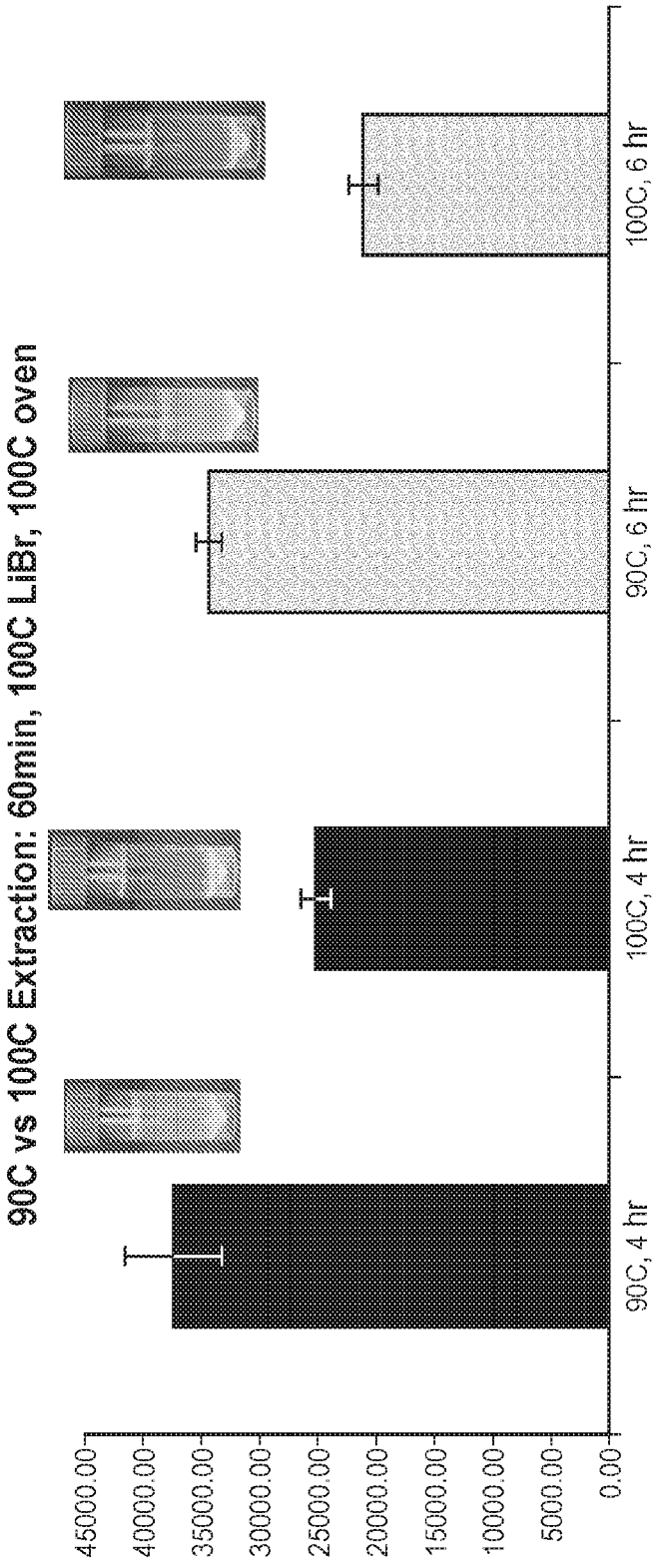

90C vs 100C Extraction: 60min, 100C LiBr, 100C oven
45000.00
40000.00
35000.00
30000.00
25000.00
20000.00
15000.00
10000.00
5000.00
0.00
90C, 4 hr
100C, 4 hr
90C, 6 hr
100C, 6 hr

FIG. 47

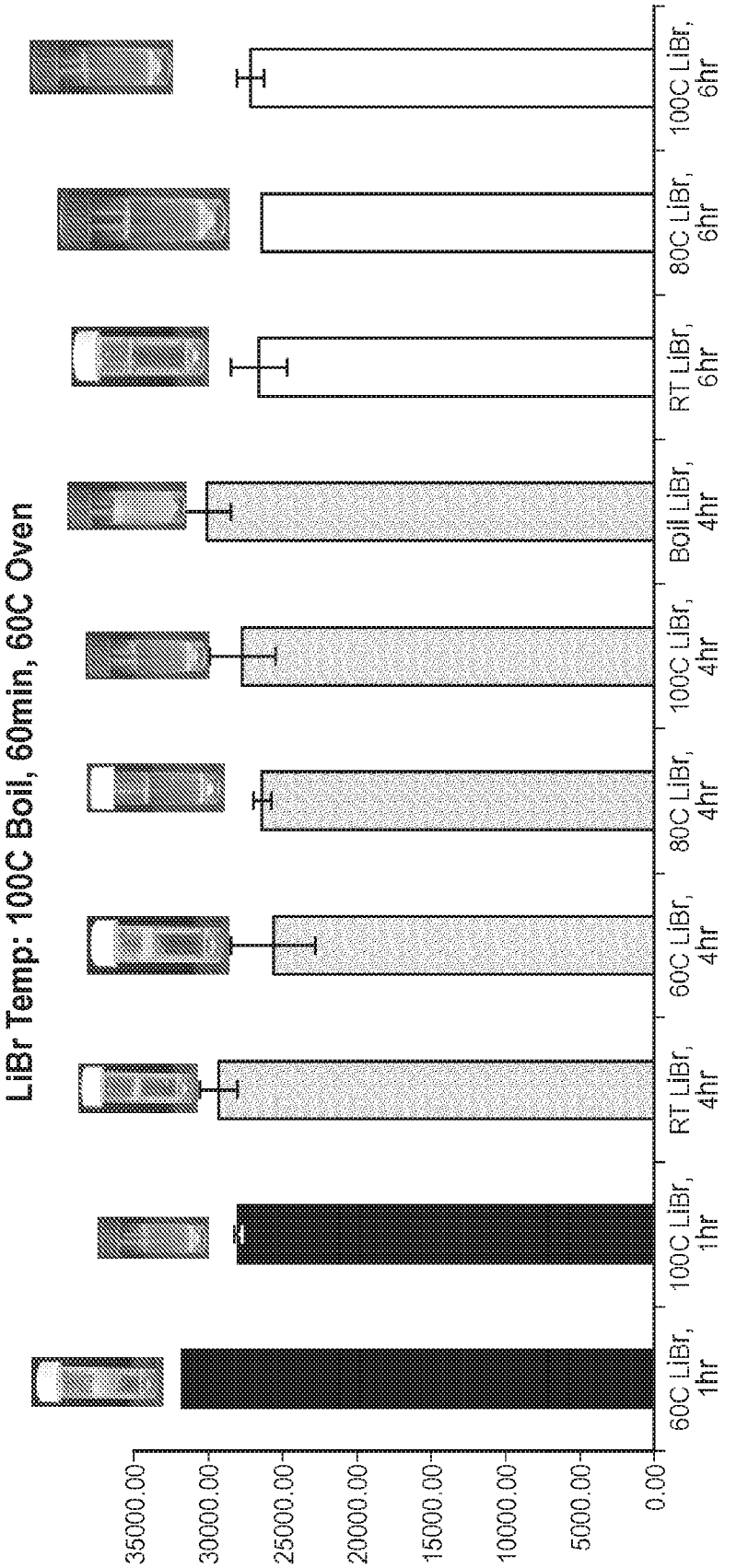

LiBr Temp: 100C Boil, 60min, 60C Oven
35000.00
30000.00
25000.00
20000.00
15000.00
10000.00
5000.00
0.00
60C LiBr, 1hr
100C LiBr, 1hr
RT LiBr, 4hr
60C LiBr, 4hr
80C LiBr, 4hr
100C LiBr, 4hr
Boil LiBr, 4hr
RT LiBr, 6hr
80C LiBr, 6hr
100C LiBr, 6hr

FIG. 48

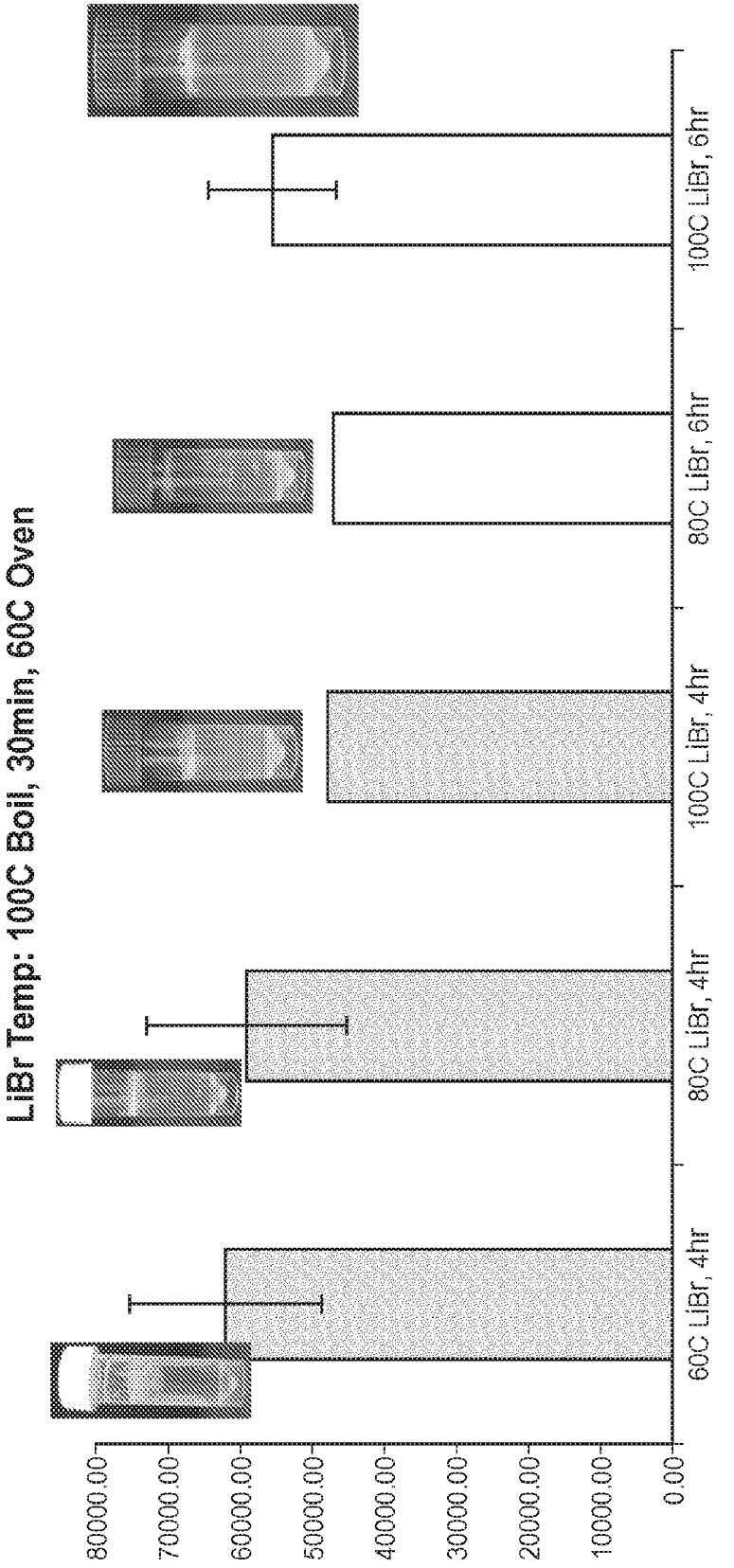

LiBr Temp: 100C Boil, 30min, 60C Oven
80000.00
70000.00
60000.00
50000.00
40000.00
30000.00
20000.00
10000.00
0.00
60C LiBr, 4hr
80C LiBr, 4hr
100C LiBr, 4hr
80C LiBr, 6hr
100C LiBr, 6hr

FIG. 49

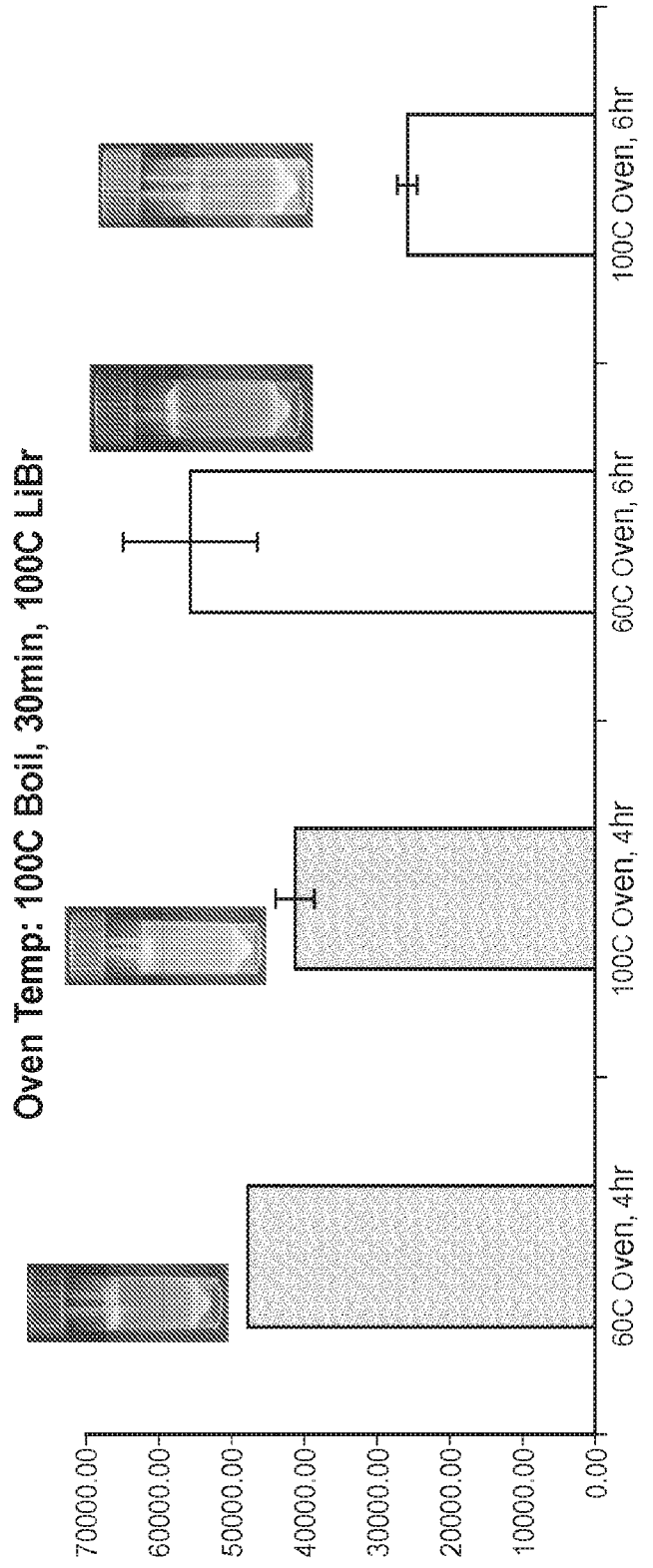

Oven Temp: 100C Boil, 30min, 100C LiBr
70000.00
60000.00
50000.00
40000.00
30000.00
20000.00
10000.00
0.00
60C Oven, 4hr
100C Oven, 4hr
60C Oven, 6hr
100C Oven, 6hr

FIG. 50

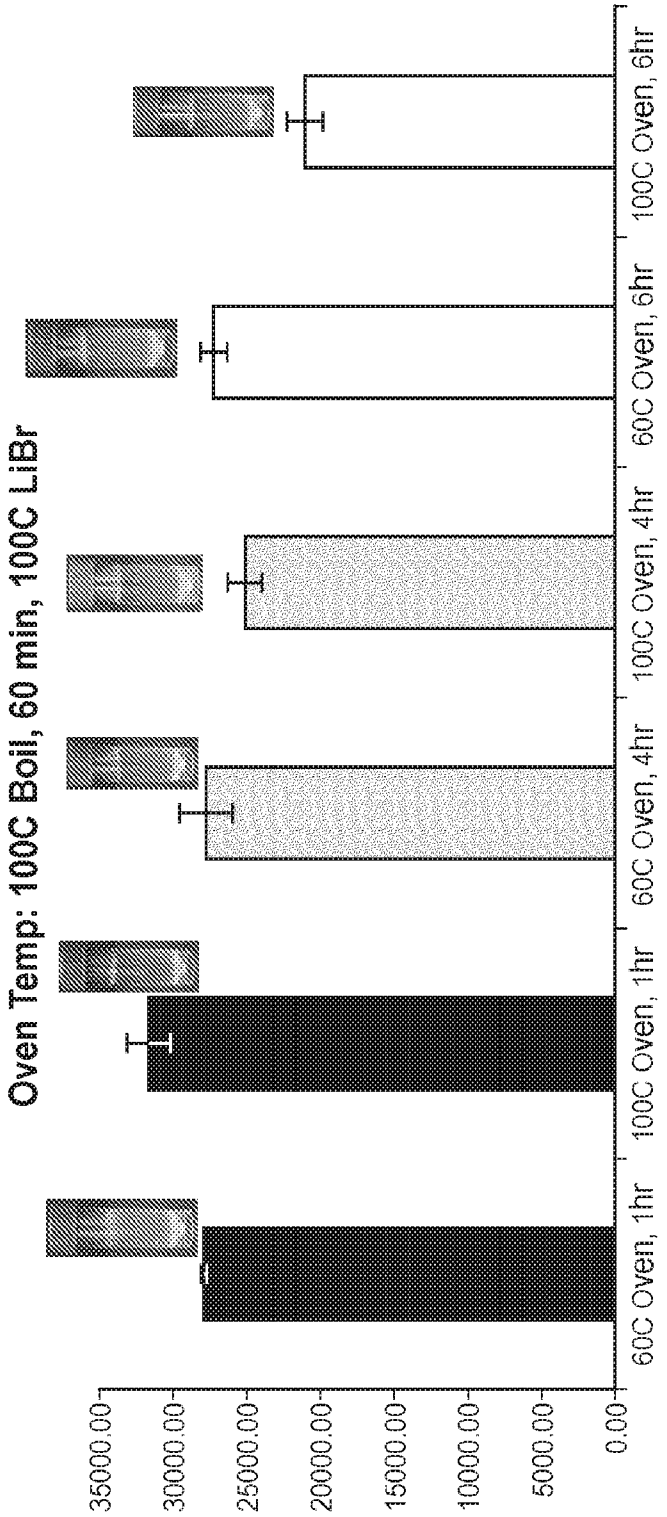

Oven Temp: 100C Boil, 60 min, 100C LiBr
35000.00
30000.00
25000.00
20000.00
15000.00
10000.00
5000.00
0.00
60C Oven, 1hr
100C Oven, 1hr
60C Oven, 4hr
100C Oven, 4hr
60C Oven, 6hr
100C Oven, 6hr

FIG. 51

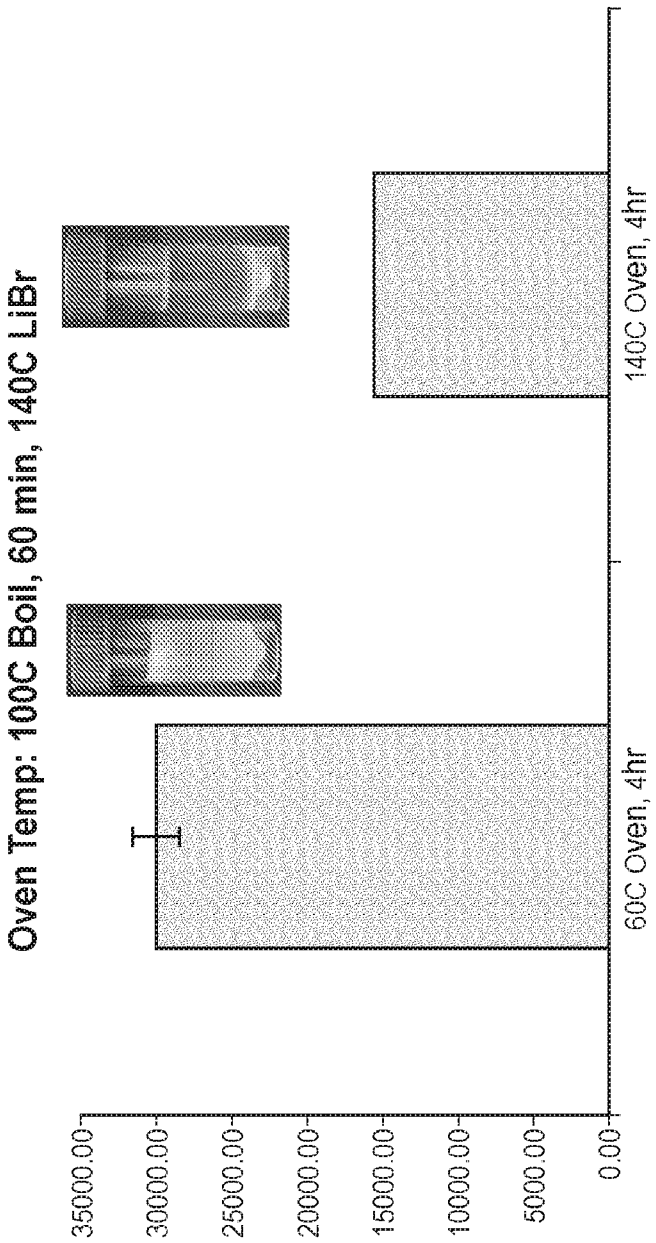

Oven Temp: 100C Boil, 60 min, 140C LiBr
35000.00
30000.00
25000.00
20000.00
15000.00
10000.00
5000.00
0.00
60C Oven, 4hr
140C Oven, 4hr

FIG. 52

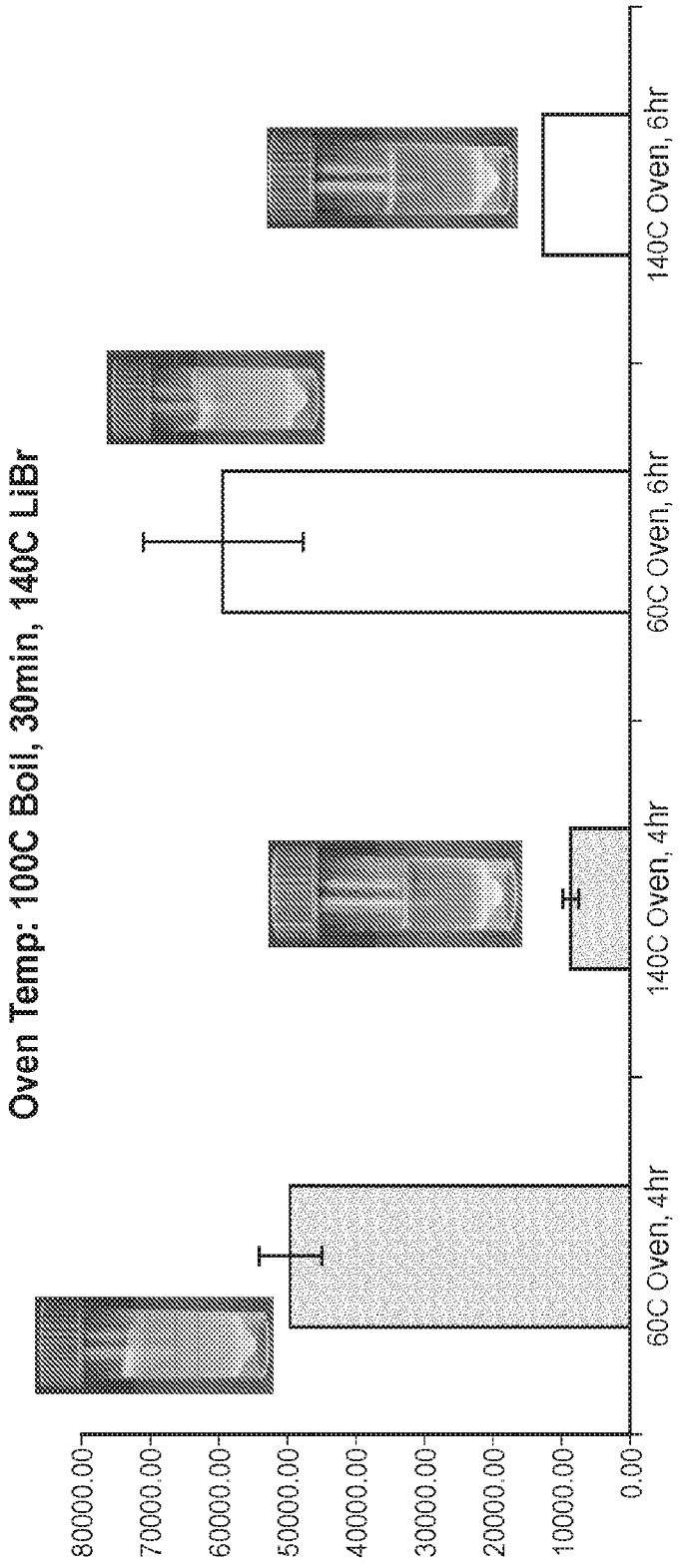

Oven Temp: 100C Boil, 30min, 140C LiBr
80000.00
70000.00
60000.00
50000.00
40000.00
30000.00
20000.00
10000.00
0.00
60C Oven, 4hr
140C Oven, 4hr
60C Oven, 6hr
140C Oven, 6hr

FIG. 53

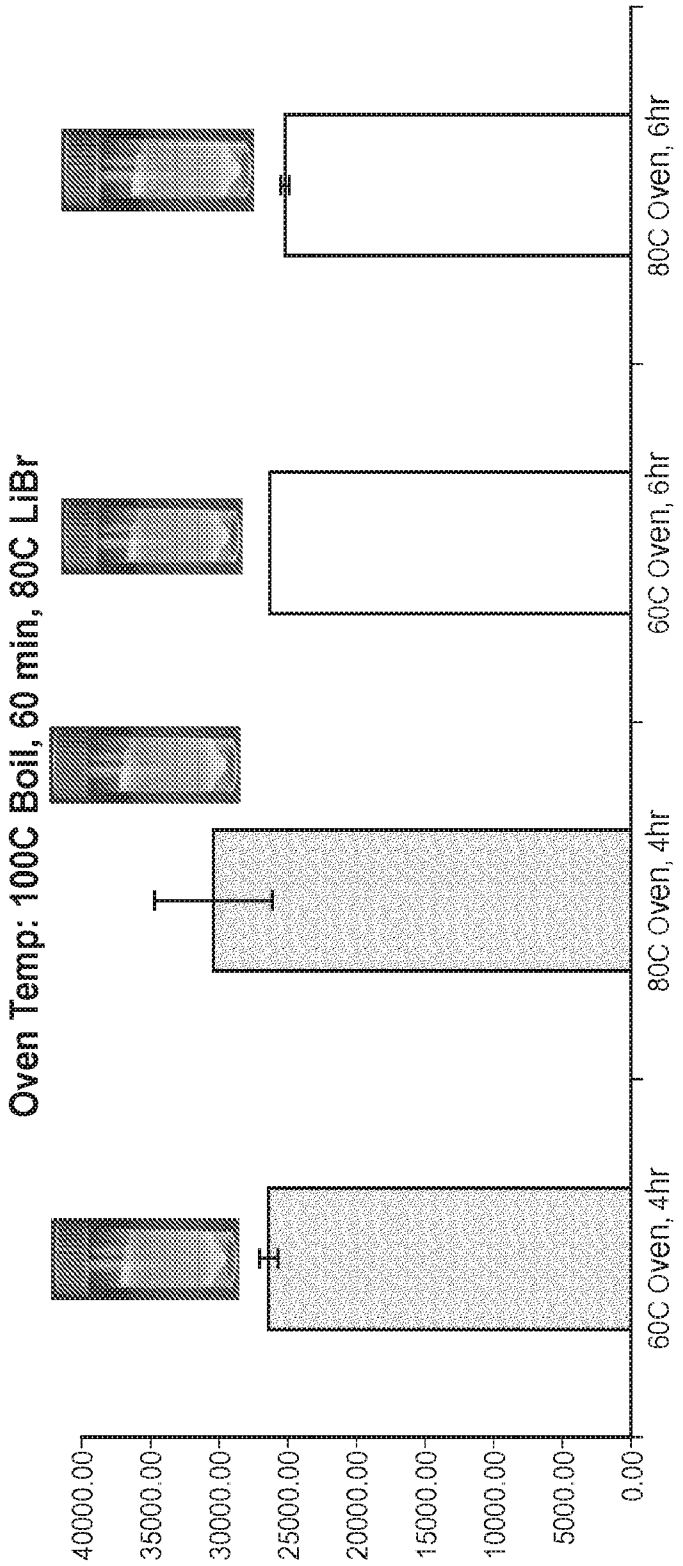

Oven Temp: 100C Boil, 60 min, 80C LiBr
40000.00
35000.00
30000.00
25000.00
20000.00
15000.00
10000.00
5000.00
0.00
60C Oven, 4hr
80C Oven, 4hr
60C Oven, 6hr
80C Oven, 6hr

FIG. 54

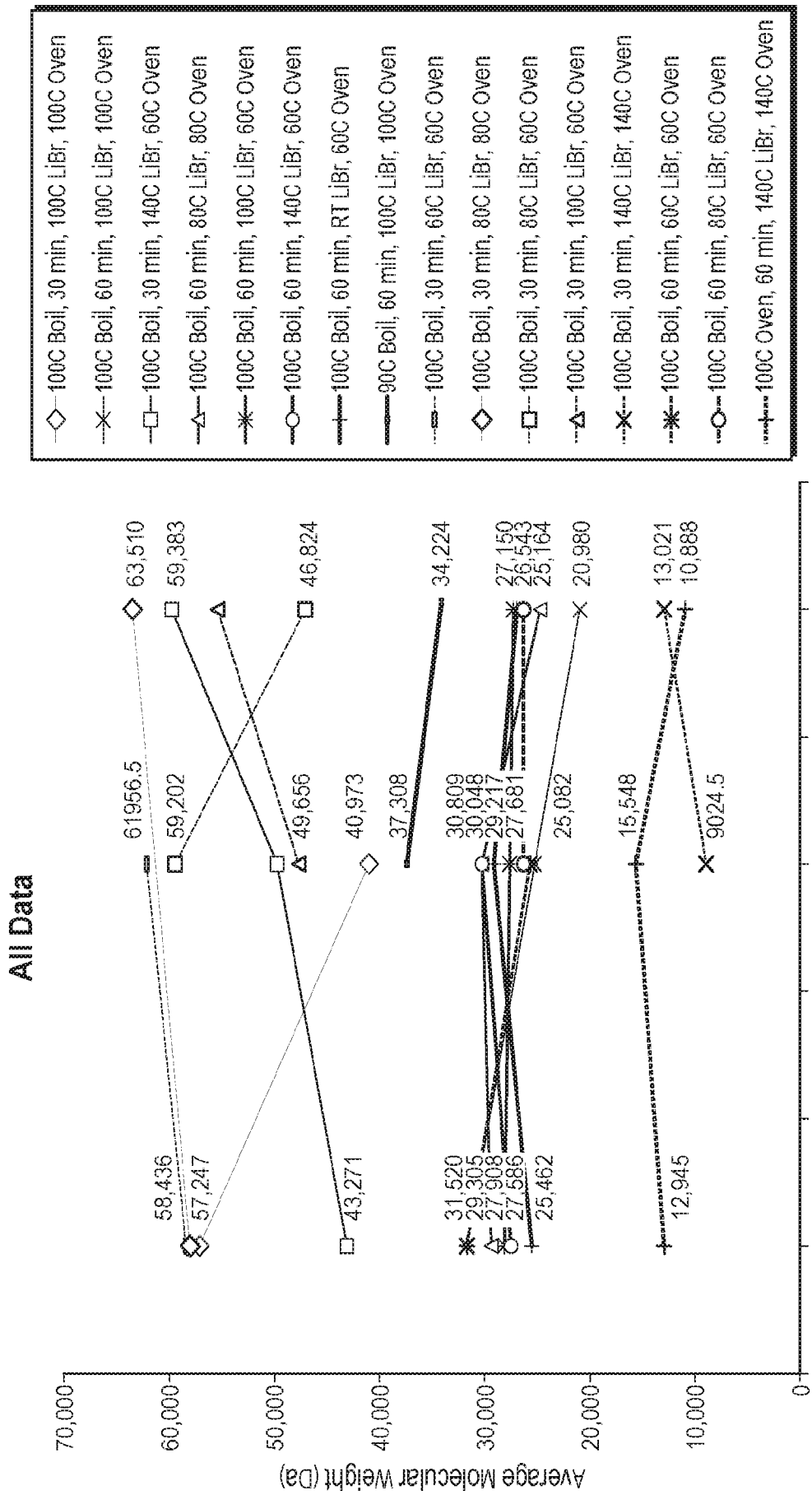

All Data
Average Molecular Weight (Da)
Time Oven (hrs)
100C Boil, 30 min, 100C LiBr, 100C Oven
100C Boil, 60 min, 100C LiBr, 100C Oven
100C Boil, 30 min, 140C LiBr, 60C Oven
100C Boil, 60 min, 80C LiBr, 80C Oven
100C Boil, 60 min, 100C LiBr, 60C Oven
100C Boil, 60 min, 140C LiBr, 60C Oven
100C Boil, 60 min, RT LiBr, 60C Oven
90C Boil, 60 min, 100C LiBr, 100C Oven
100C Boil, 30 min, 60C LiBr, 60C Oven
100C Boil, 30 min, 80C LiBr, 80C Oven
100C Boil, 30 min, 80C LiBr, 60C Oven
100C Boil, 30 min, 100C LiBr, 60C Oven
100C Boil, 30 min, 140C LiBr, 140C Oven
100C Boil, 60 min, 60C LiBr, 60C Oven
100C Boil, 60 min, 80C LiBr, 60C Oven
100C Oven, 60 min, 140C LiBr, 140C Oven
63,510
59,383
46,824
61956.5
59,202
49,656
40,973
37,308
34,224
27,150
26,543
25,164
30,809
30,048
29,217
27,681
25,082
20,980
58,436
57,247
43,271
31,520
29,305
27,908
27,586
25,462
15,548
13,021
10,888
12,945
9024.5

FIG. 55

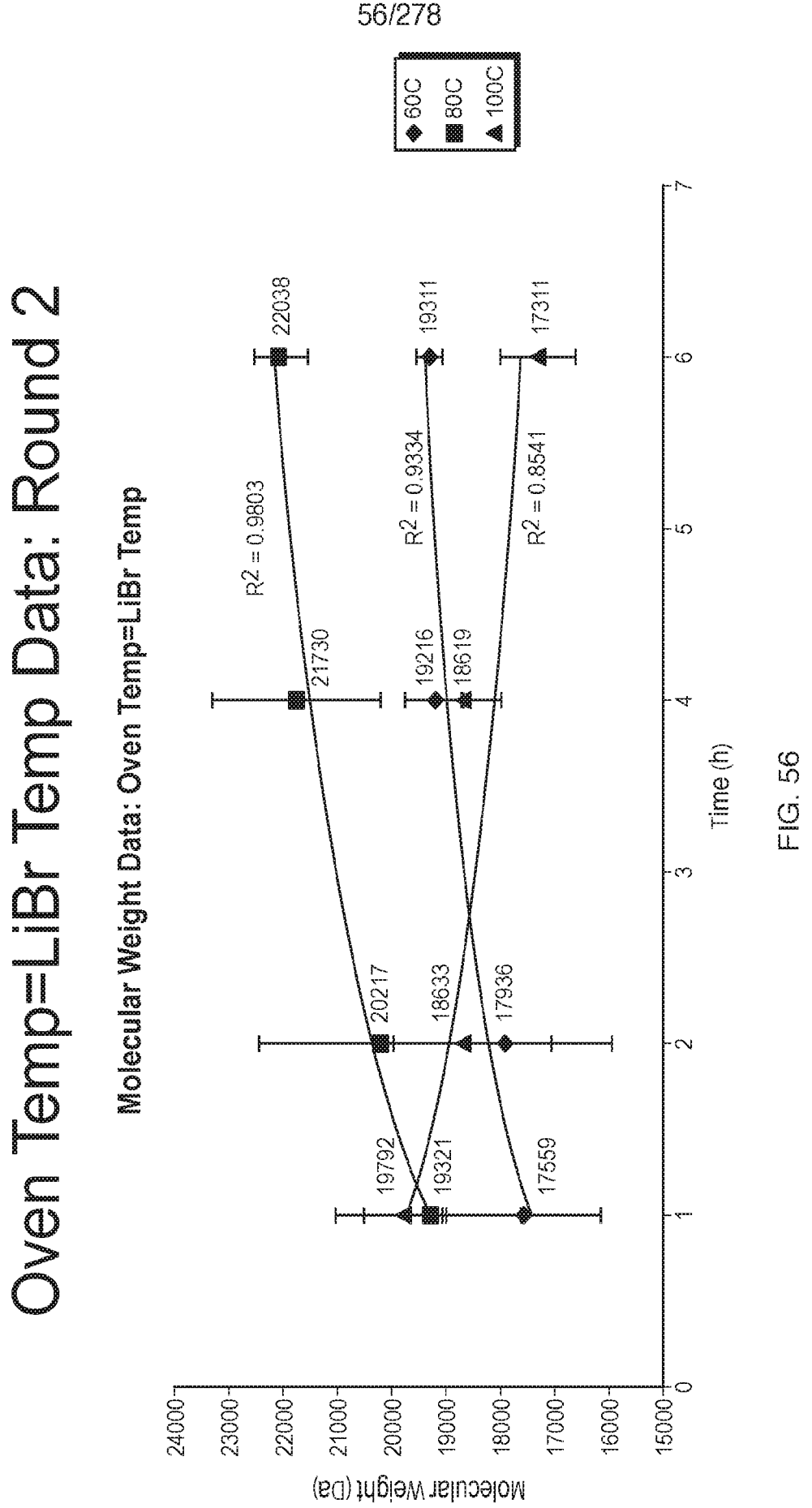

Oven Temp=LiBr Temp Data: Round 2
Molecular Weight Data: Oven Temp=LiBr Temp
60C
80C
100C
R2 = 0.9803
R2 = 0.9334
R2 = 0.8541
22038
21730
20217
19792
19311
19216
18633
19321
18619
17936
17311
17559
Molecular Weight (Da)
Time (h)
24000
23000
22000
21000
20000
19000
18000
17000
16000
15000
0
1
2
3
4
5
6
7

FIG. 56

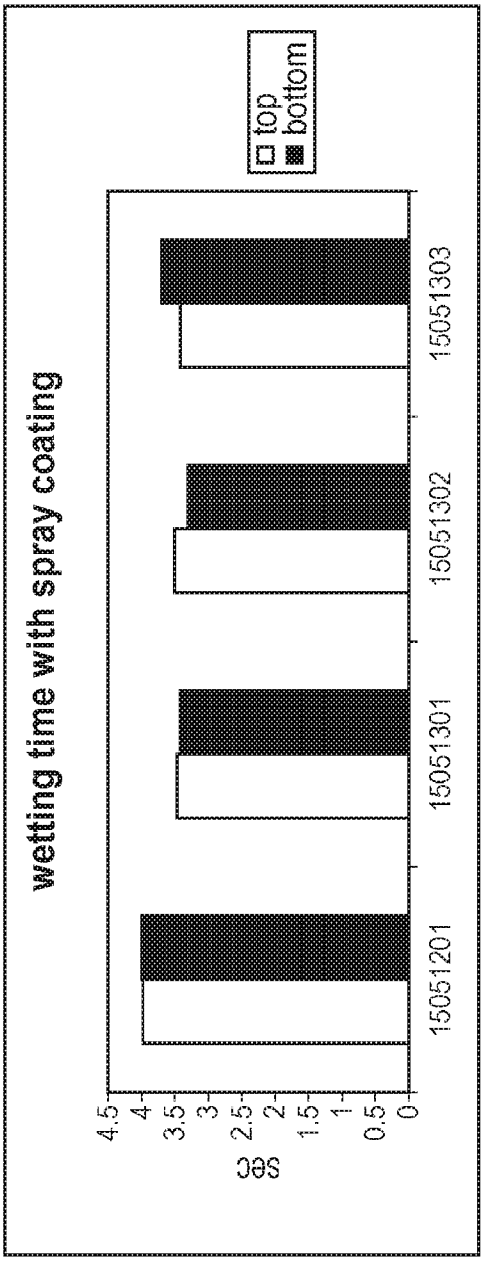


FIG. 57A

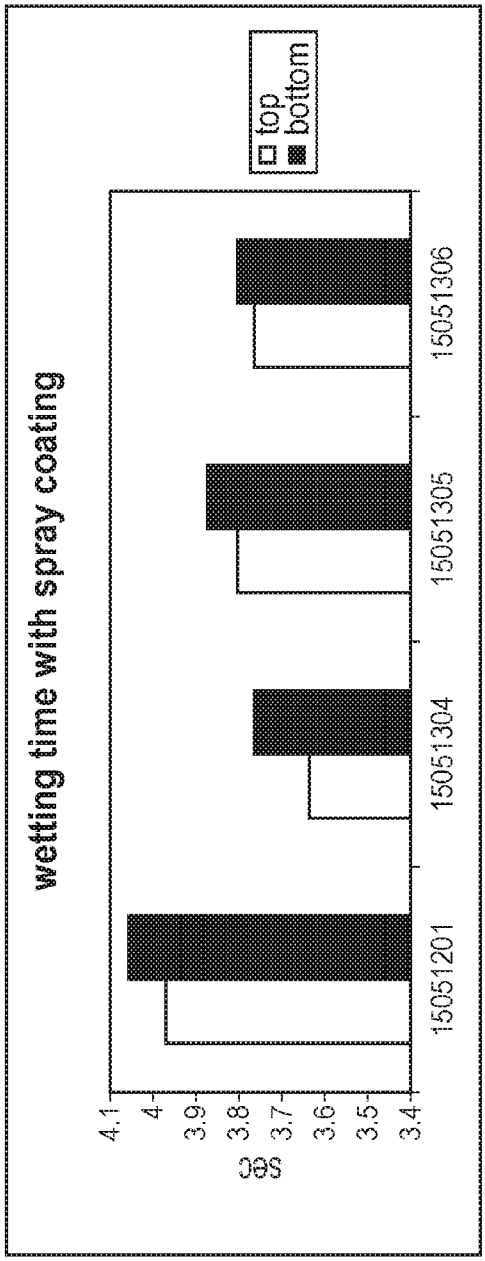


FIG. 57B

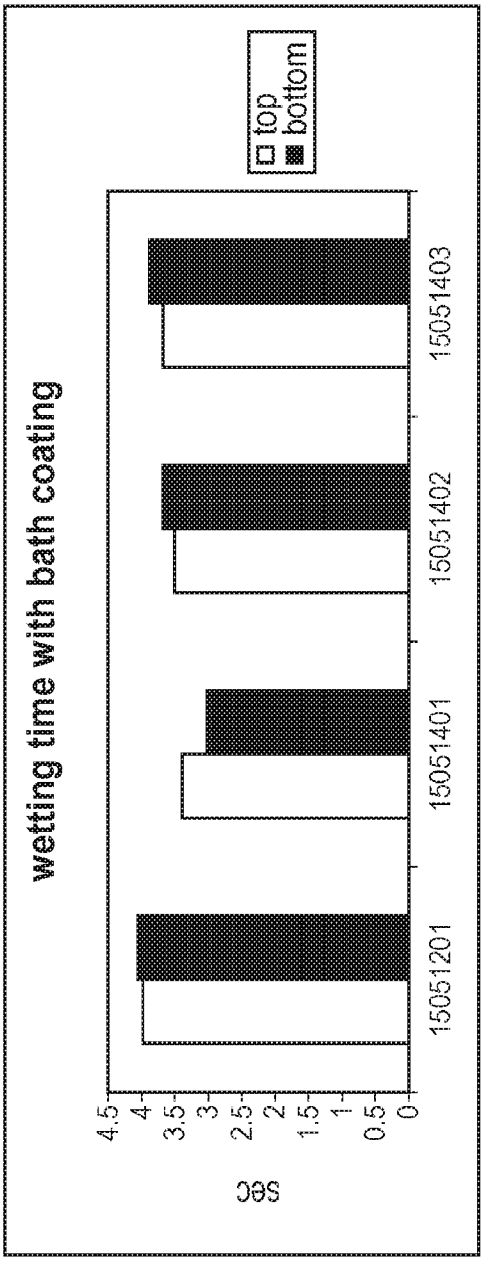


FIG. 57C

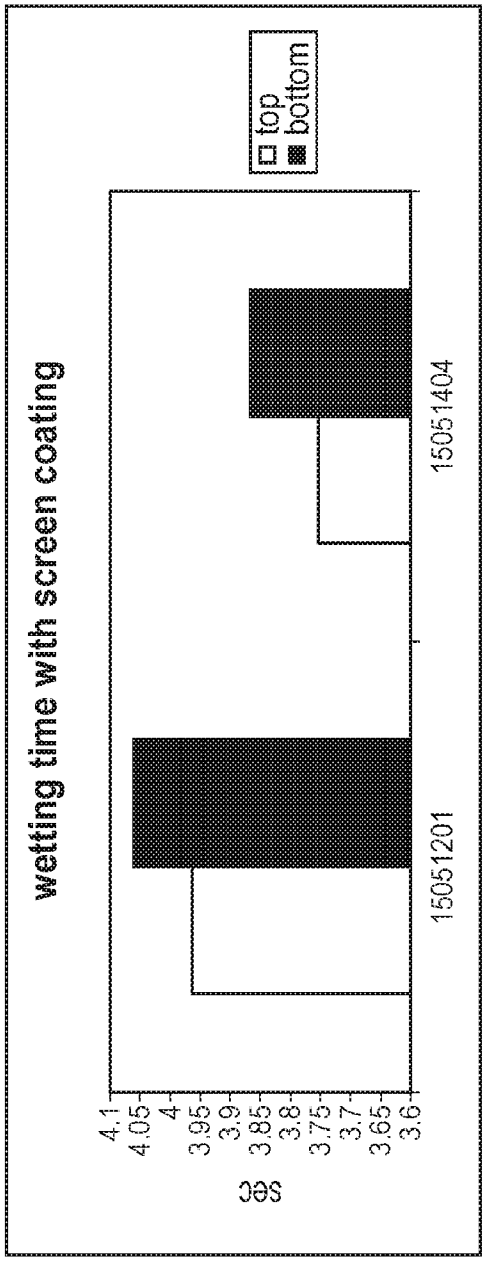


FIG. 57D

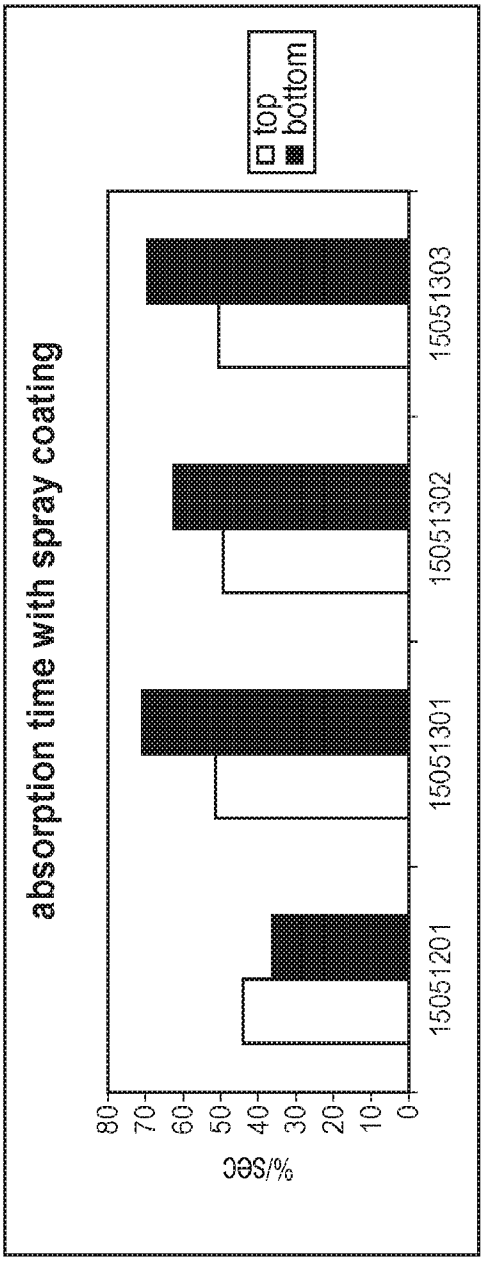


FIG. 58A

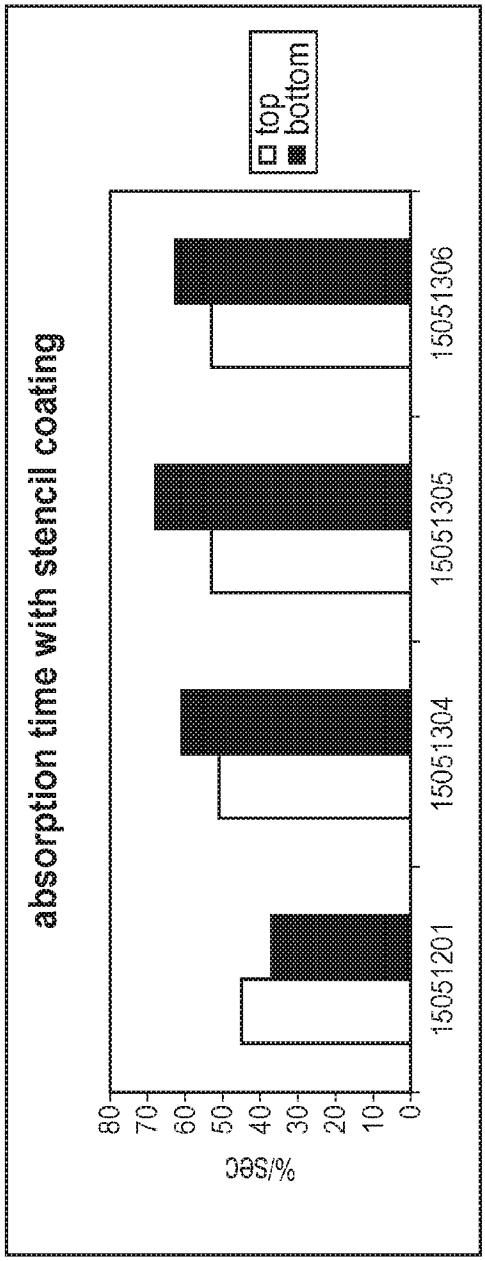


FIG. 58B

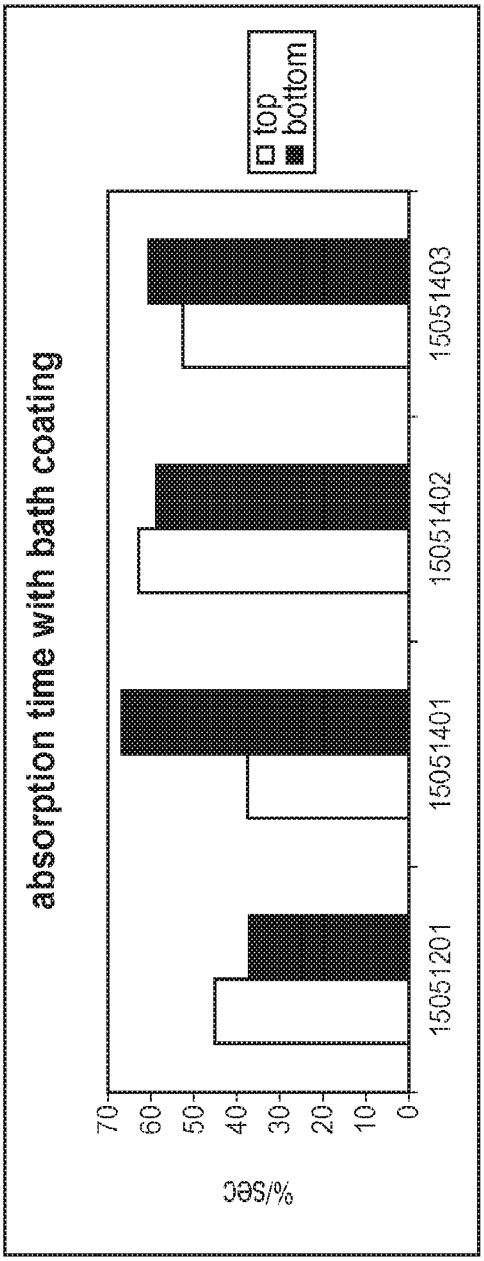


FIG. 58C

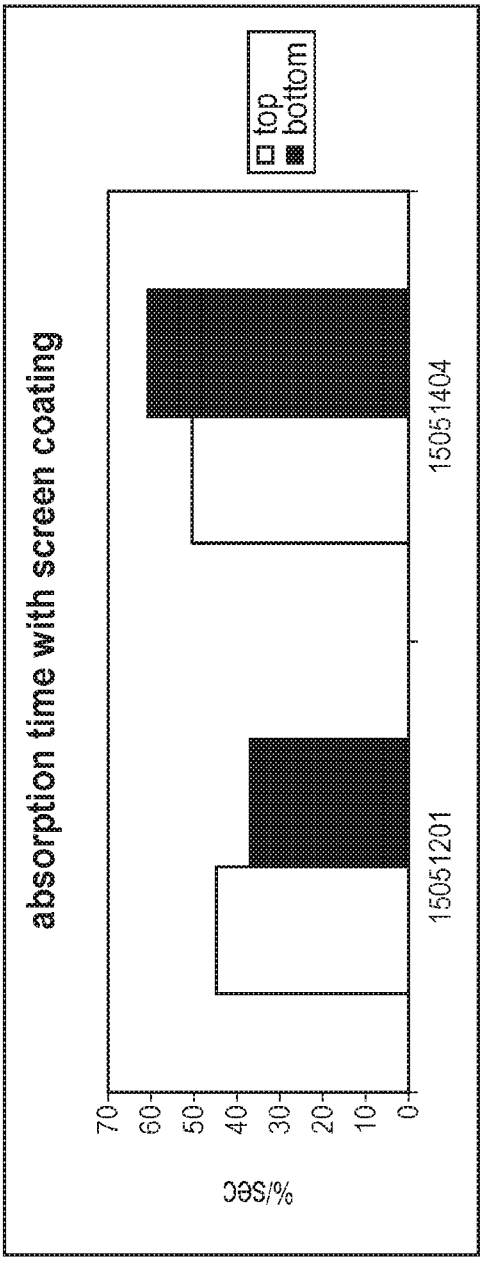


FIG. 58D

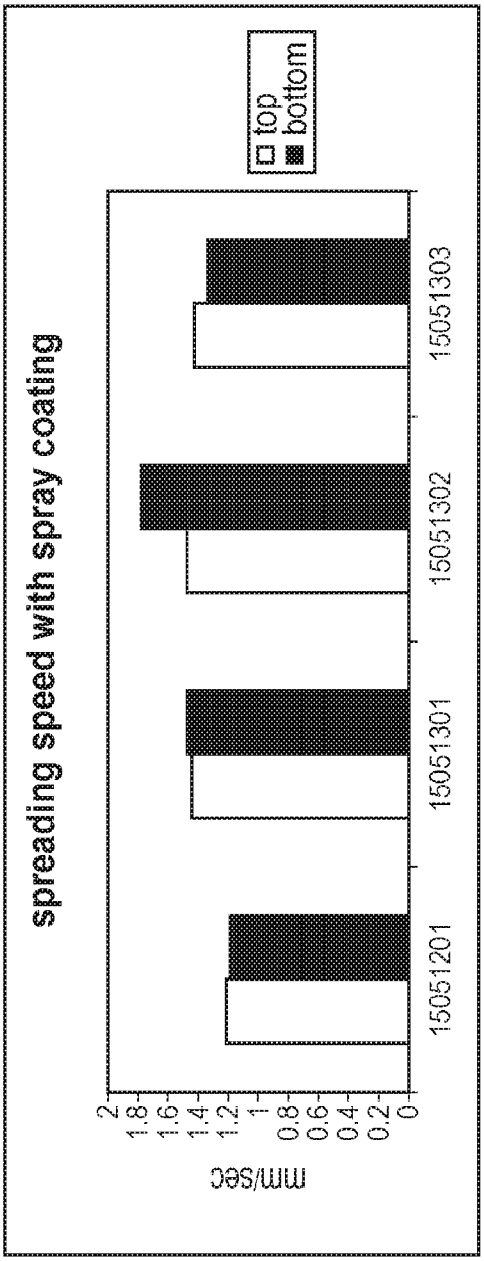


FIG. 59A

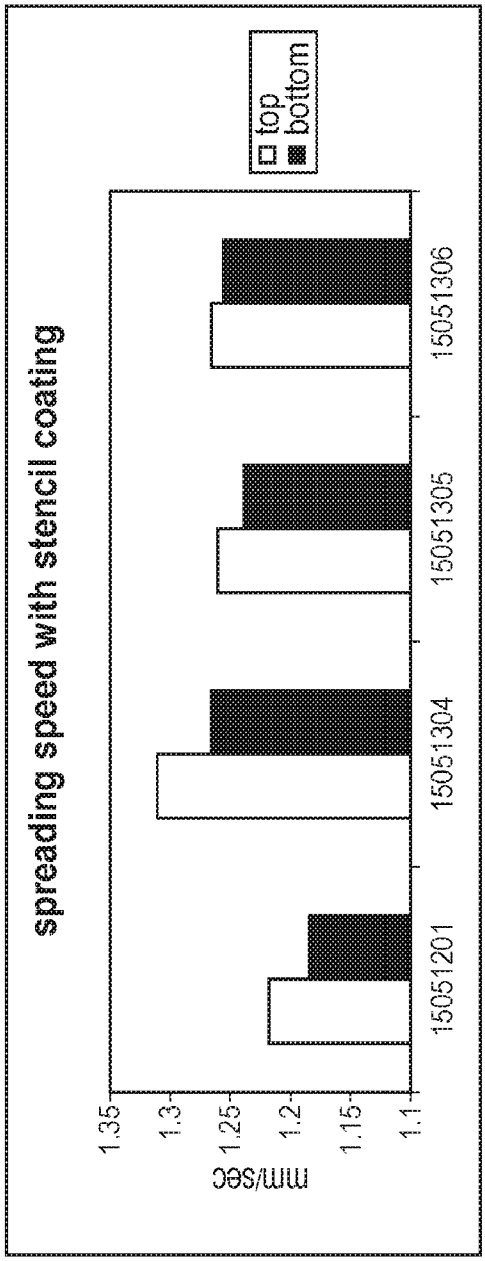


FIG. 59B

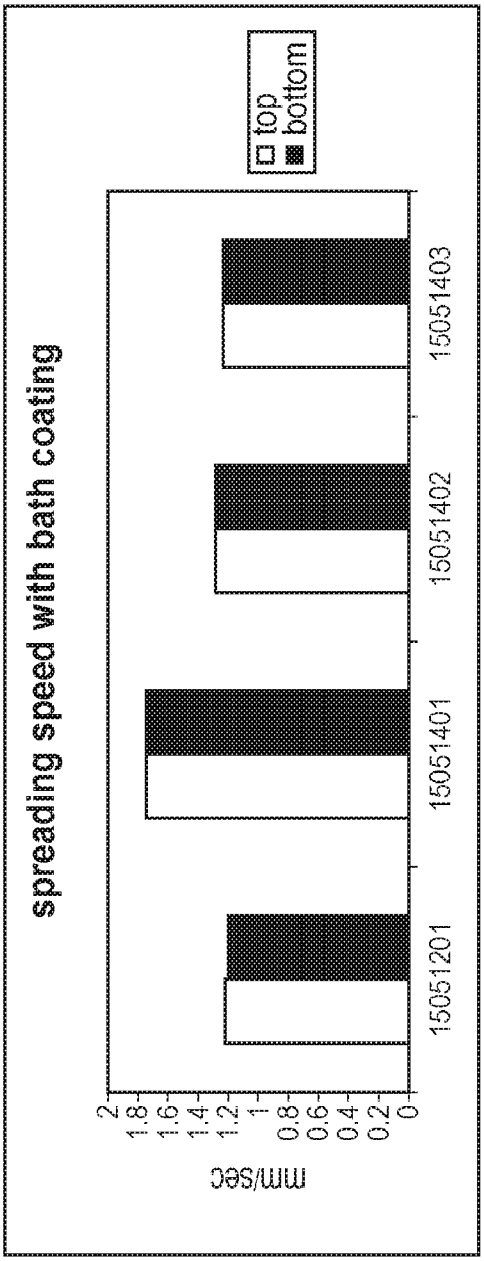


FIG. 59C

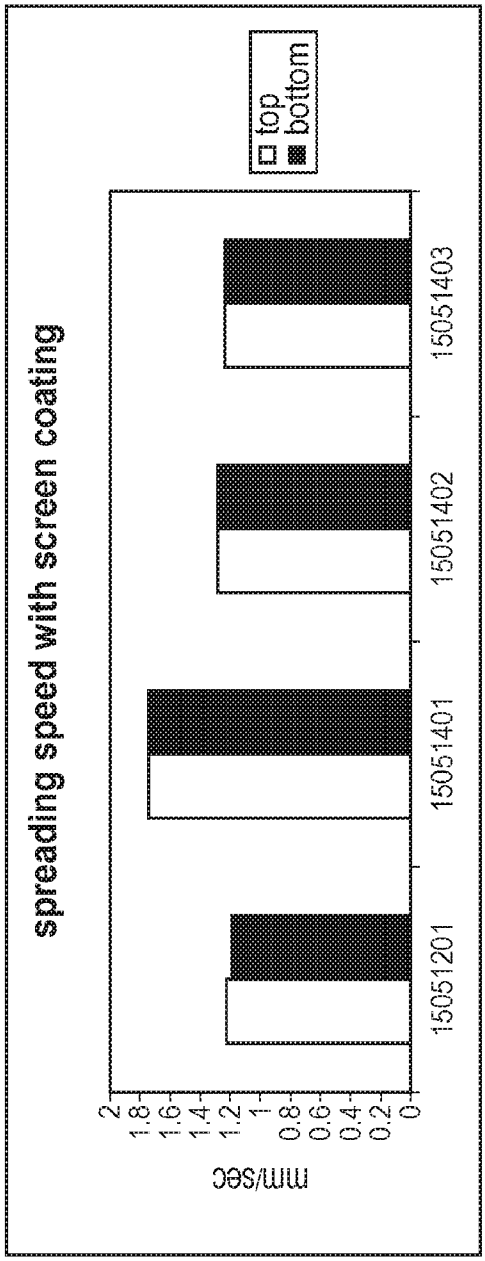


FIG. 59D

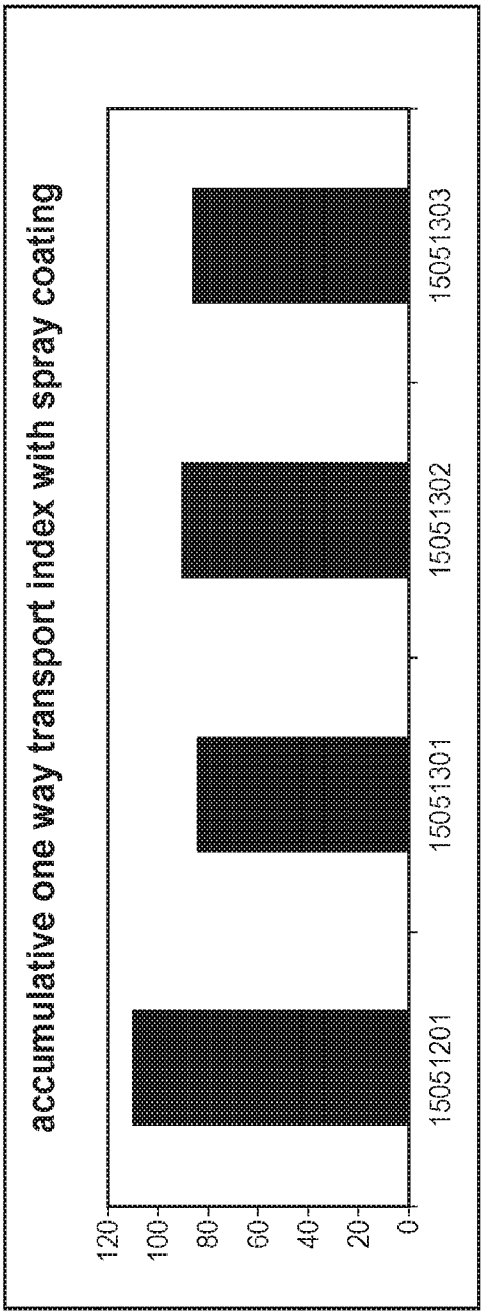


FIG. 60A

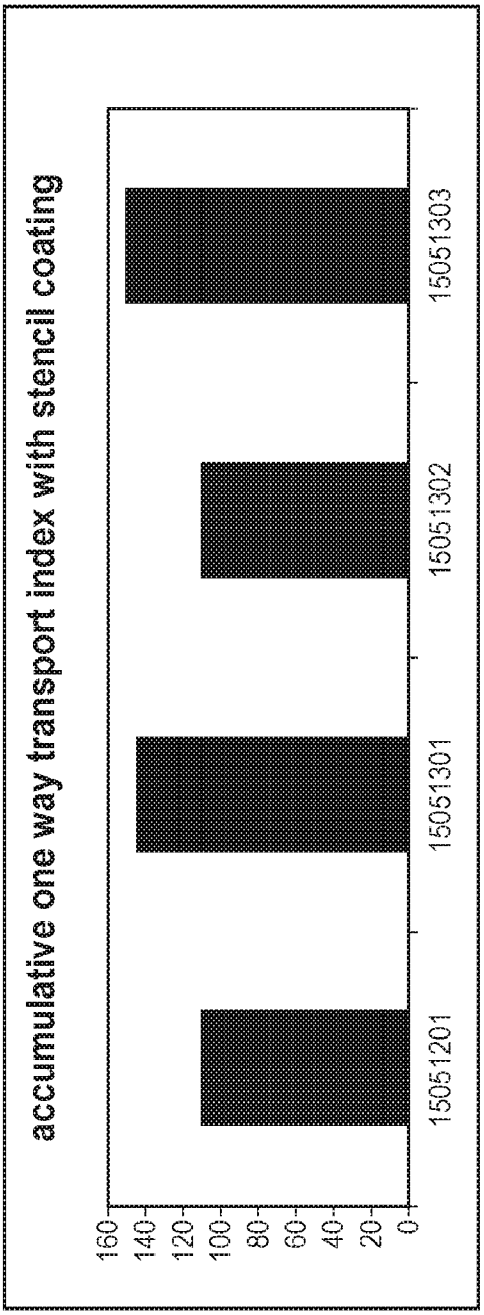


FIG. 60B

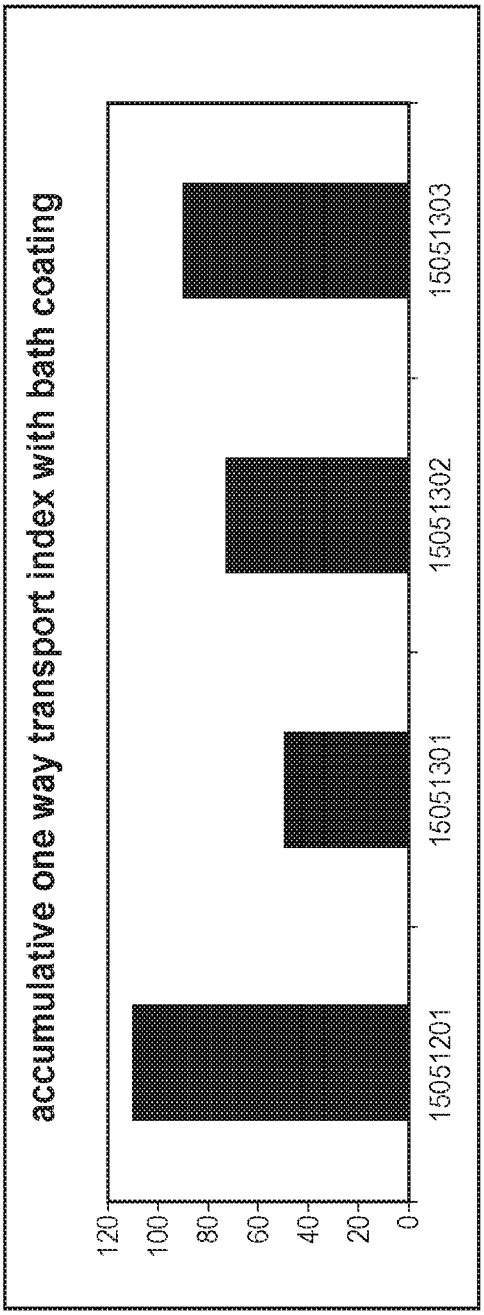


FIG. 60C

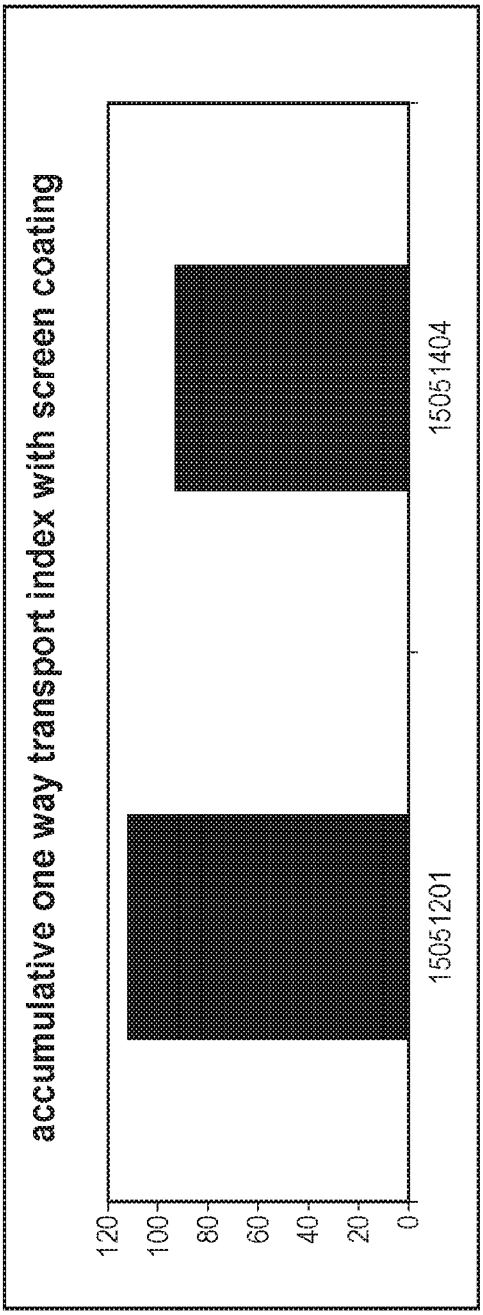


FIG. 60D

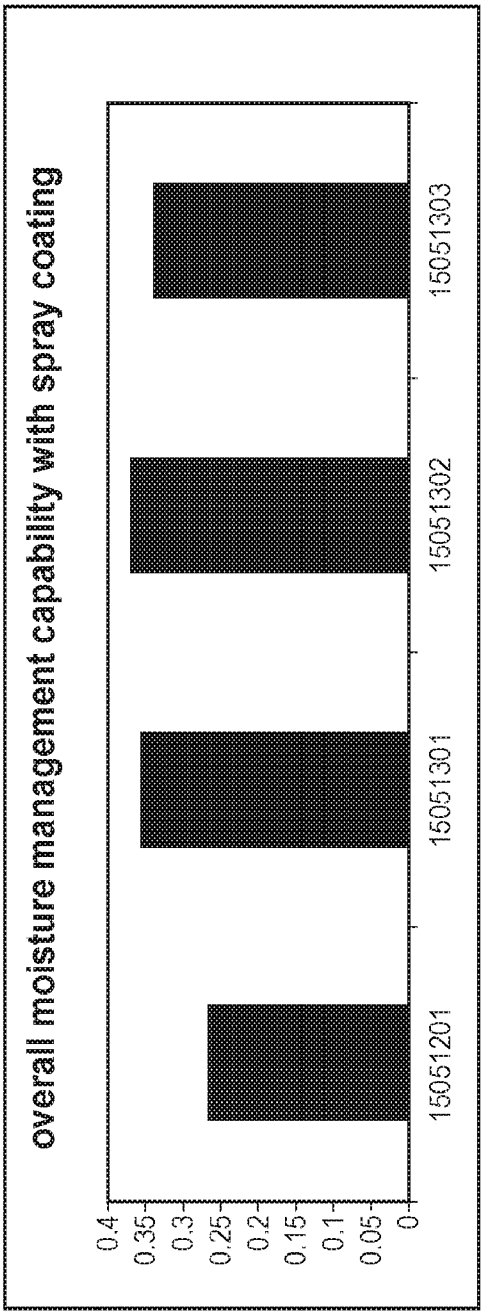


FIG. 61A

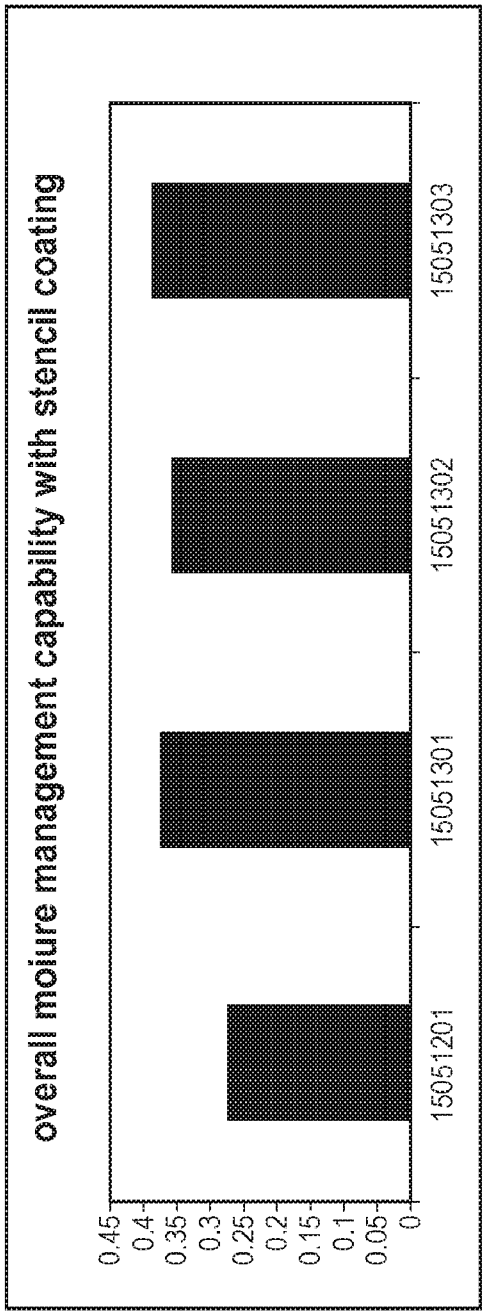


FIG. 61B

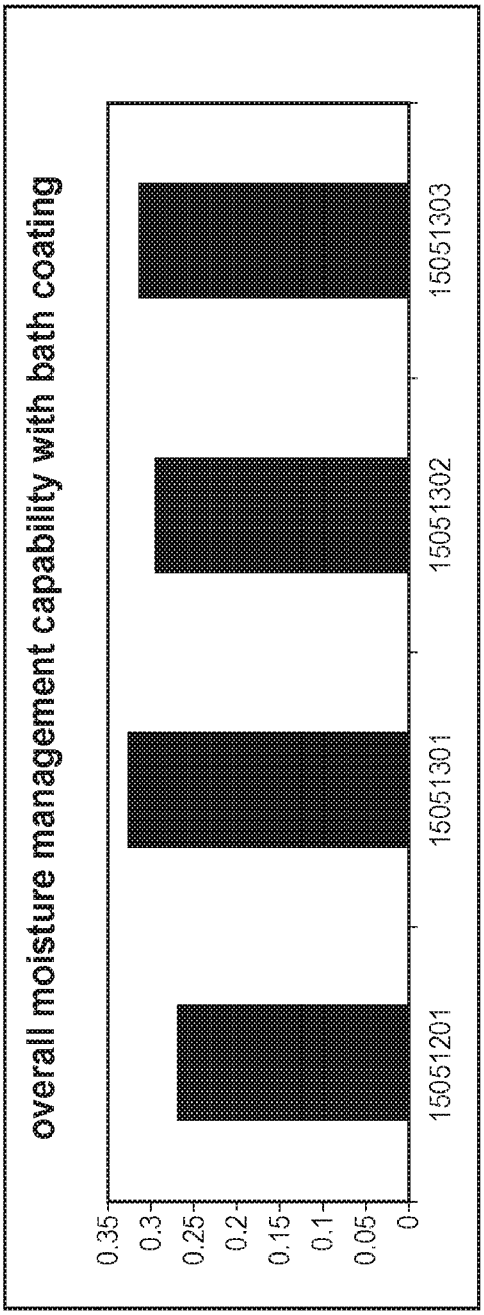


FIG. 61C

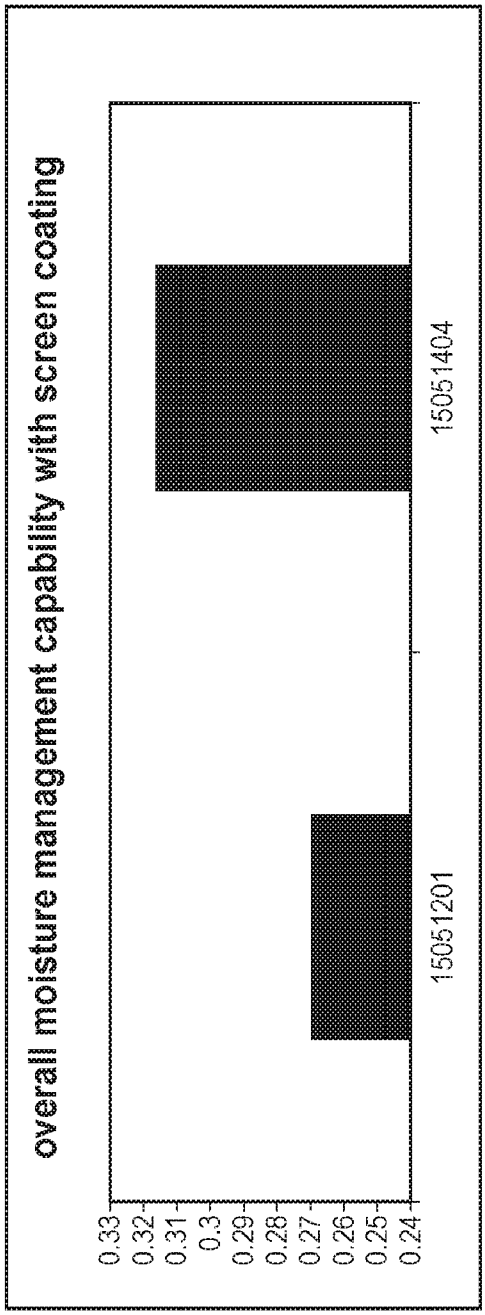


FIG. 61D

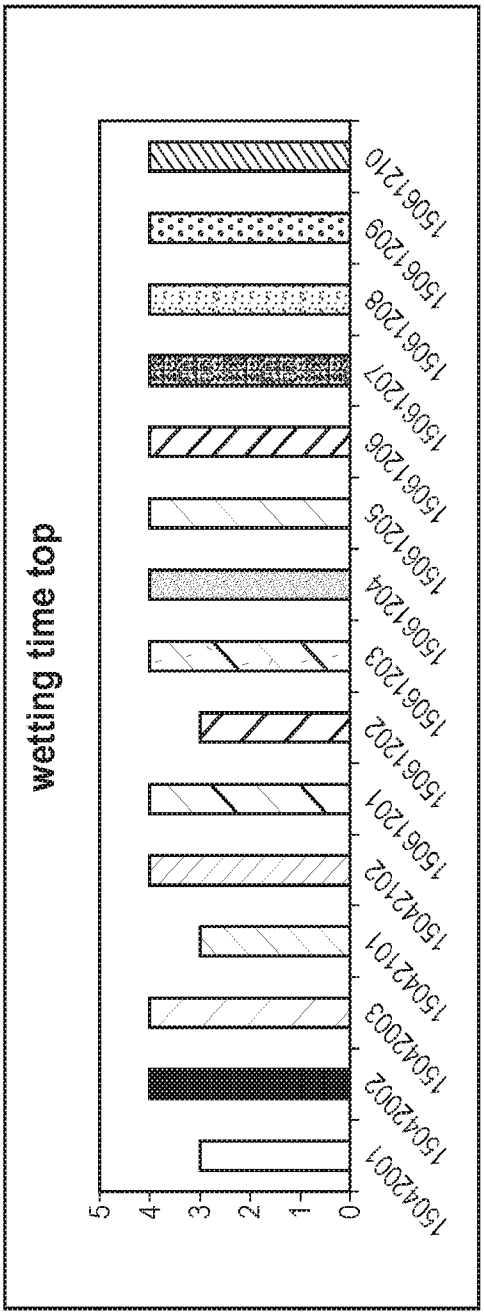


FIG. 62A

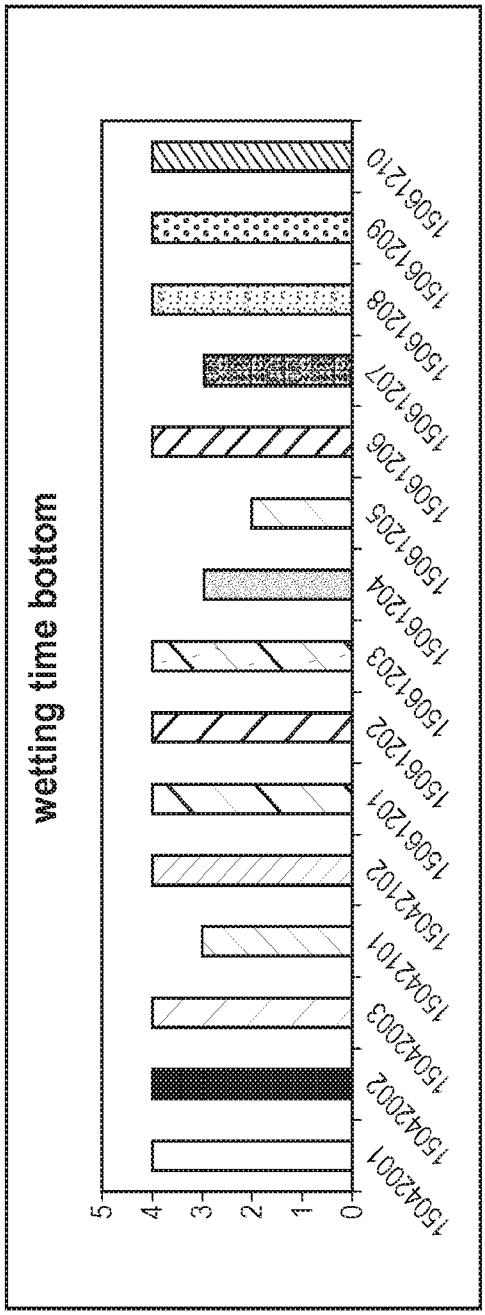


FIG. 62B

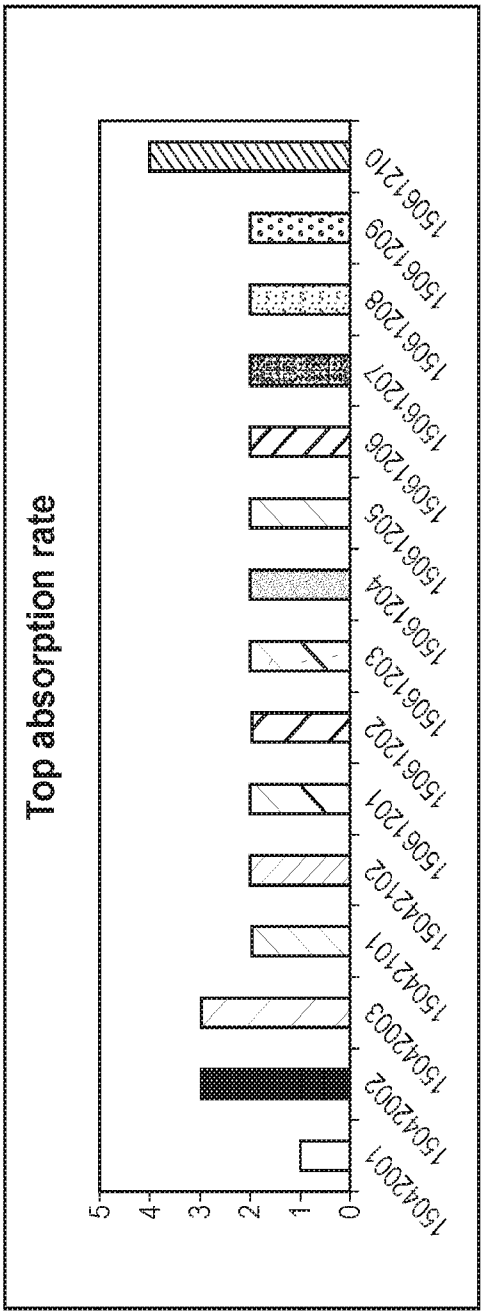


FIG. 63A

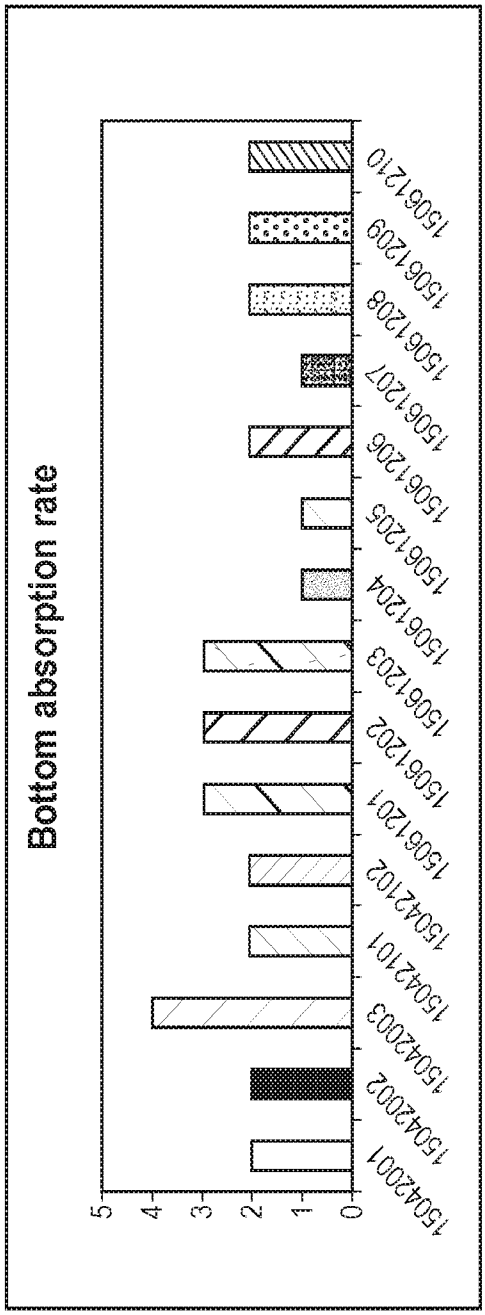


FIG. 63B

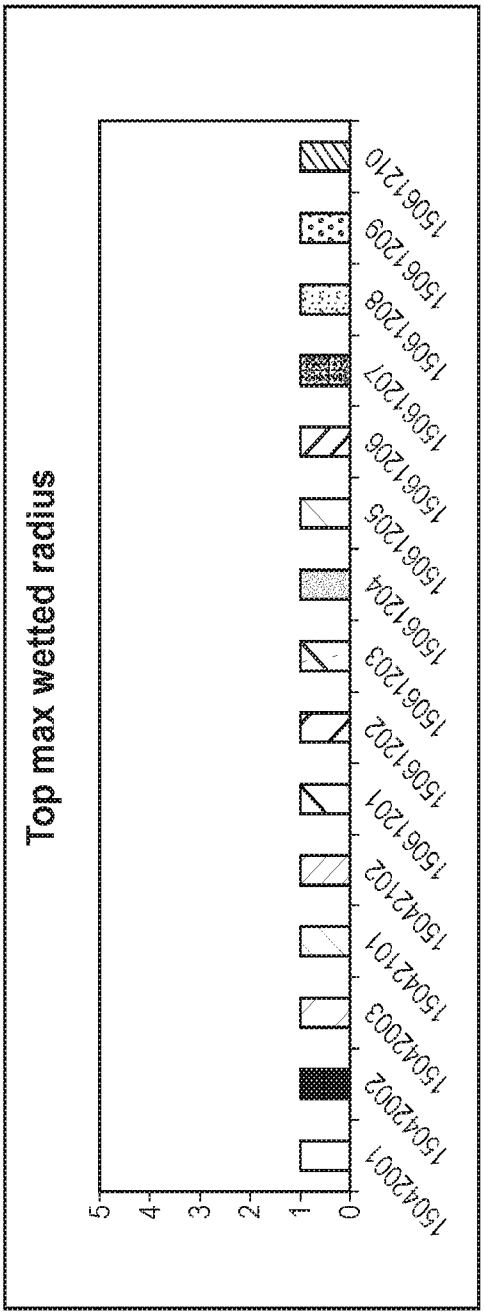


FIG. 64A

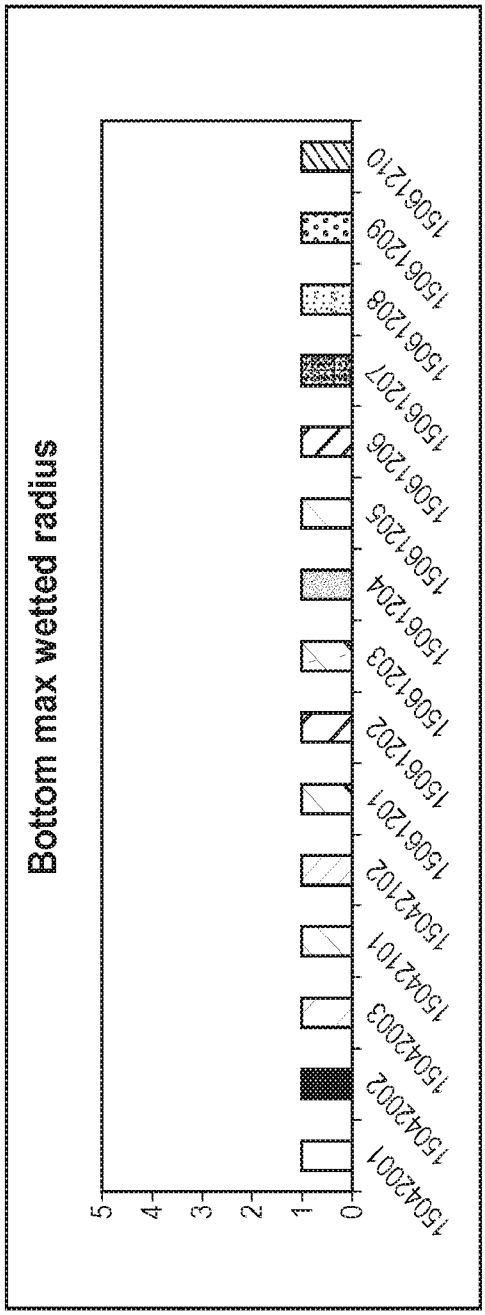


FIG. 64B

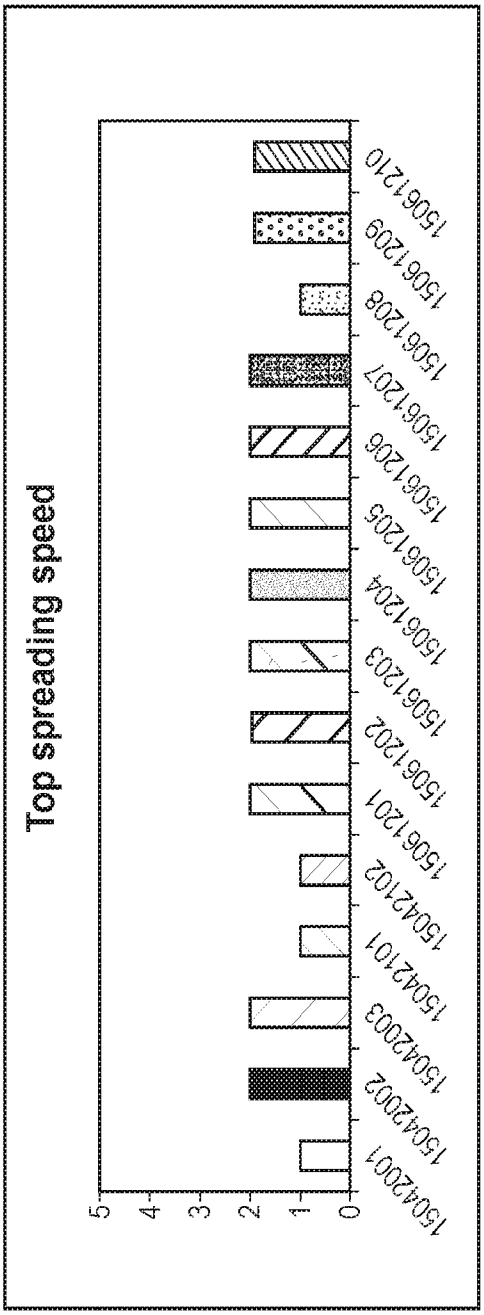


FIG. 65A

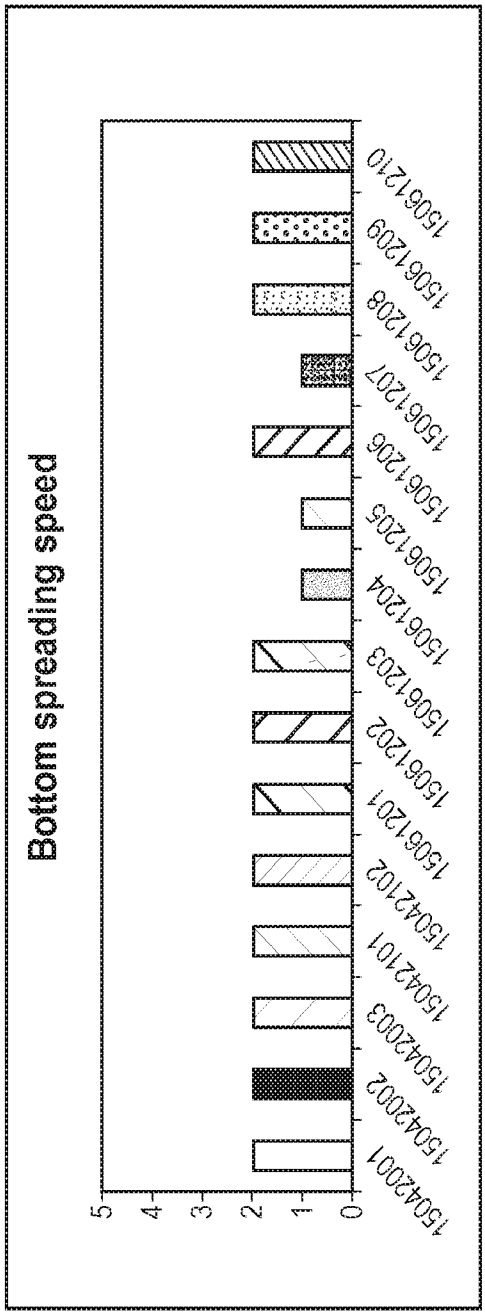


FIG. 65B

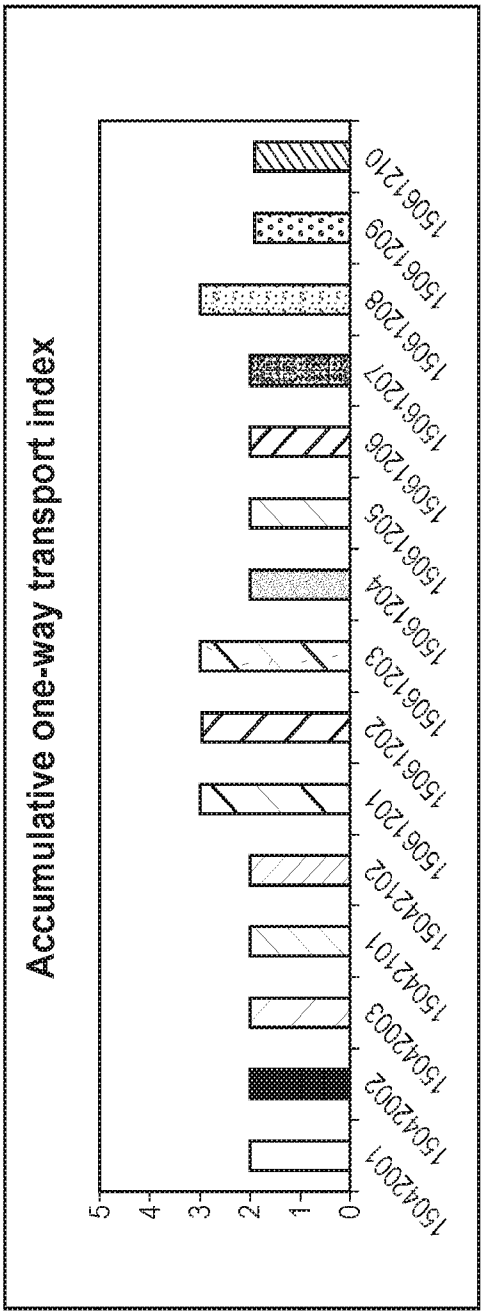


FIG. 66A

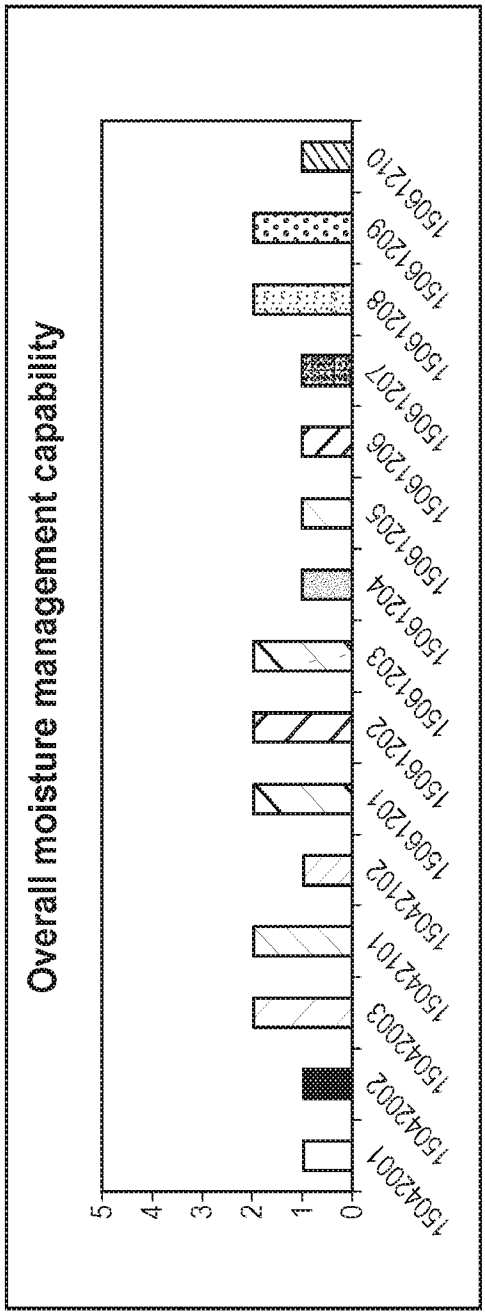


FIG. 66B

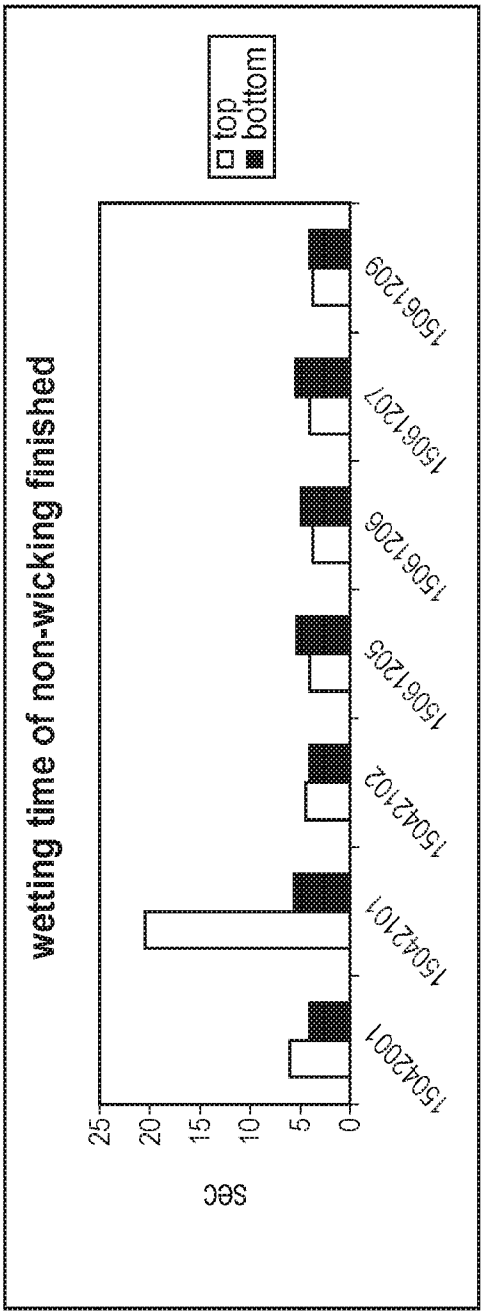


FIG. 67A

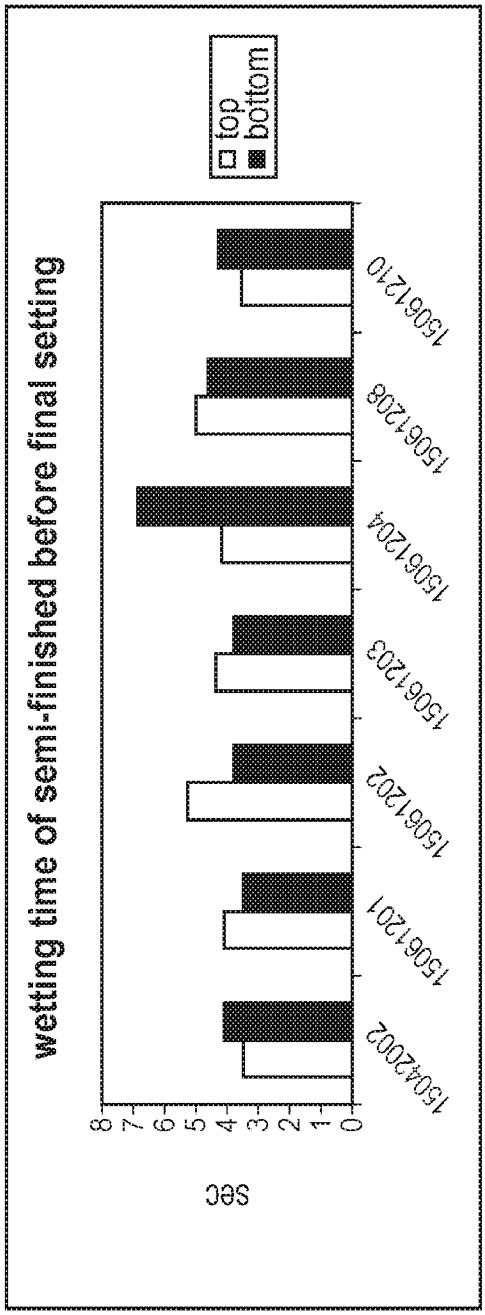


FIG. 67B

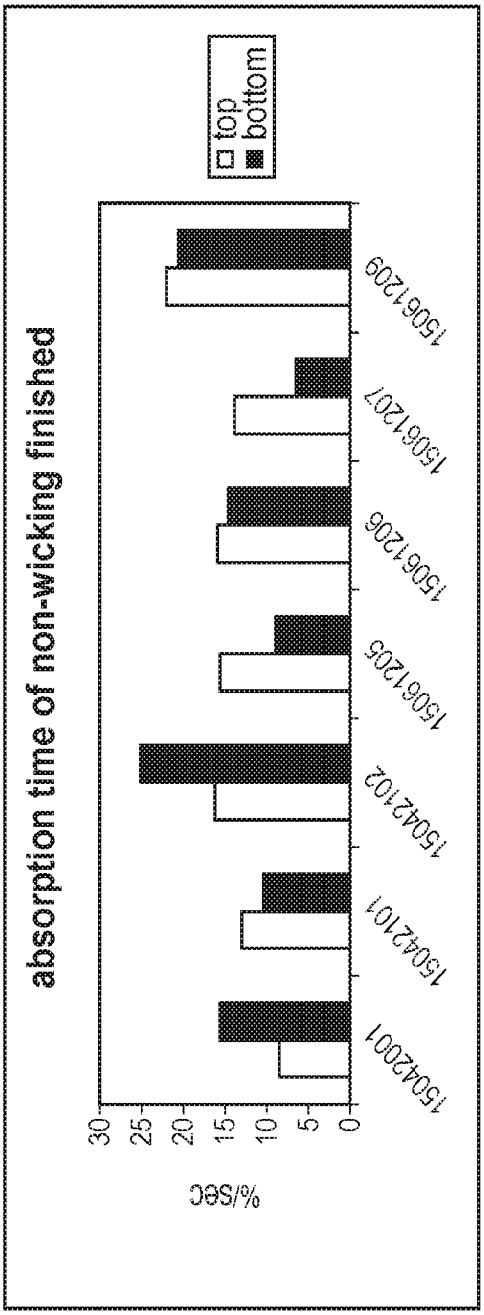


FIG. 68A

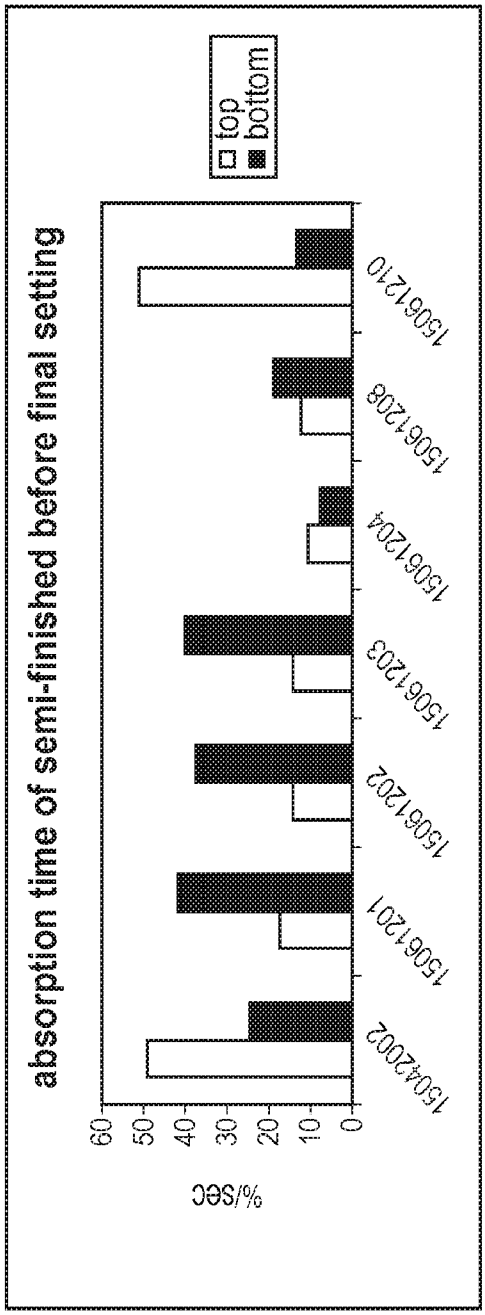


FIG. 68B

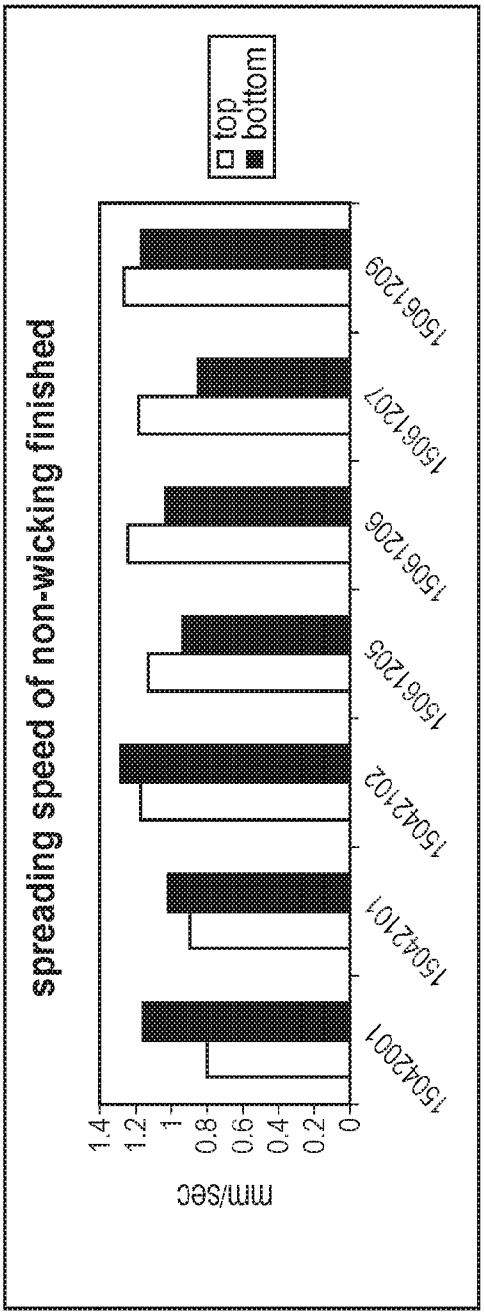


FIG. 69A

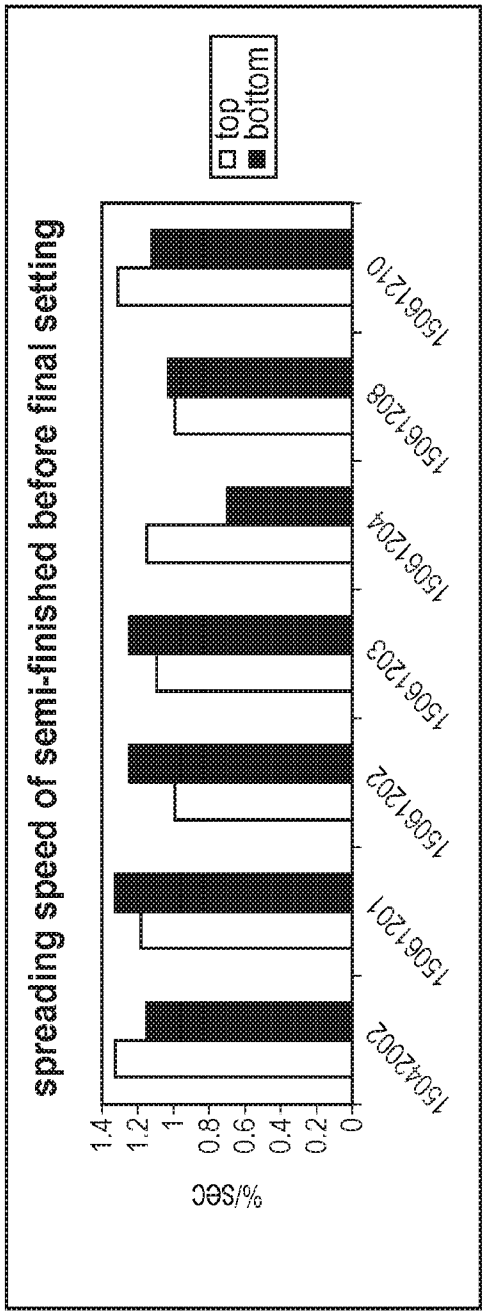


FIG. 69B

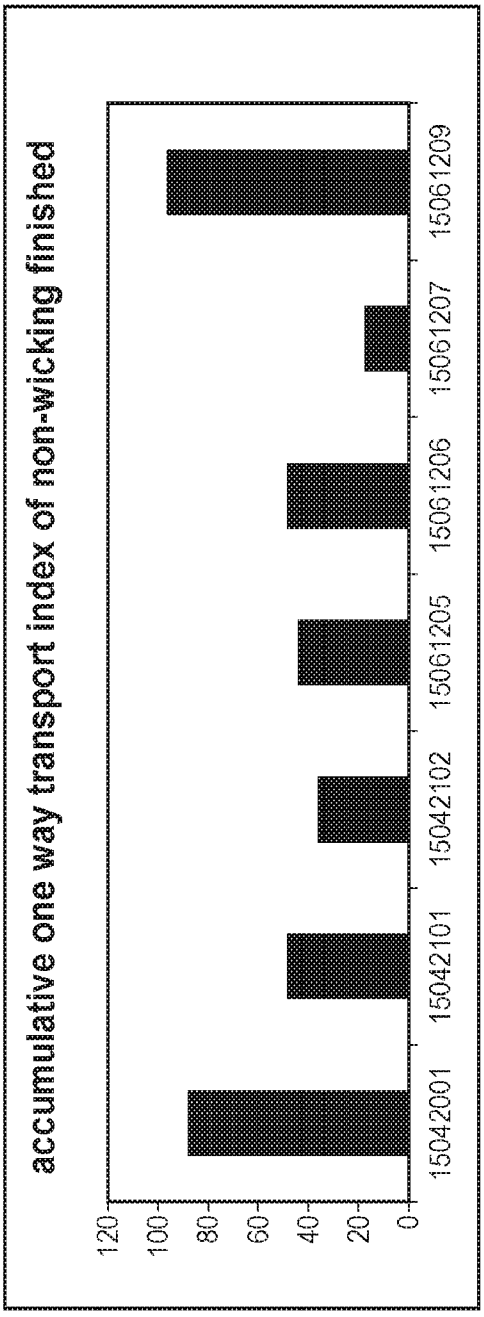


FIG. 70A

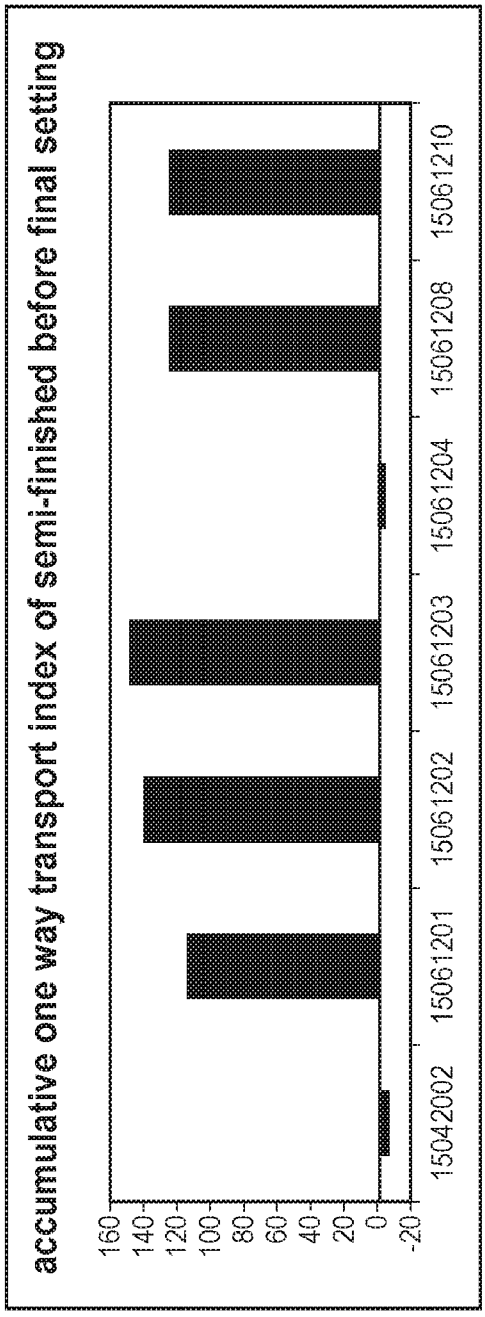


FIG. 70B

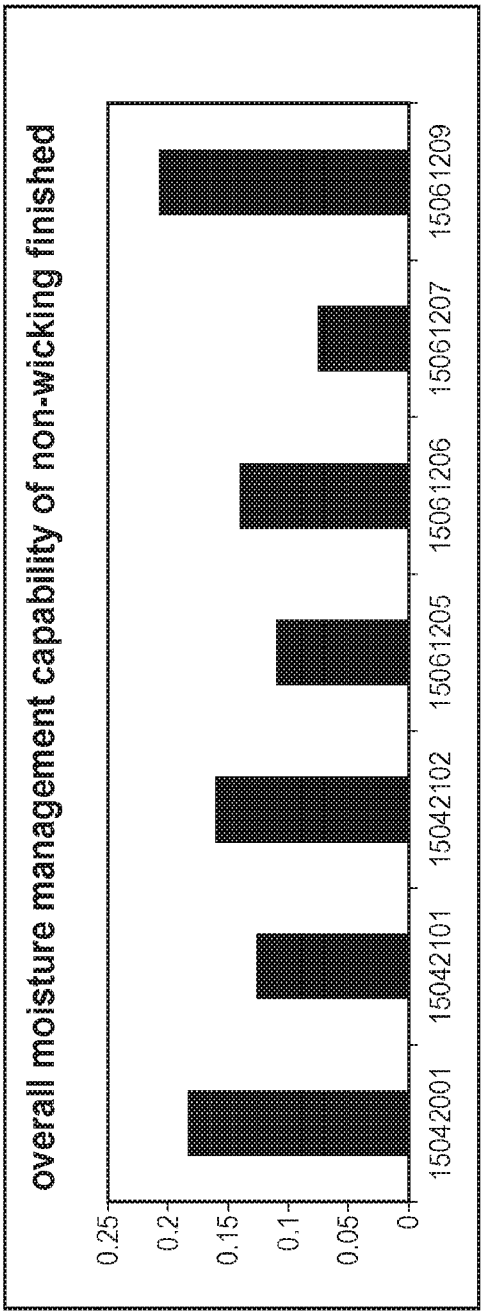


FIG. 71A

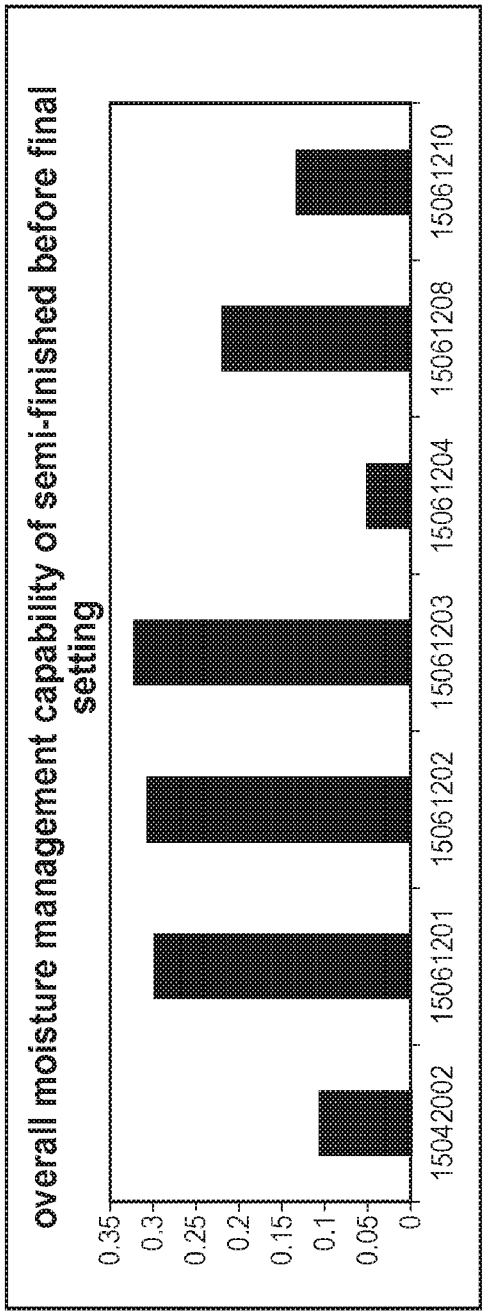


FIG. 71B

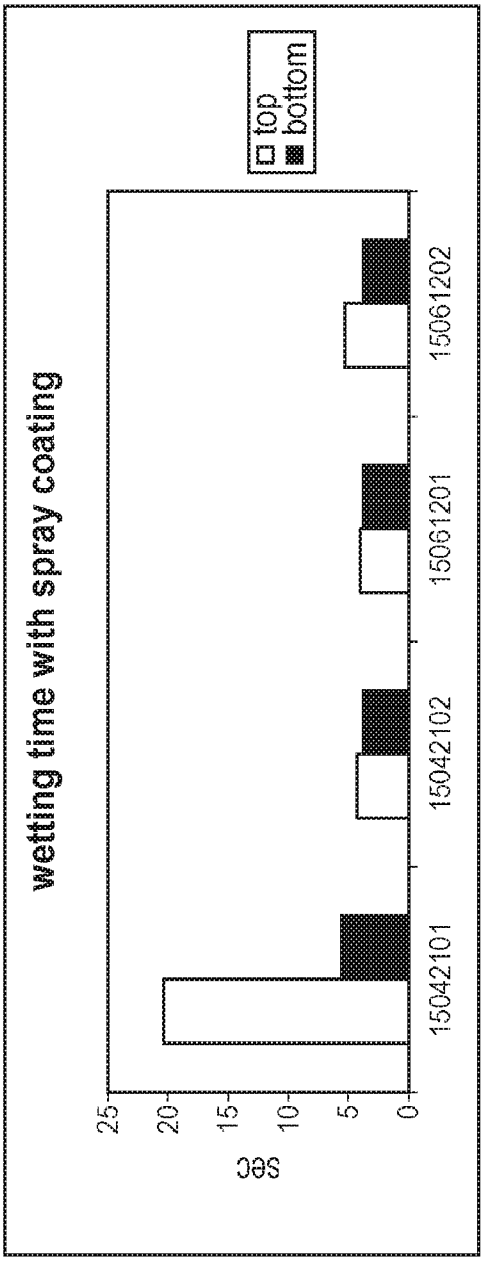


FIG. 72A

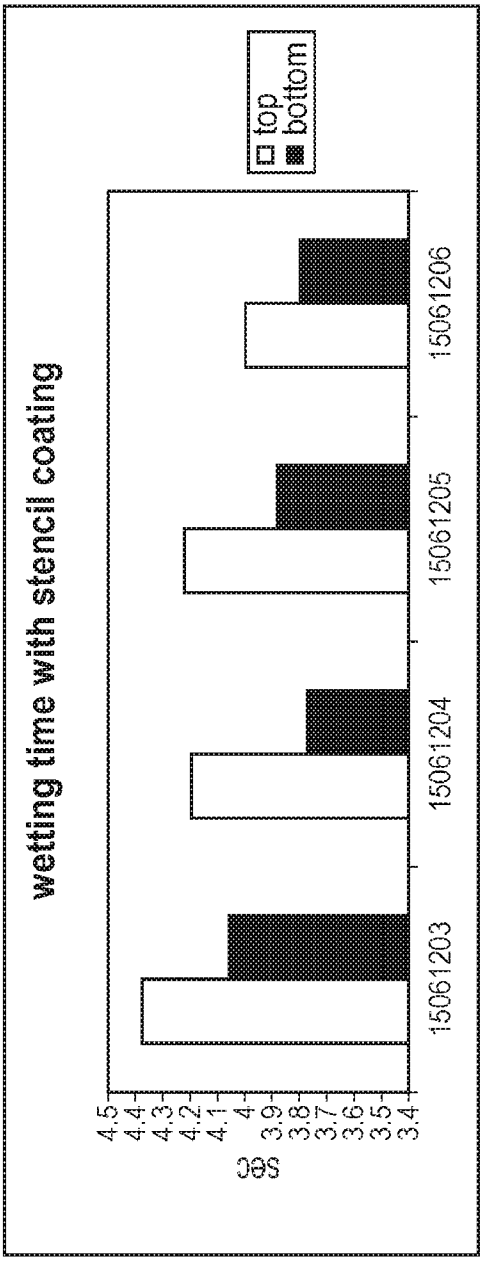


FIG. 72B

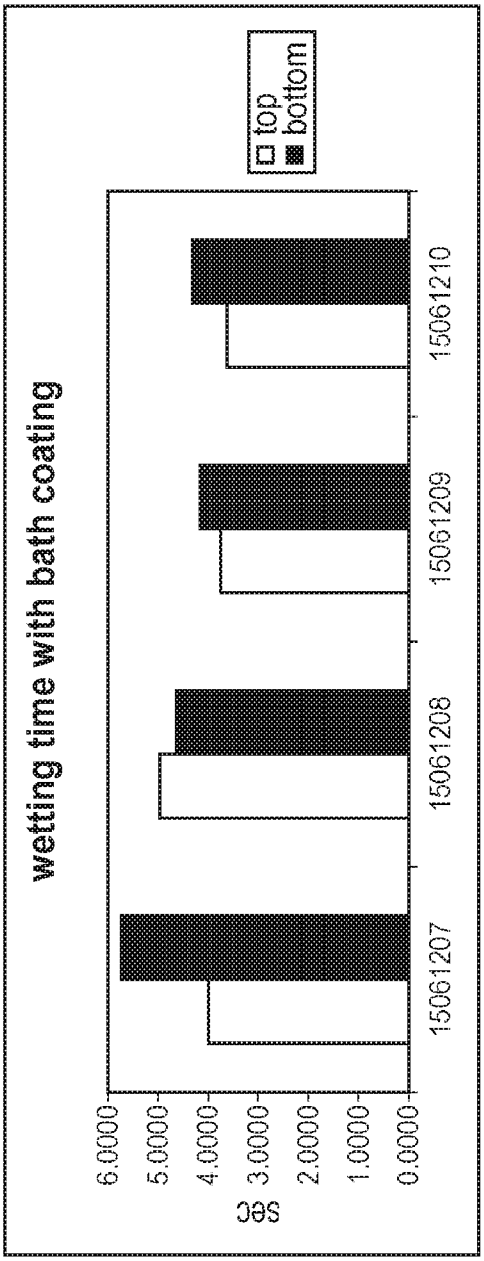


FIG. 72C

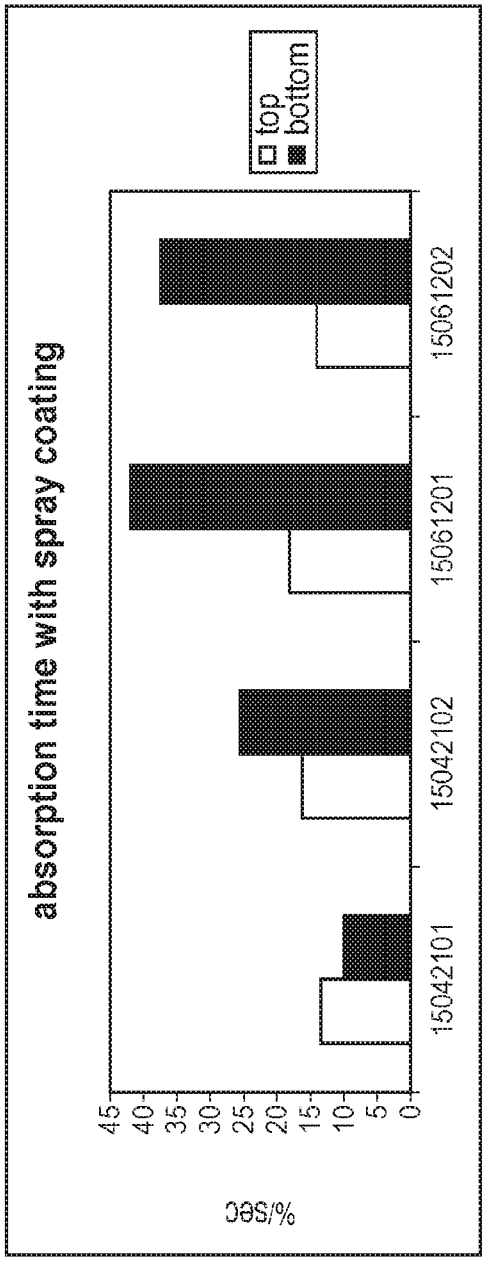


FIG. 73A

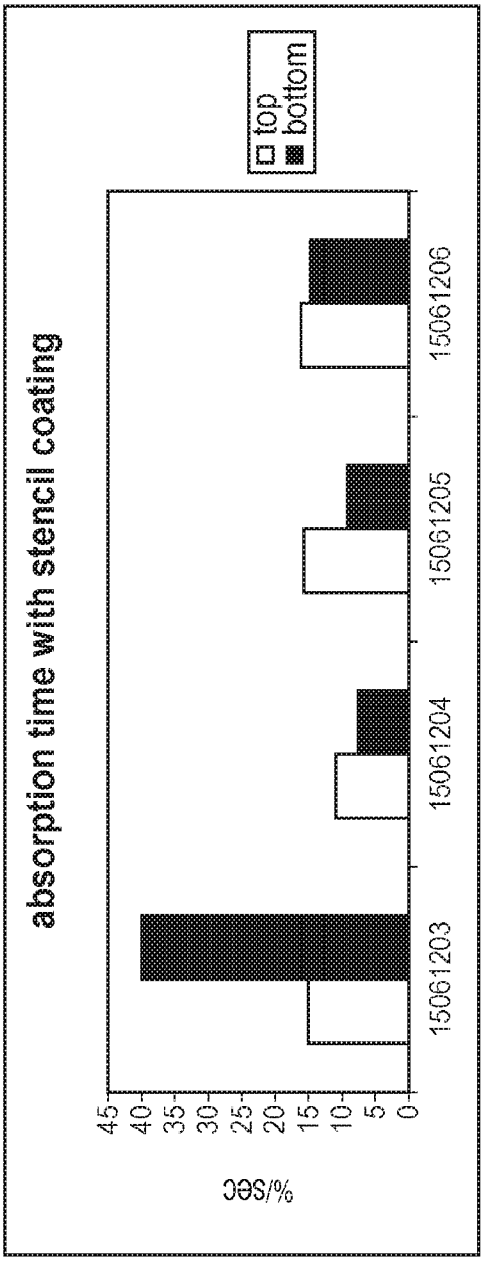


FIG. 73B

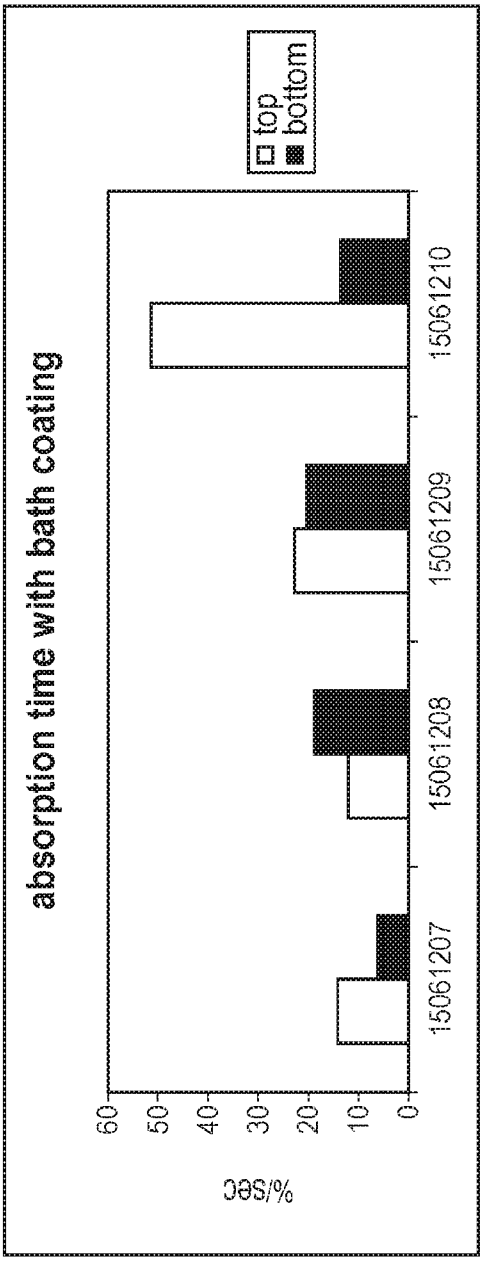


FIG. 73C

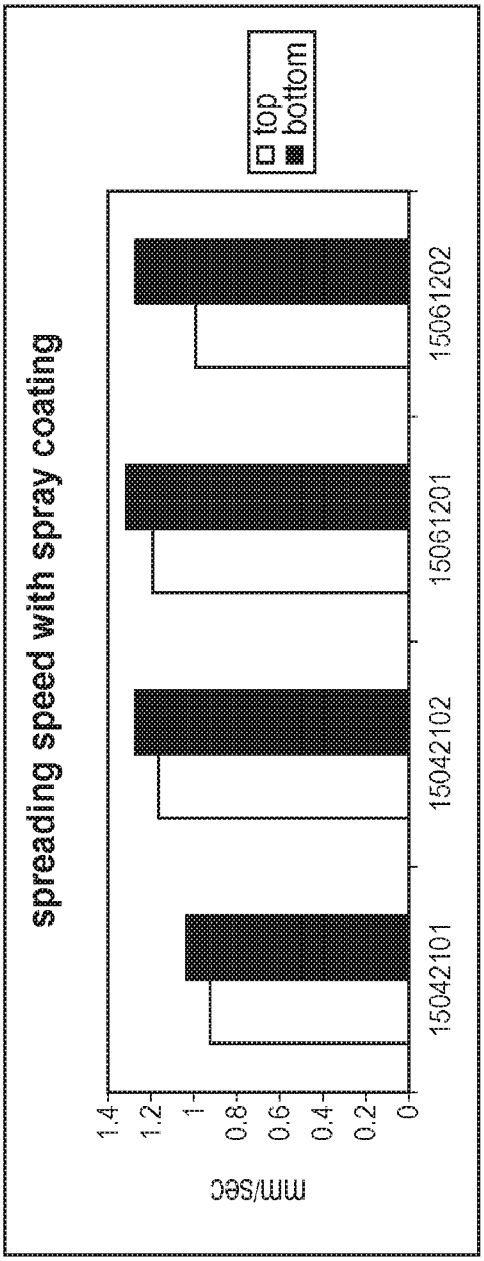


FIG. 74A

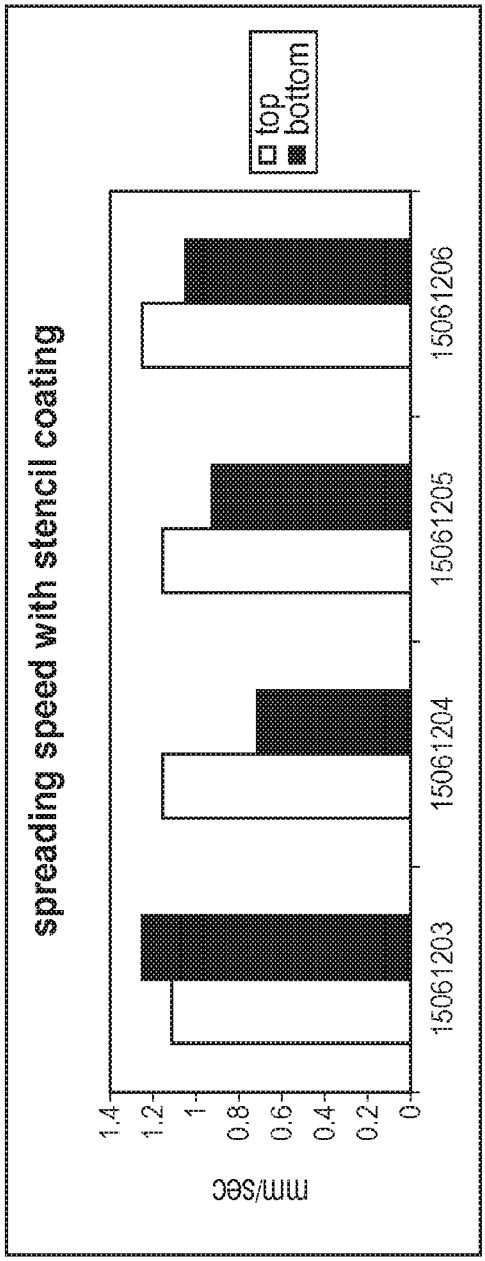


FIG. 74B

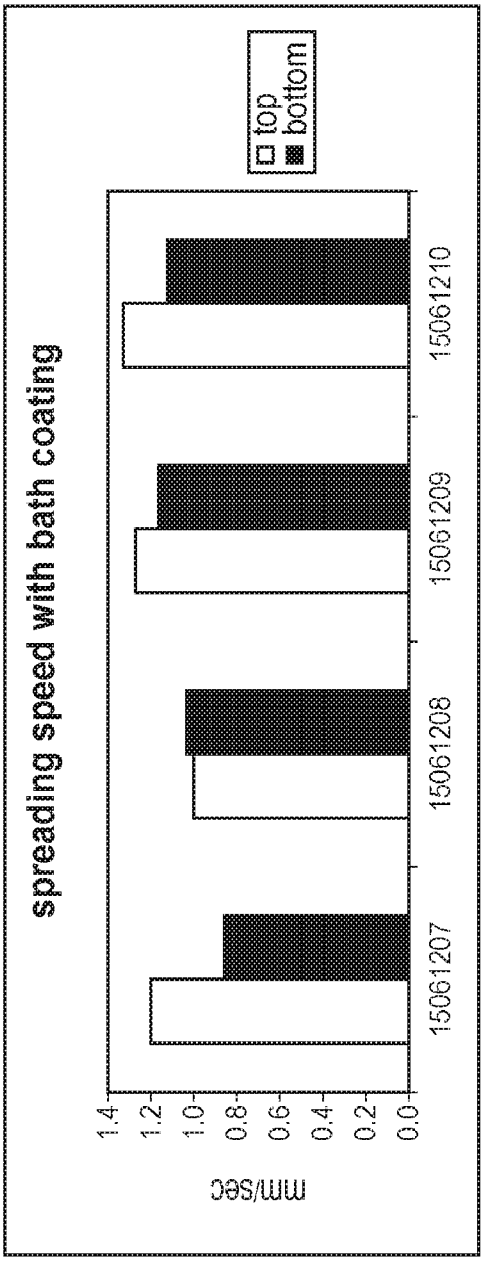


FIG. 74C

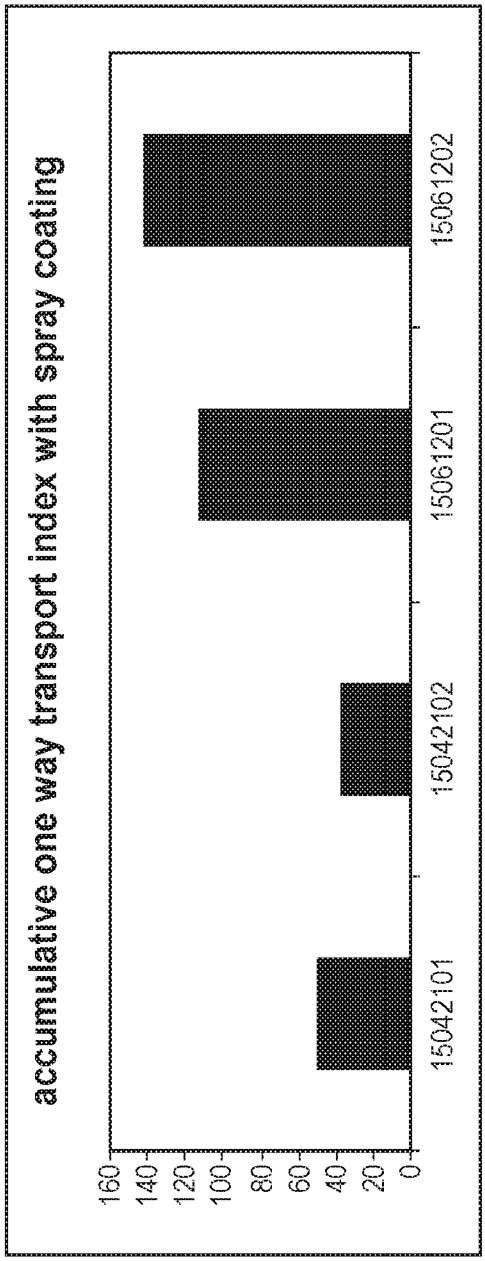


FIG. 75A

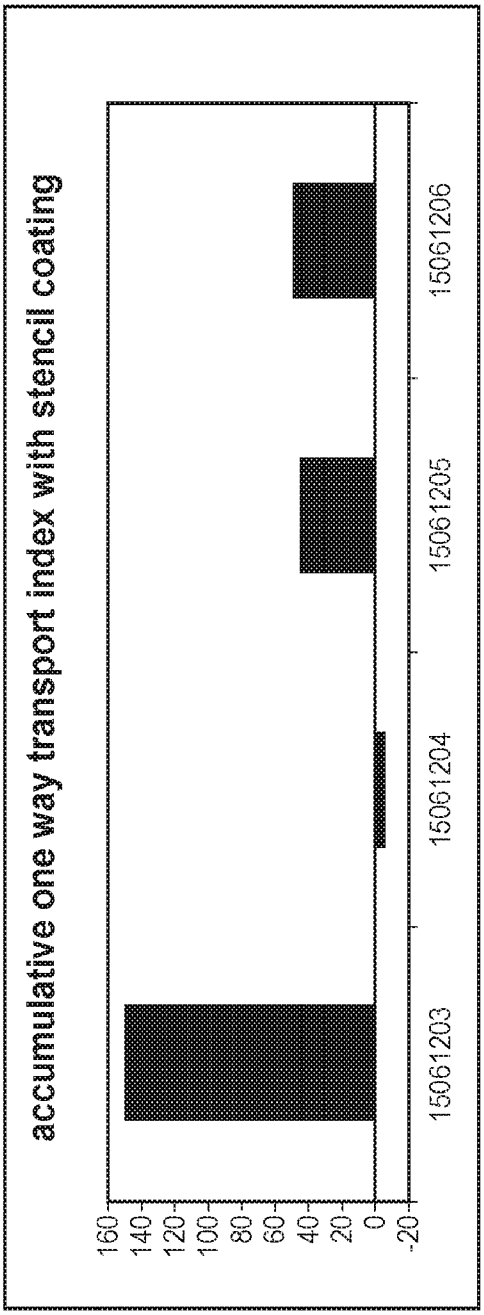


FIG. 75B

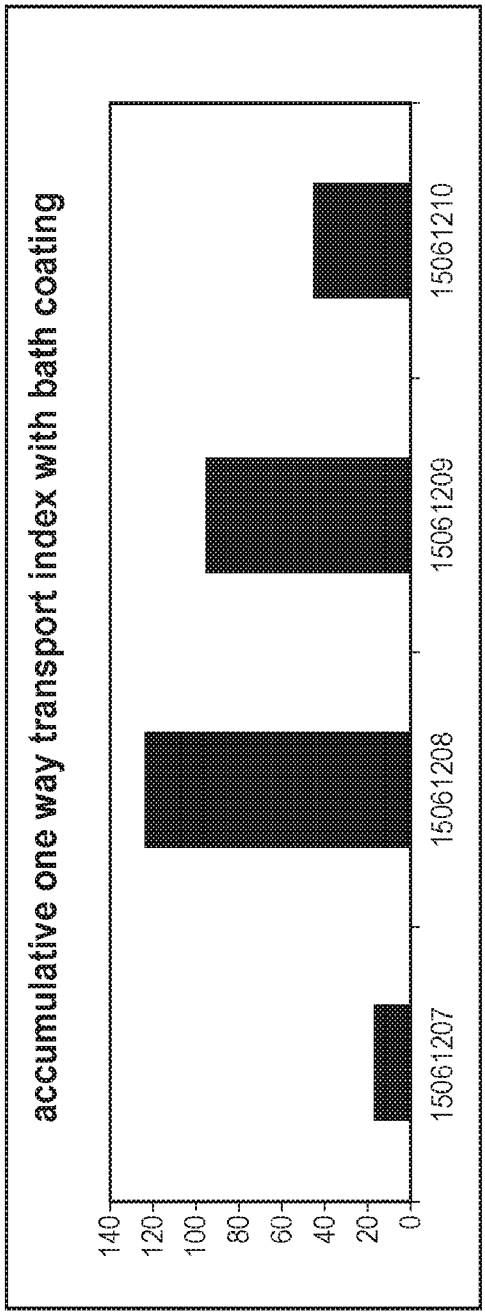


FIG. 75C

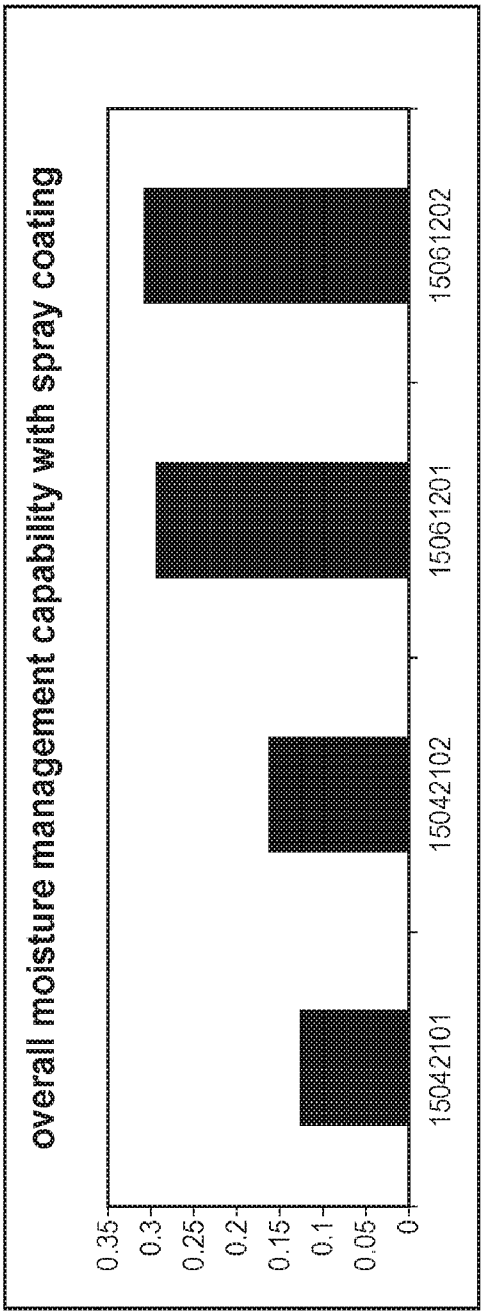


FIG. 76A

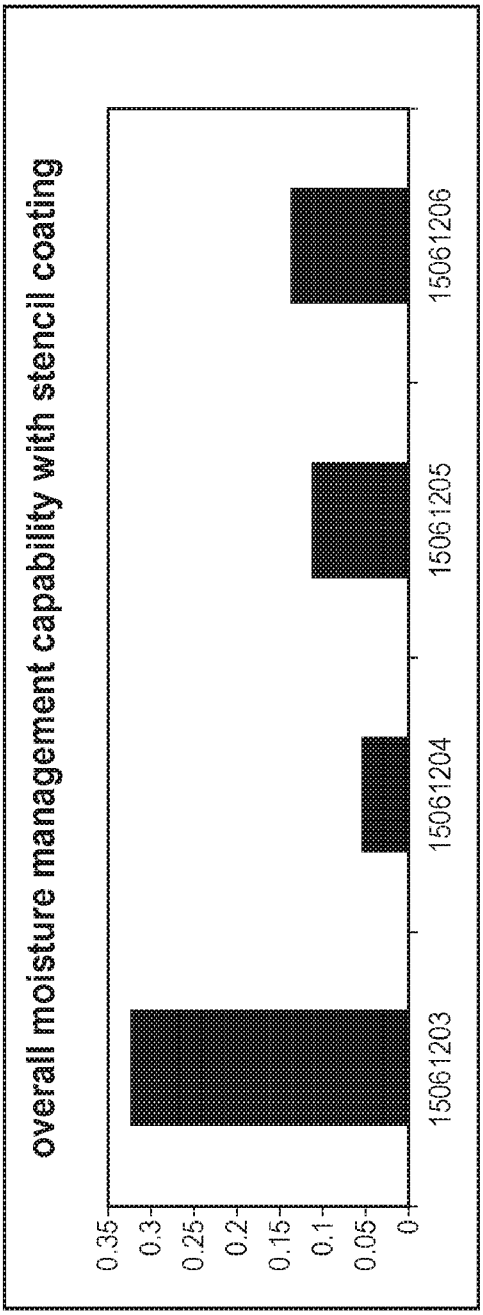


FIG. 76B

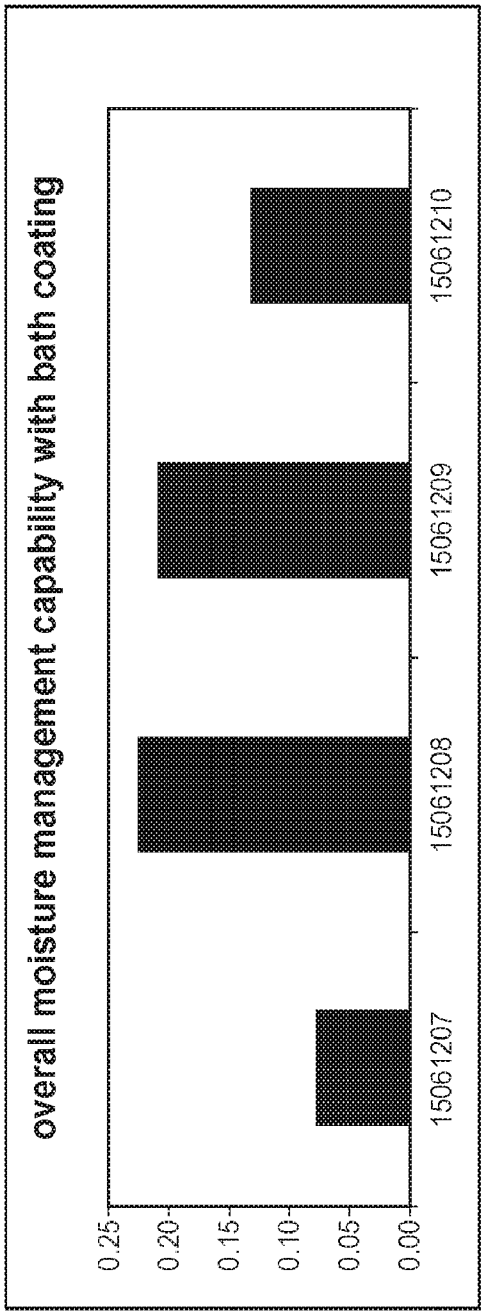

overall moisture management capability with bath coating
0.25
0.20
0.15
0.10
0.05
0.00
15061207
15061208
15061209
15061210

FIG. 76C

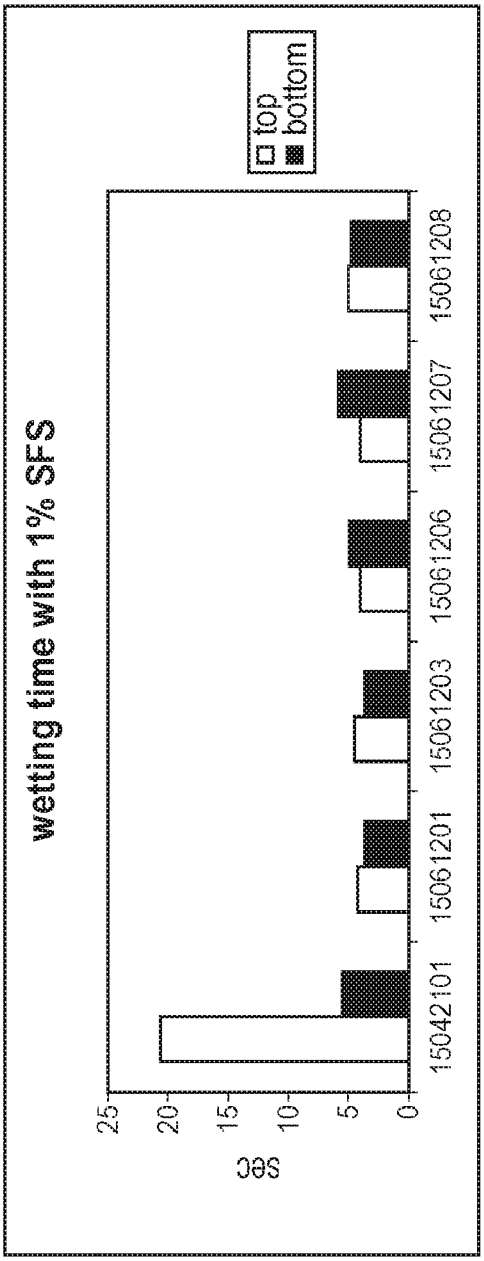


FIG. 77A

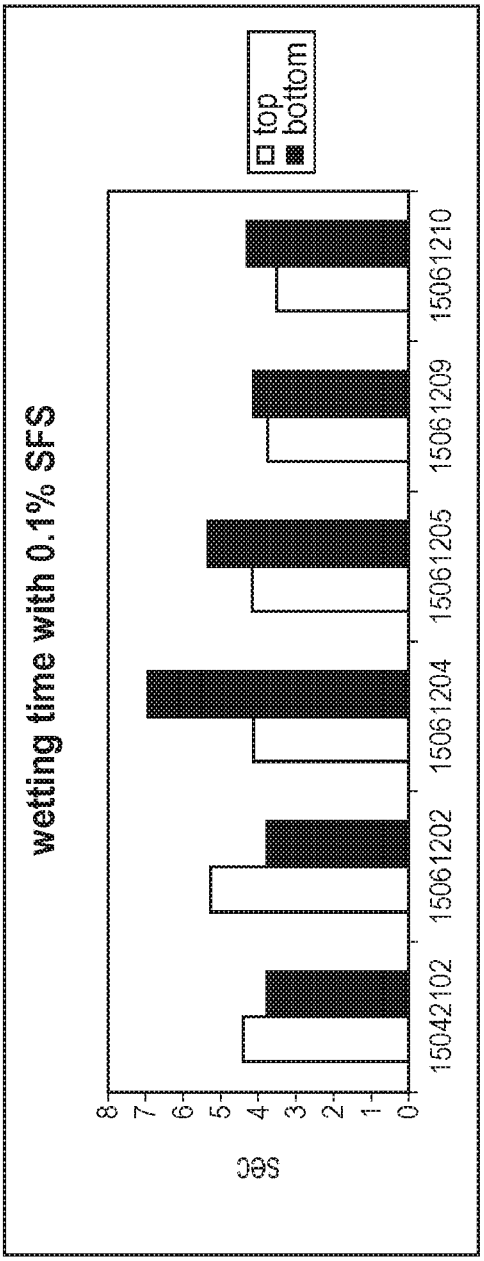


FIG. 77B

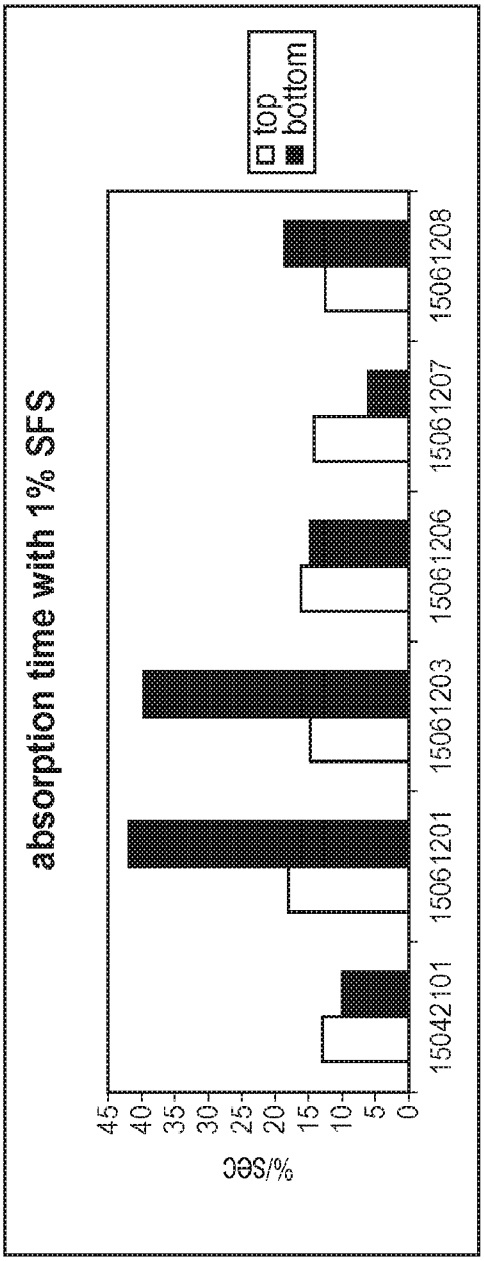


FIG. 78A

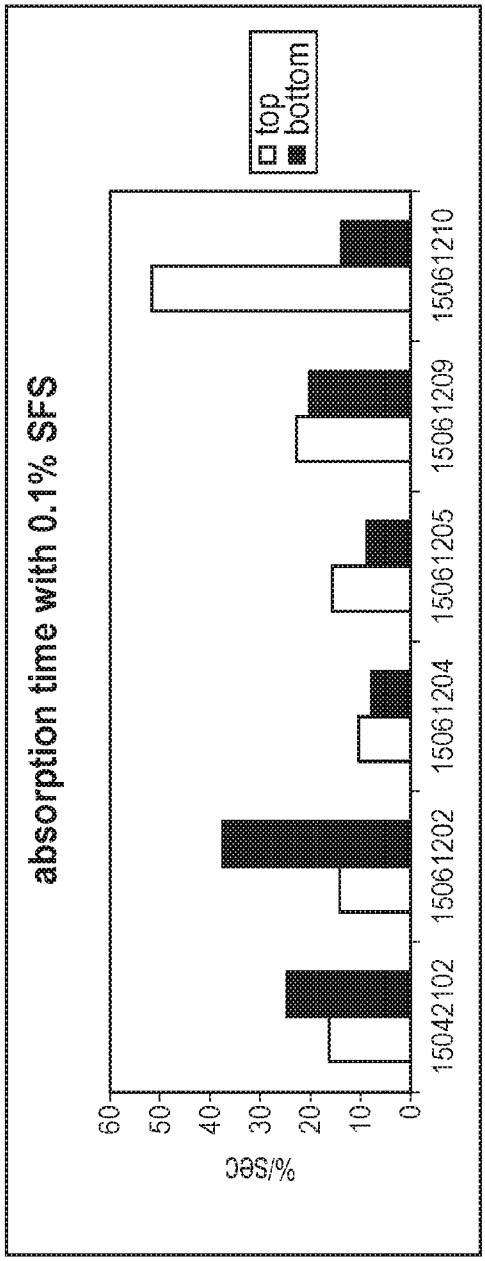


FIG. 78B

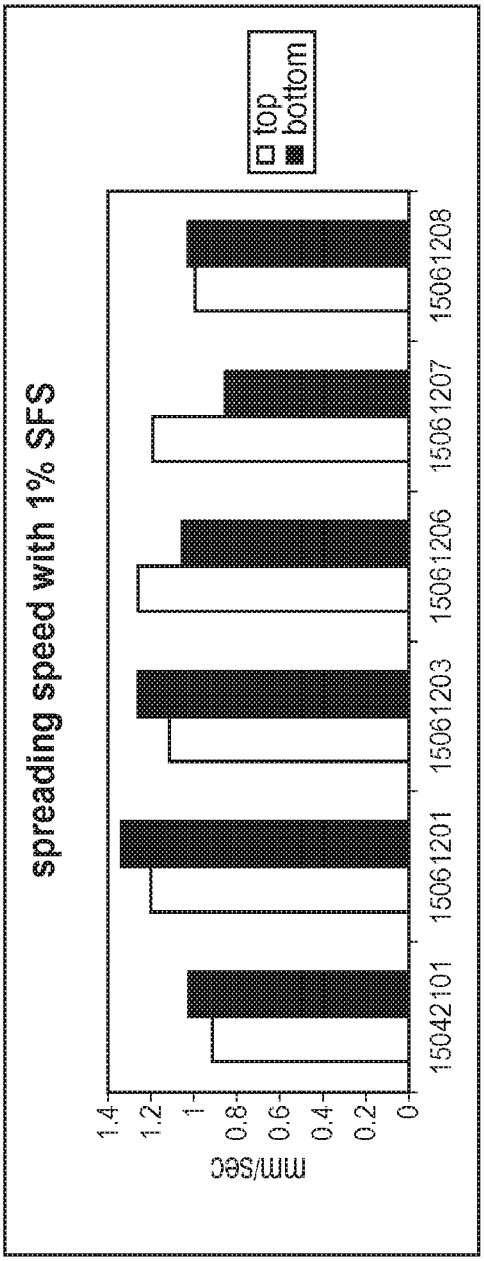


FIG. 79A

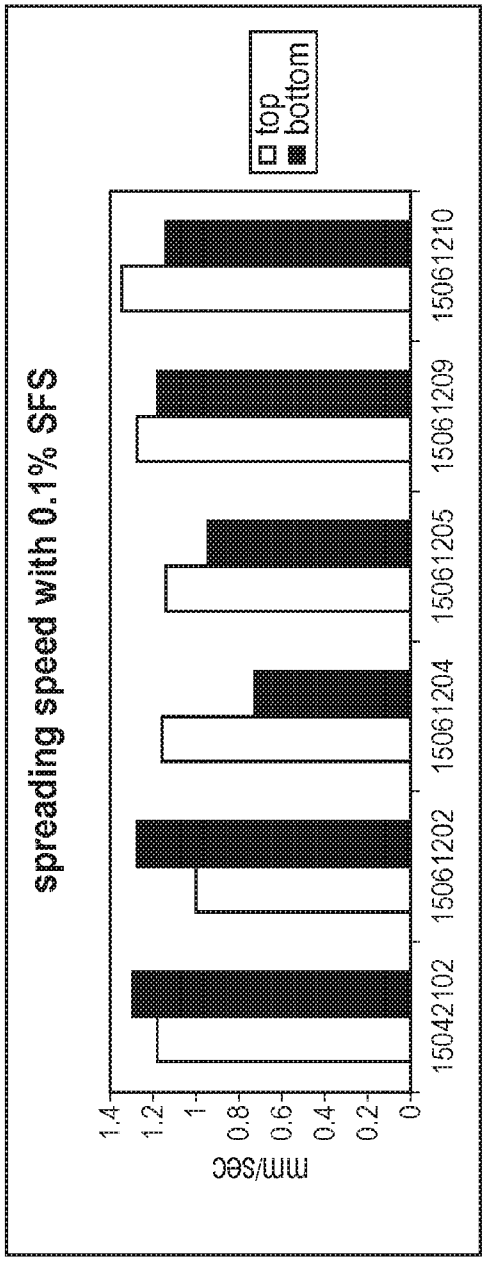


FIG. 79B

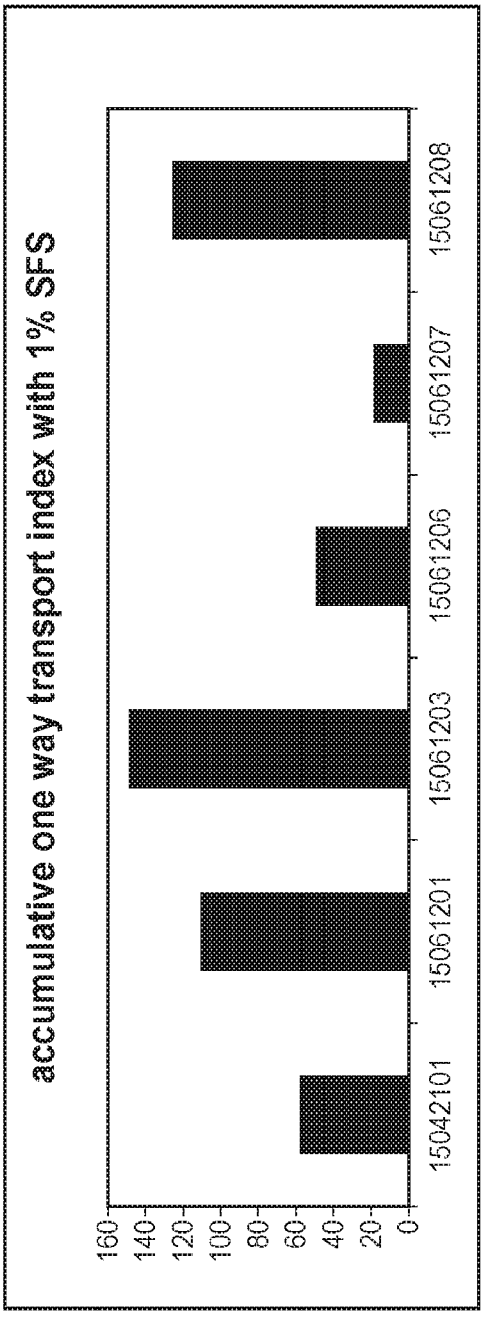


FIG. 80A

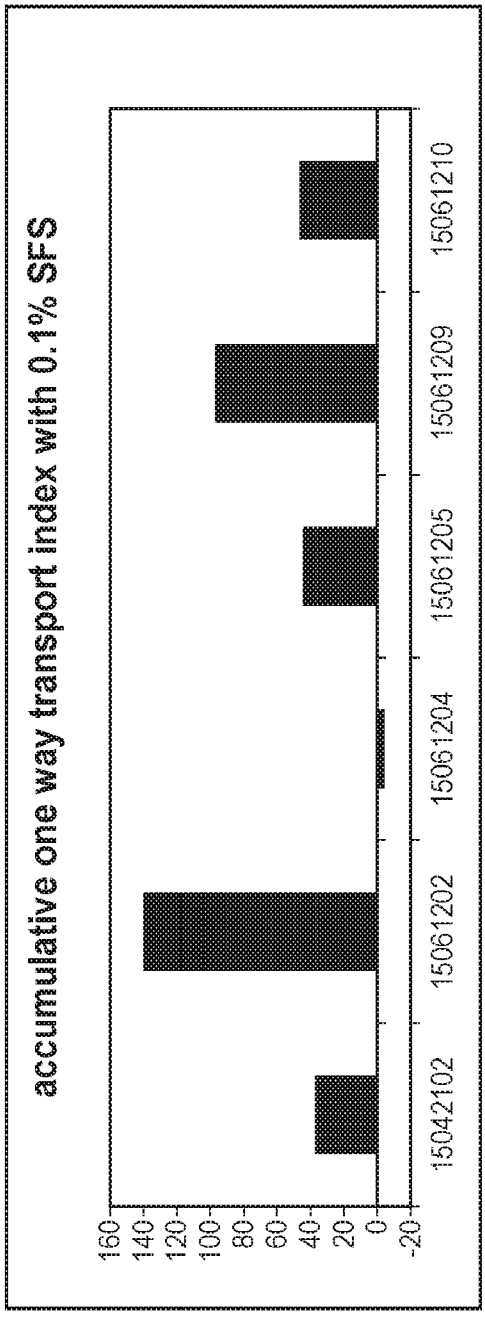


FIG. 80B

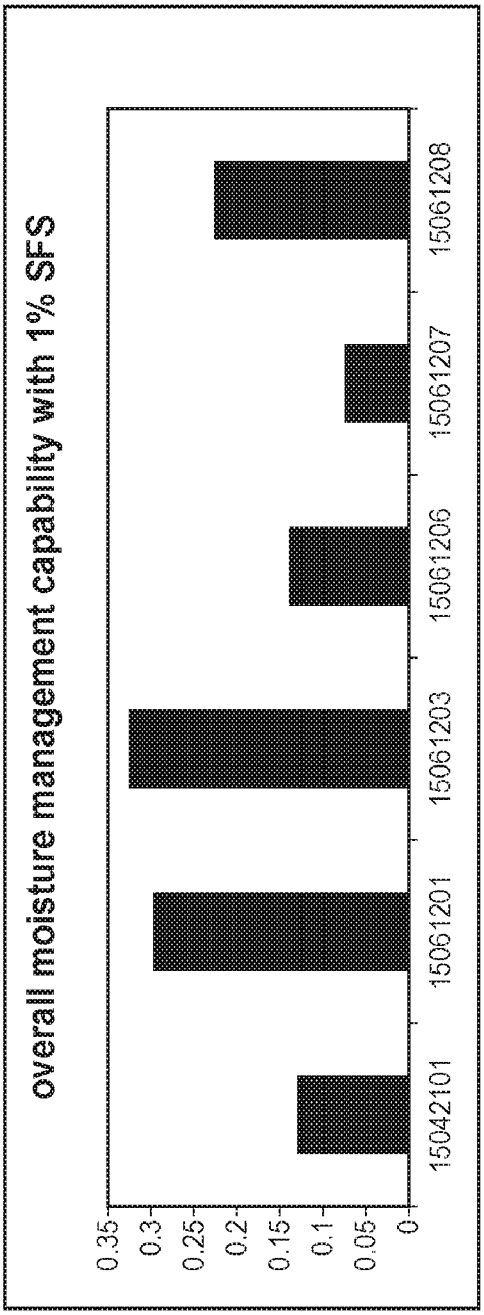


FIG. 81A

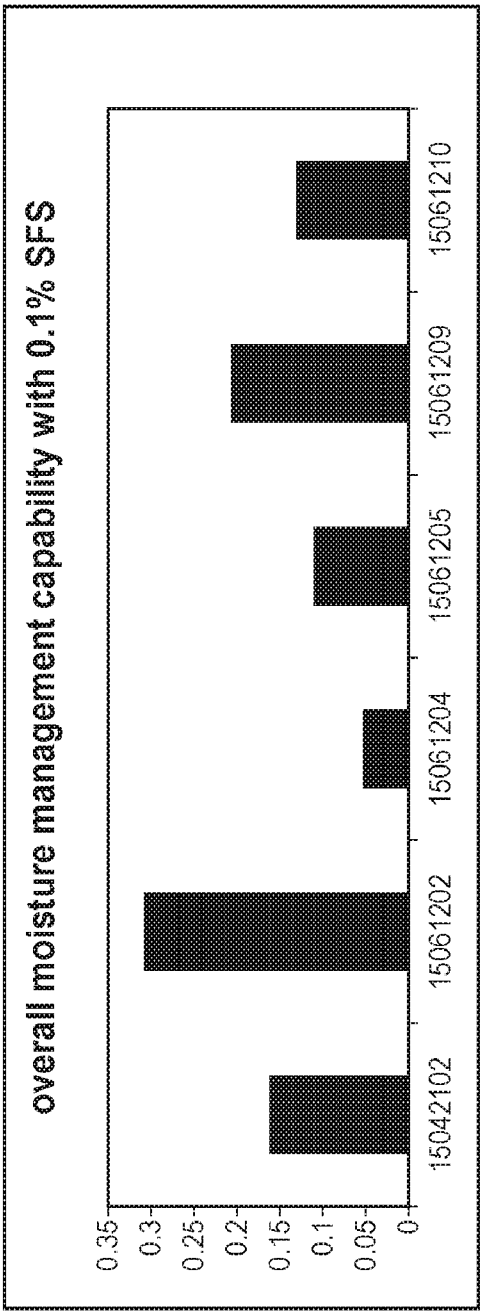


FIG. 81B

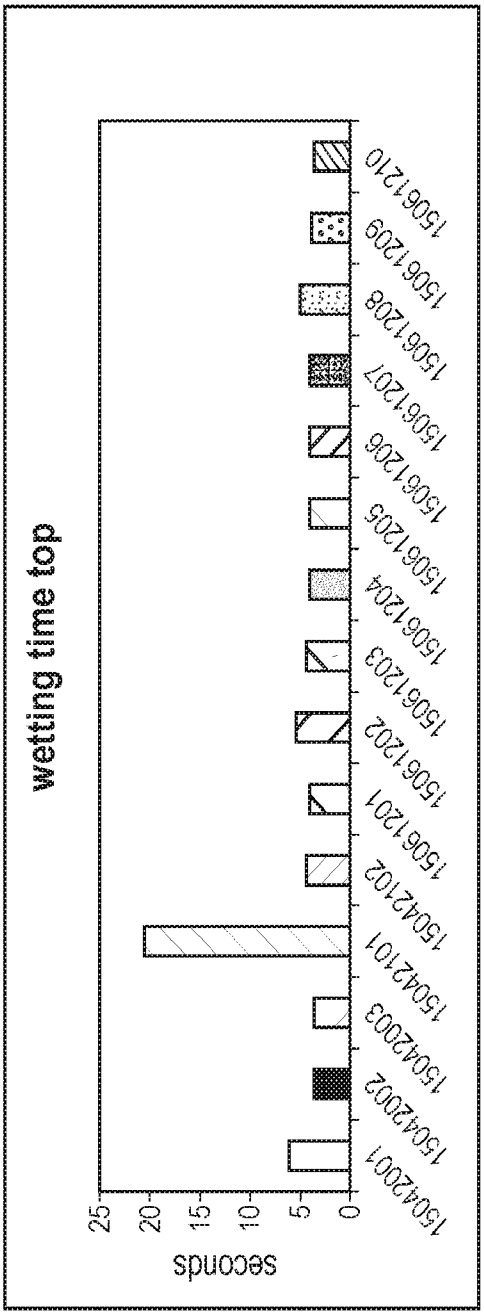


FIG. 82A

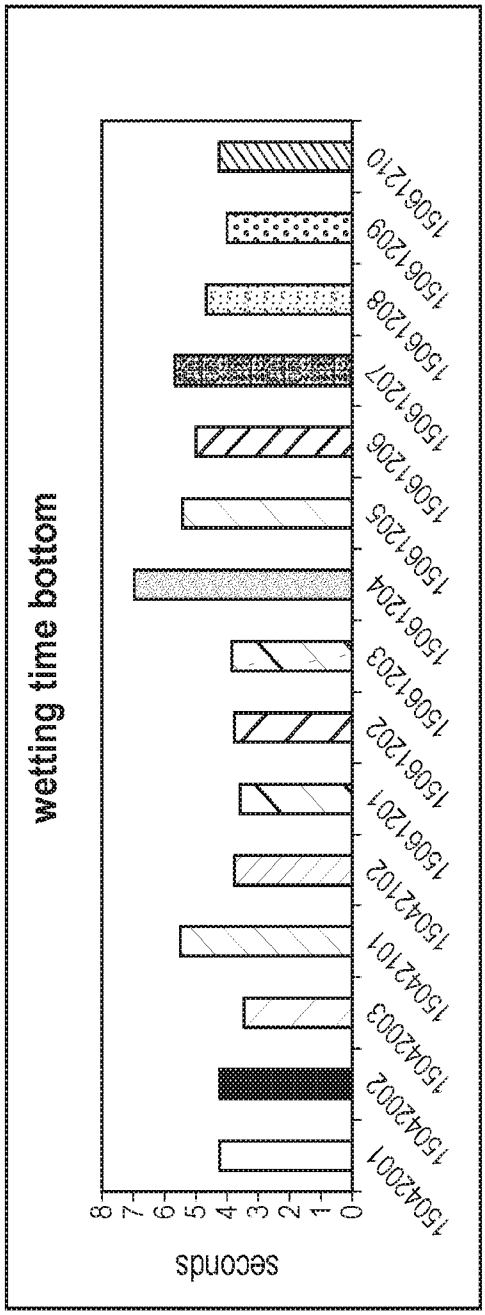


FIG. 82B

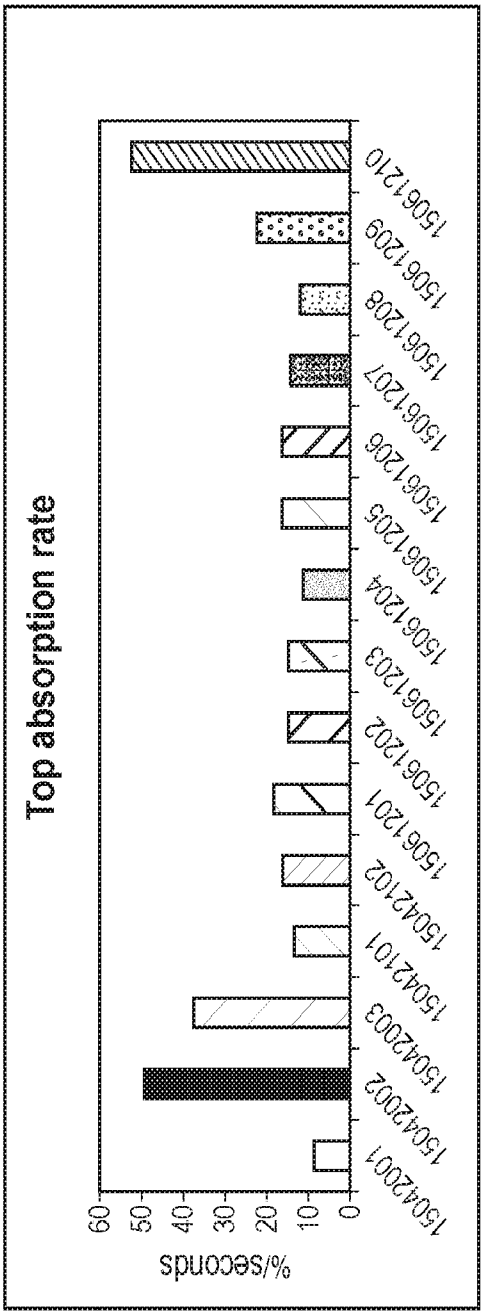


FIG. 83A

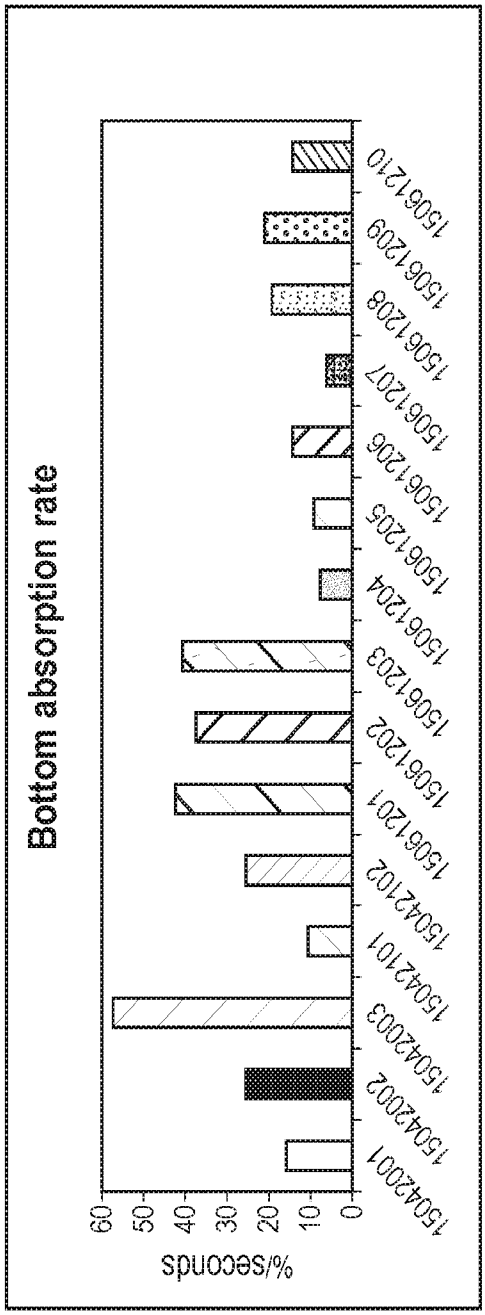


FIG. 83B

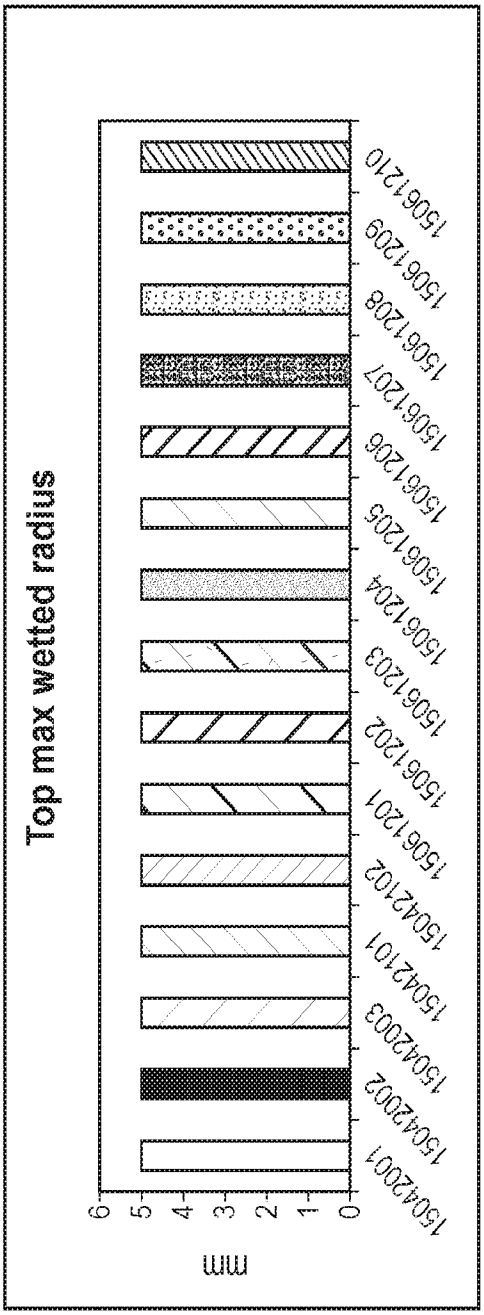


FIG. 84A

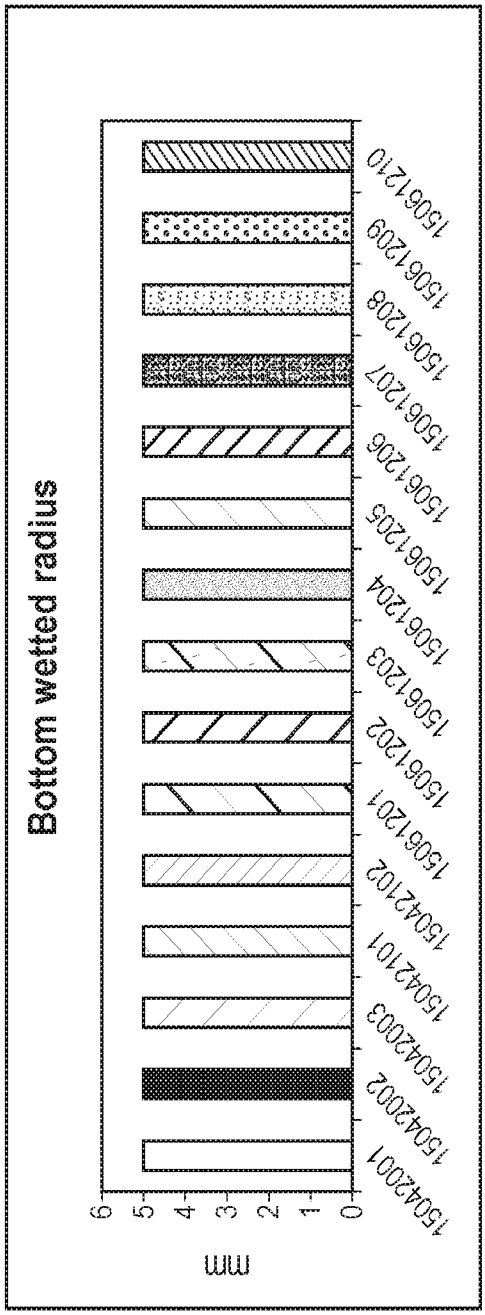


FIG. 84B

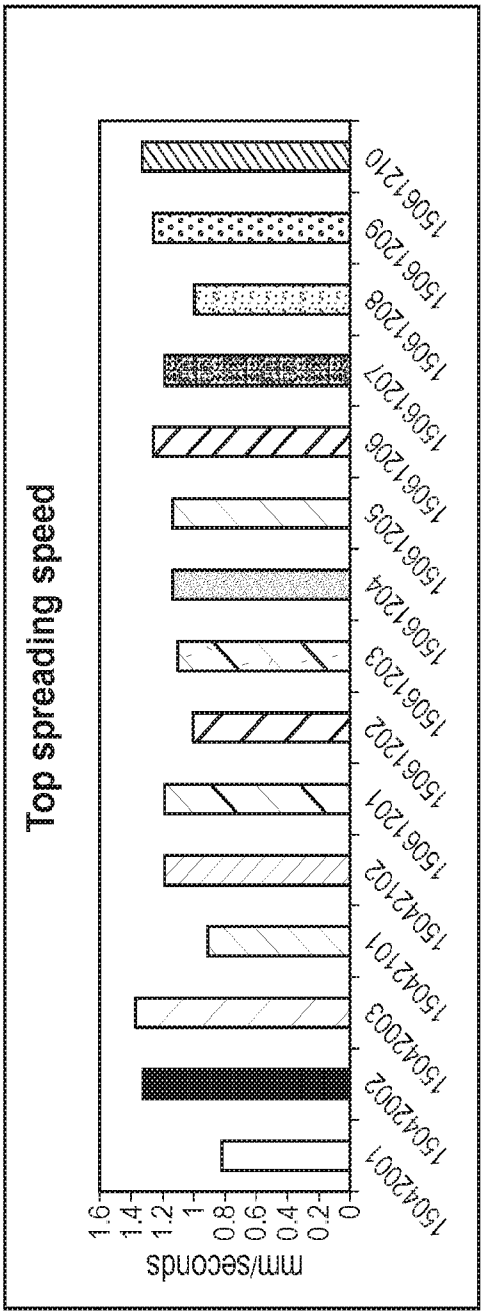


FIG. 85A

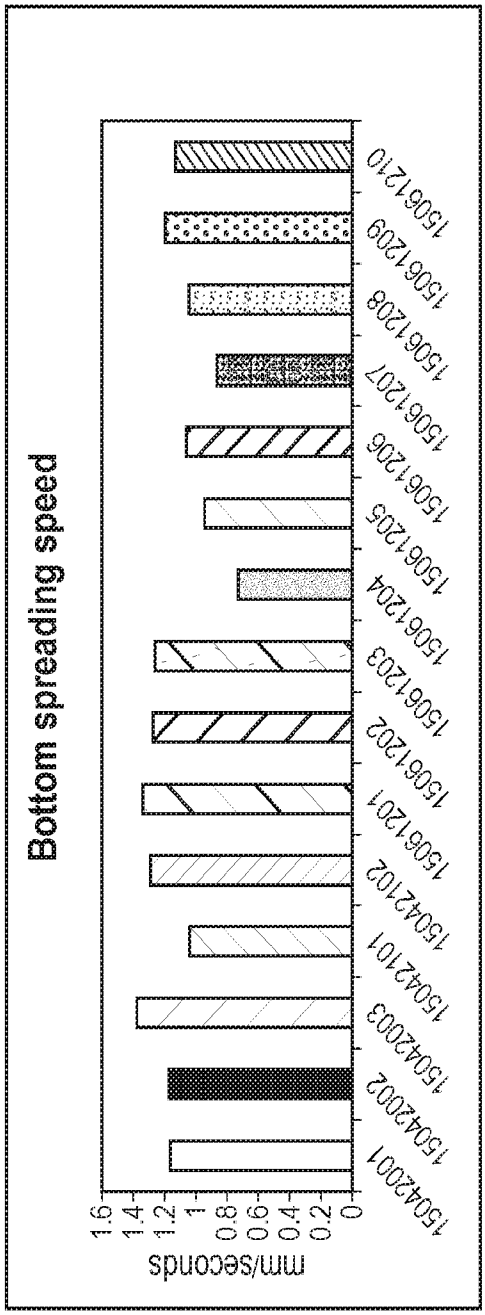


FIG. 85B

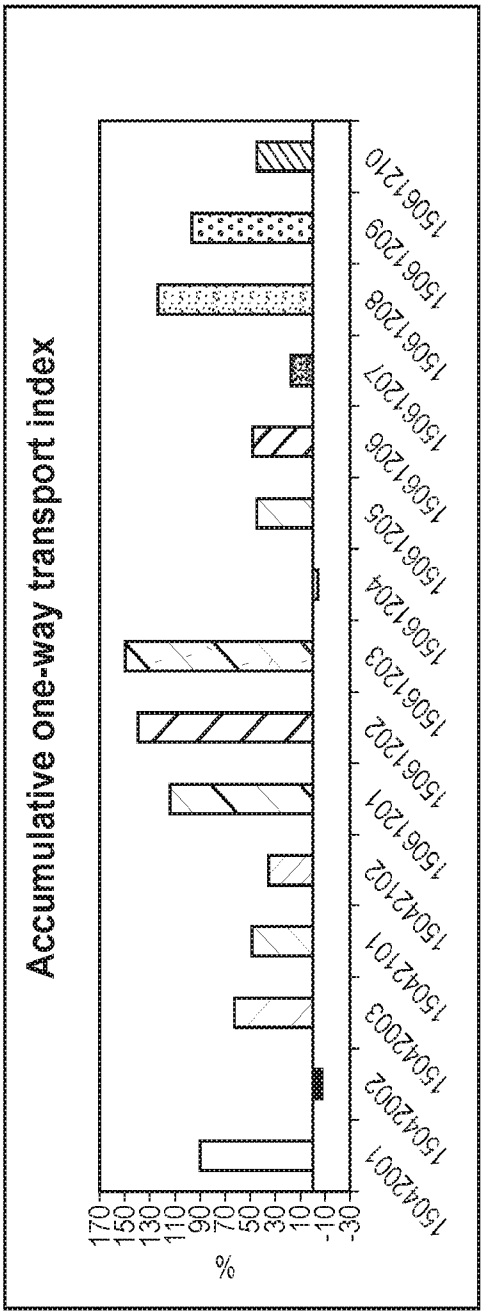


FIG. 86A

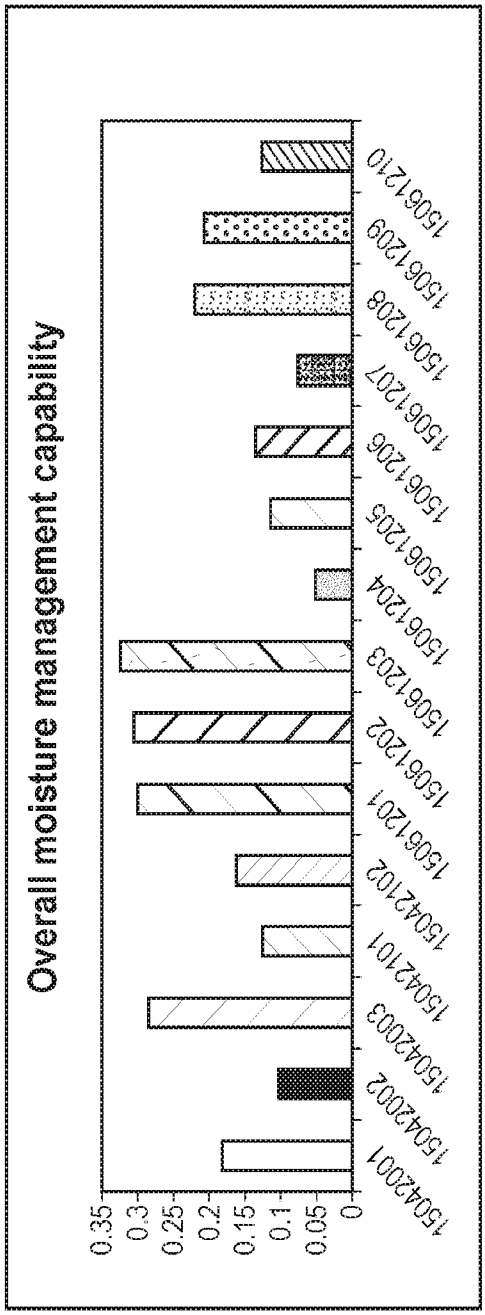


FIG. 86B

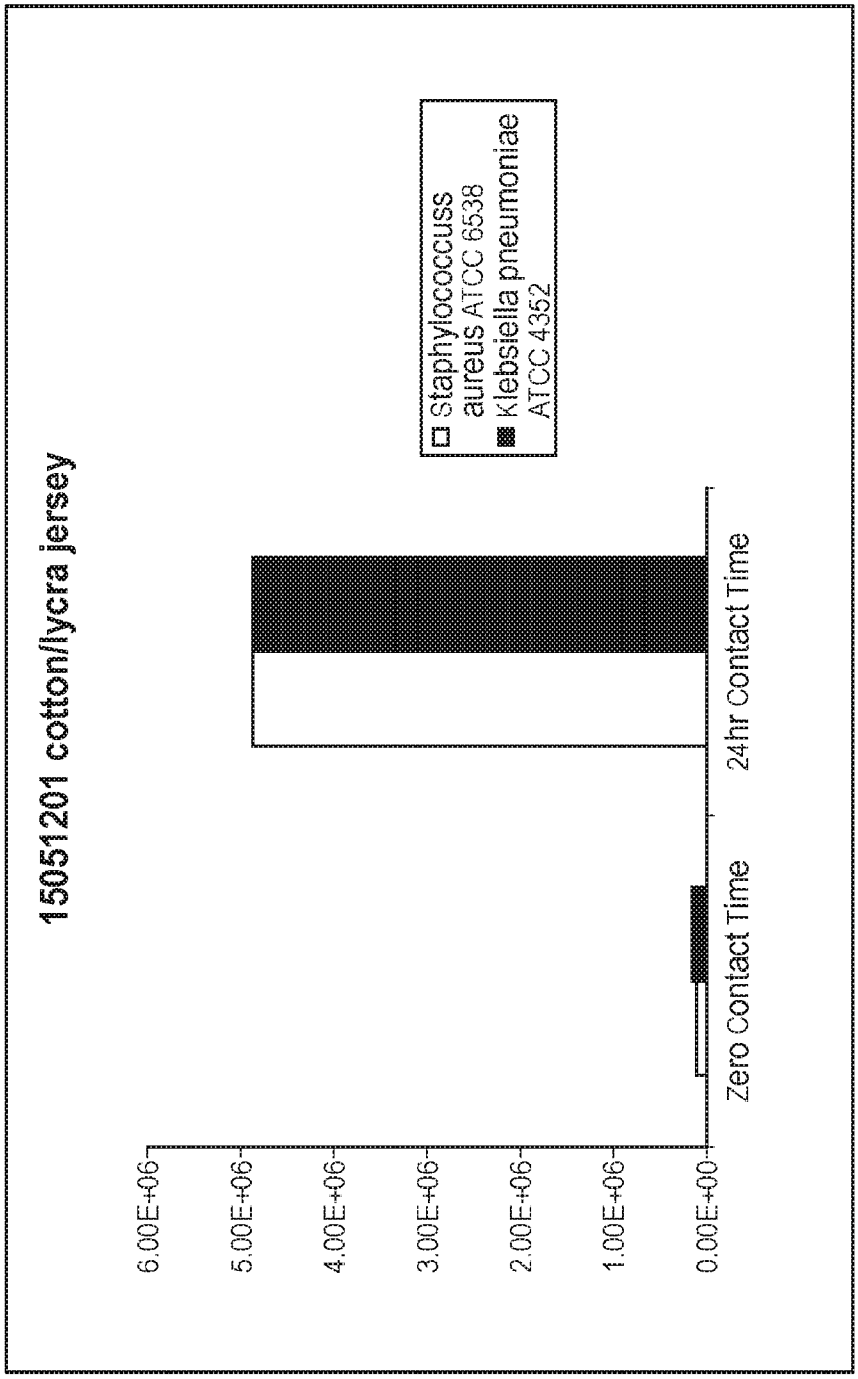

15051201 cotton/lycra jersey
Staphylococcuss aureus ATCC 6538
Klebsiella pneumoniae ATCC 4352
6.00E+06
5.00E+06
4.00E+06
3.00E+06
2.00E+06
1.00E+06
0.00E+00
Zero Contact Time
24hr Contact Time

FIG. 87

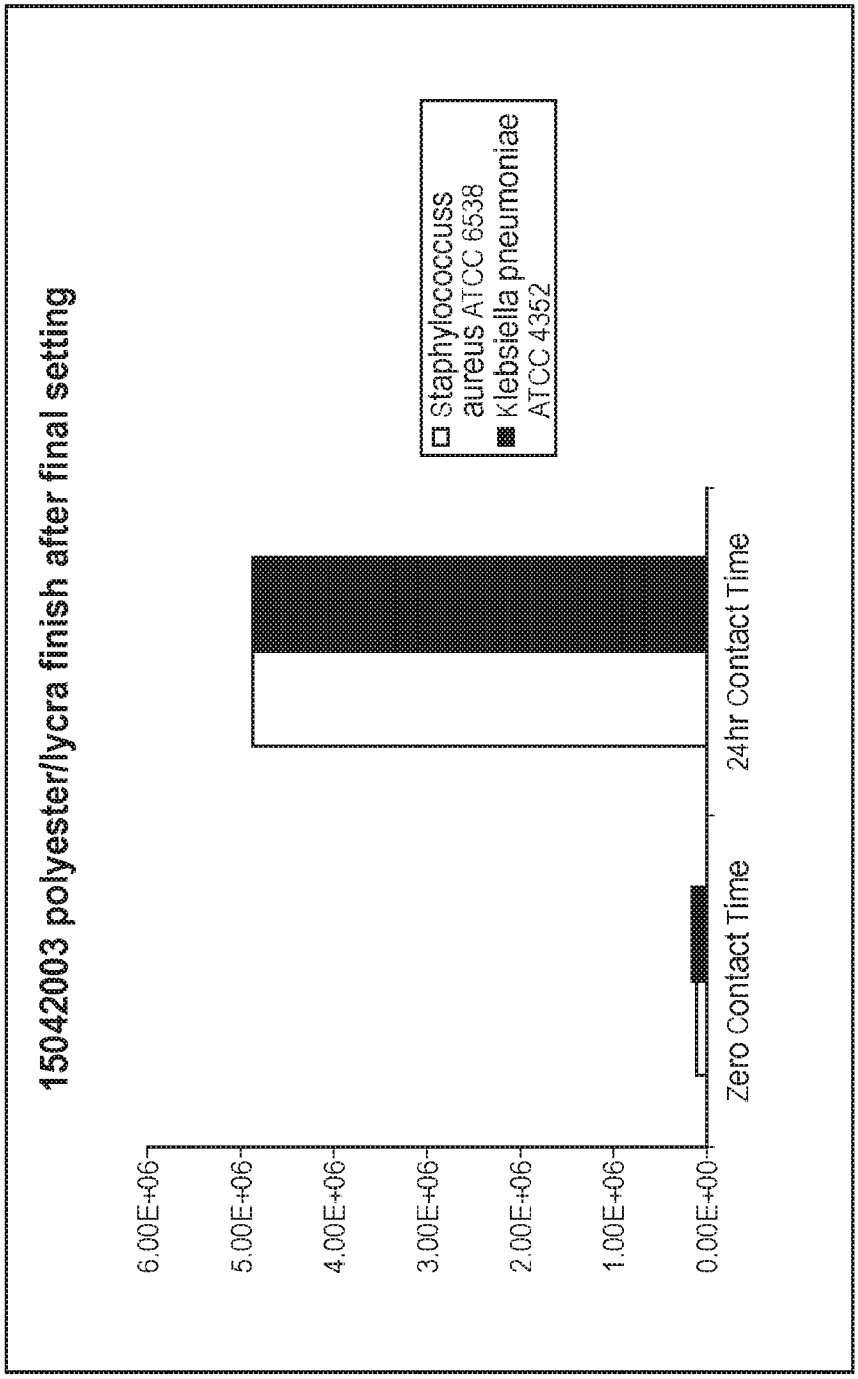

15042003 polyester/lycra finish after final setting
Staphylococcuss aureus ATCC 6538
Klebsiella pneumoniae ATCC 4352
6.00E+06
5.00E+06
4.00E+06
3.00E+06
2.00E+06
1.00E+06
0.00E+00
Zero Contact Time
24hr Contact Time

FIG. 88

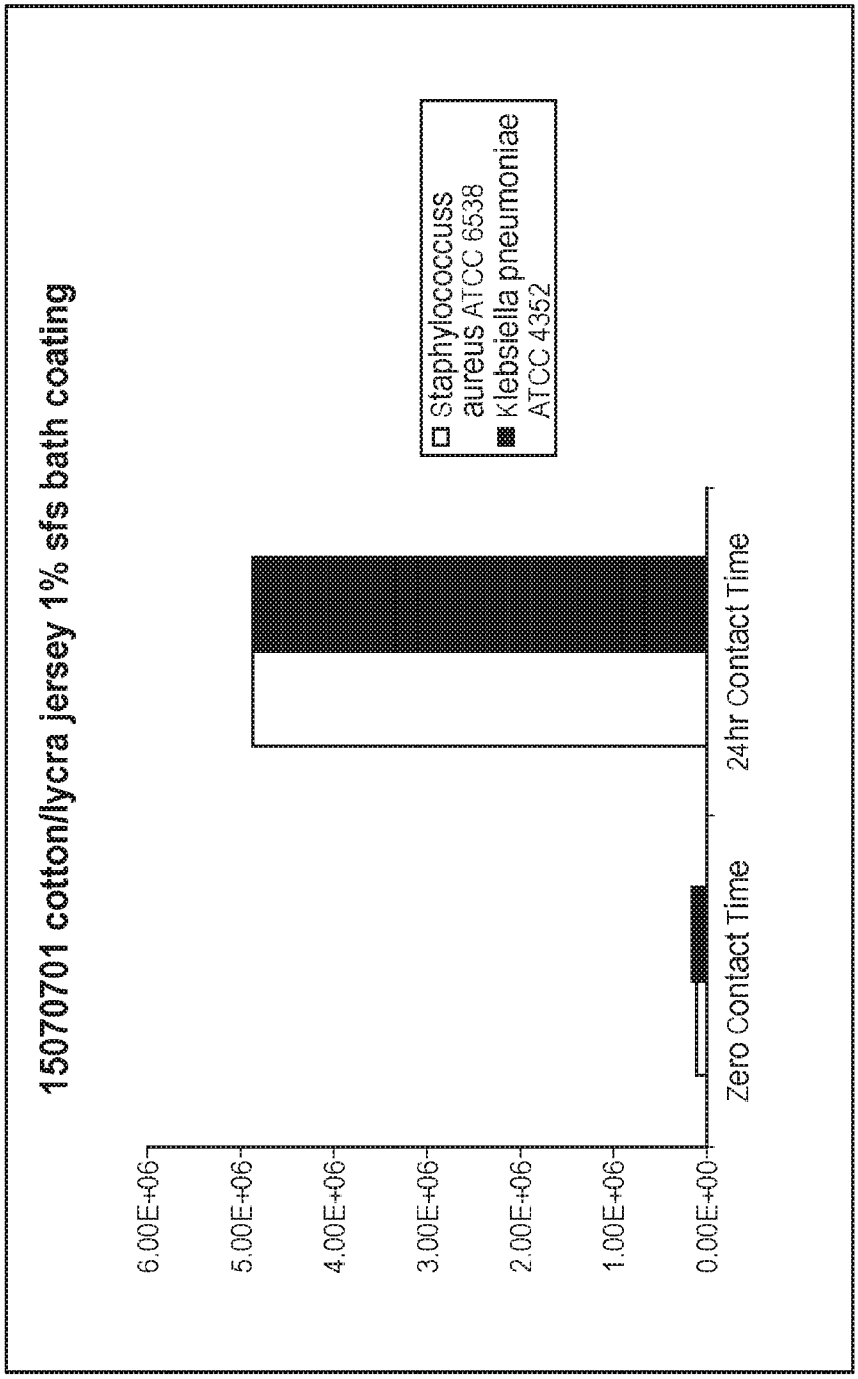

15070701 cotton/lycra jersey 1% sfs bath coating
Staphylococcuss aureus ATCC 6538
Klebsiella pneumoniae ATCC 4352
6.00E+06
5.00E+06
4.00E+06
3.00E+06
2.00E+06
1.00E+06
0.00E+00
Zero Contact Time
24hr Contact Time

FIG. 89

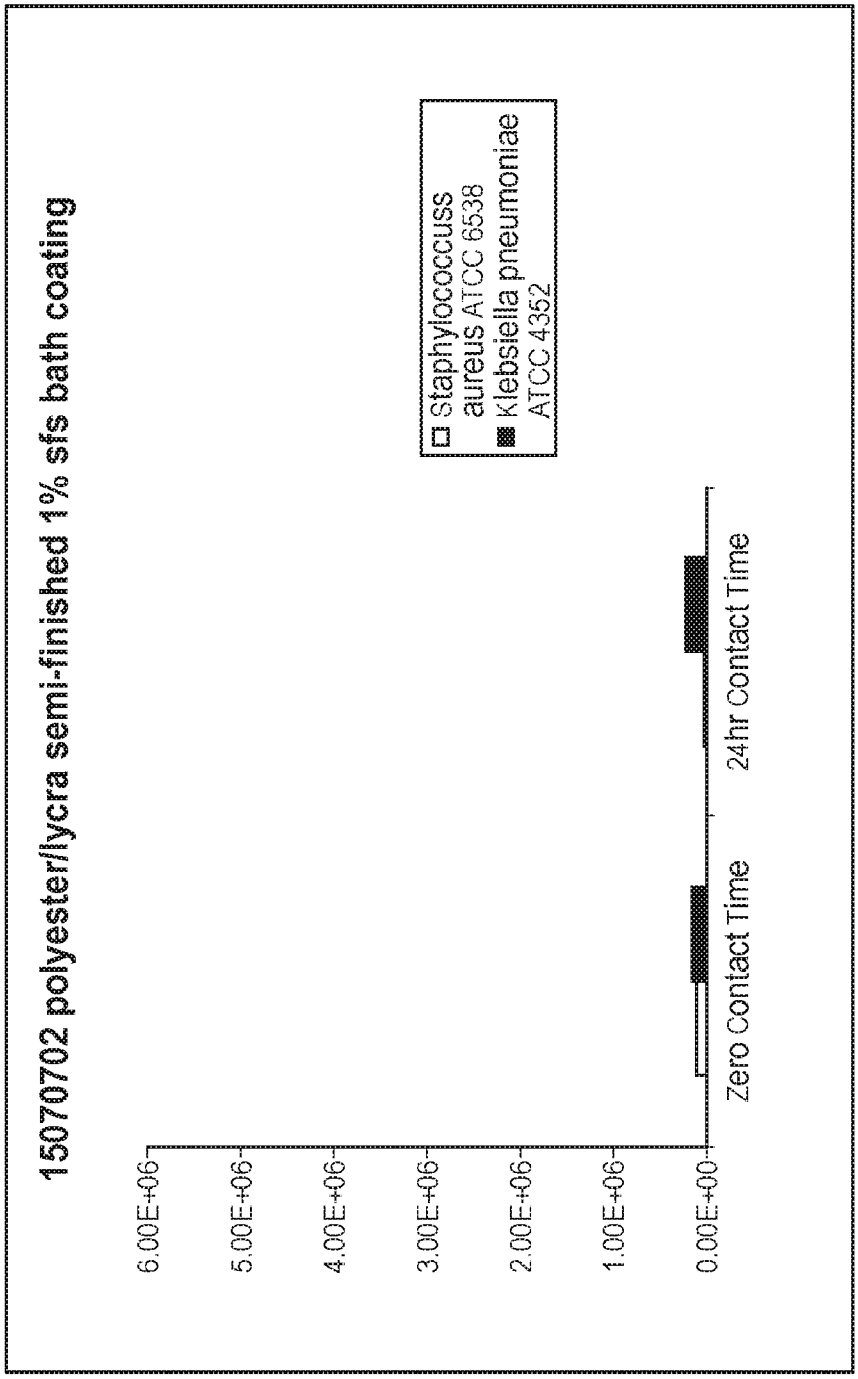

15070702 polyester/lycra semi-finished 1% sfs bath coating
6.00E+06
5.00E+06
4.00E+06
3.00E+06
2.00E+06
1.00E+06
0.00E+00
Staphylococcuss aureus ATCC 6538
Klebsiella pneumoniae ATCC 4352
Zero Contact Time
24hr Contact Time

FIG. 90

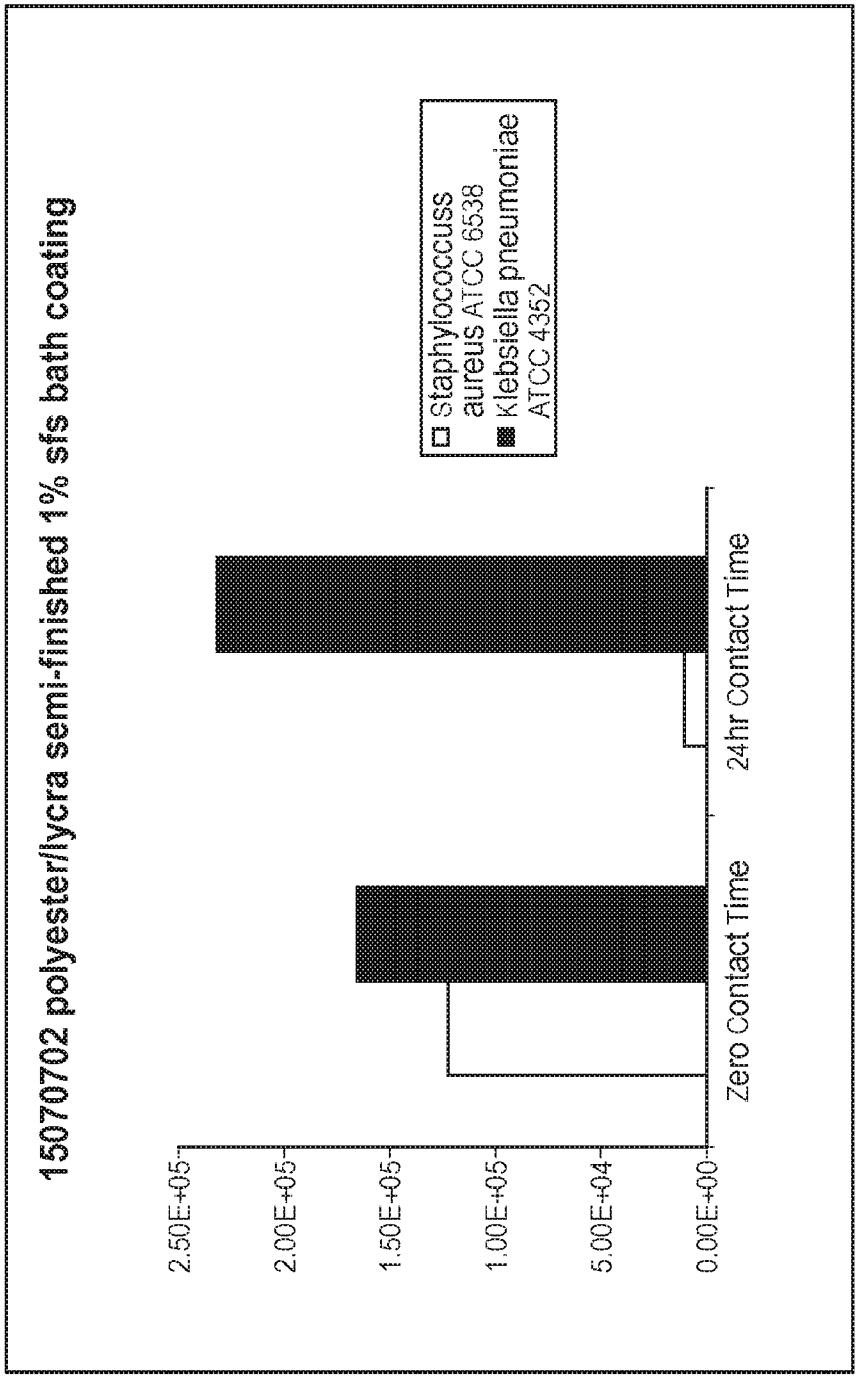

15070702 polyester/lycra semi-finished 1% sfs bath coating
Staphylococcuss aureus ATCC 6538
Klebsiella pneumoniae ATCC 4352
2.50E+05
2.00E+05
1.50E+05
1.00E+05
5.00E+04
0.00E+00
Zero Contact Time
24hr Contact Time

FIG. 91

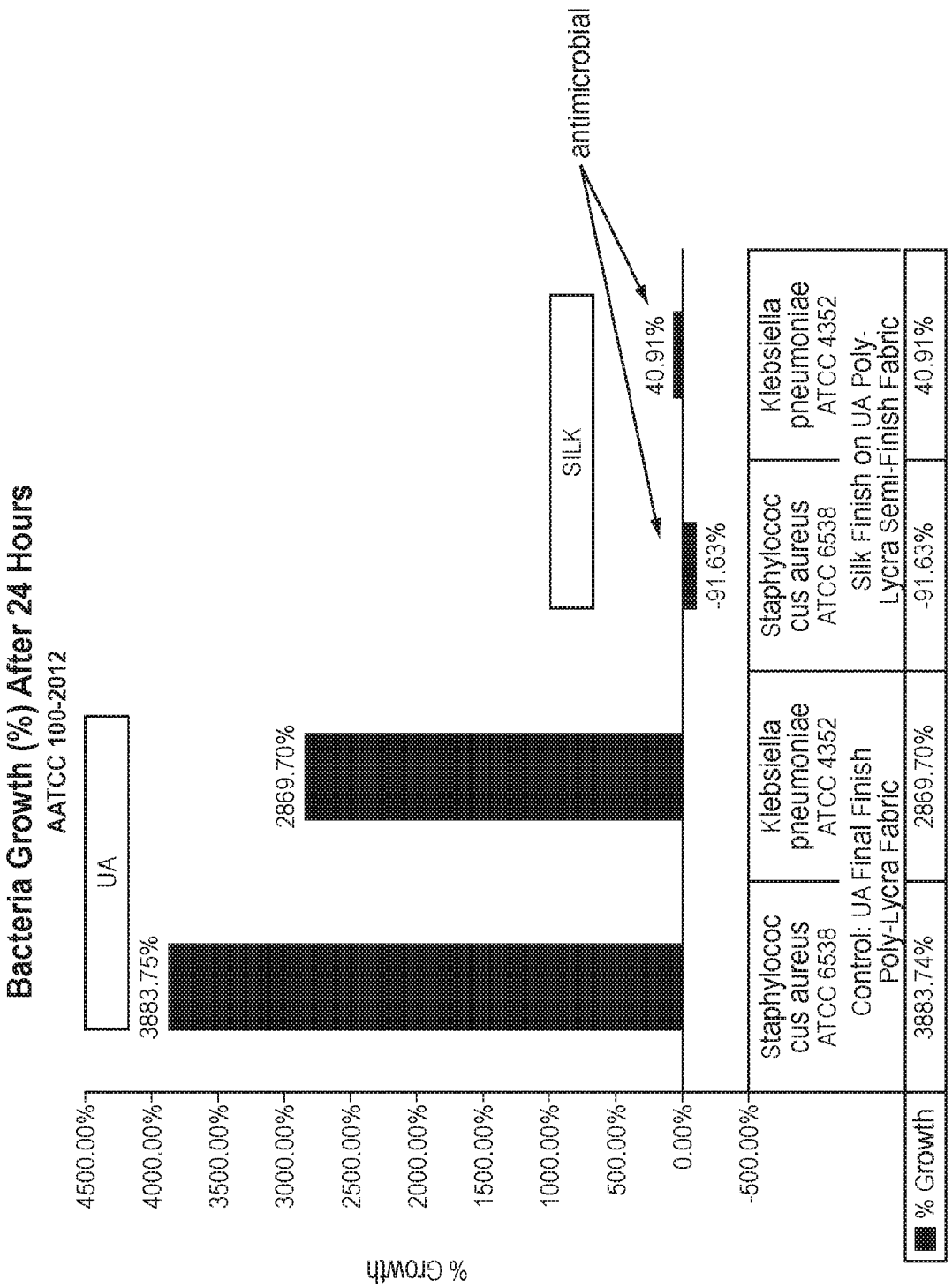

Bacteria Growth (%) After 24 Hours
AATCC 100-2012
UA
SILK
antimicrobial
3883.75%
2869.70%
-91.63%
40.91%
% Growth
4500.00%
4000.00%
3500.00%
3000.00%
2500.00%
2000.00%
1500.00%
1000.00%
500.00%
0.00%
-500.00%
Staphylococcus aureus ATCC 6538
Klebsiella pneumoniae ATCC 4352
Staphylococcus aureus ATCC 6538
Klebsiella pneumoniae ATCC 4352
Control: UA Final Finish Poly-Lycra Fabric
Silk Finish on UA Poly-Lycra Semi-Finish Fabric
% Growth
3883.74%
2869.70%
-91.63%
40.91%

FIG. 92

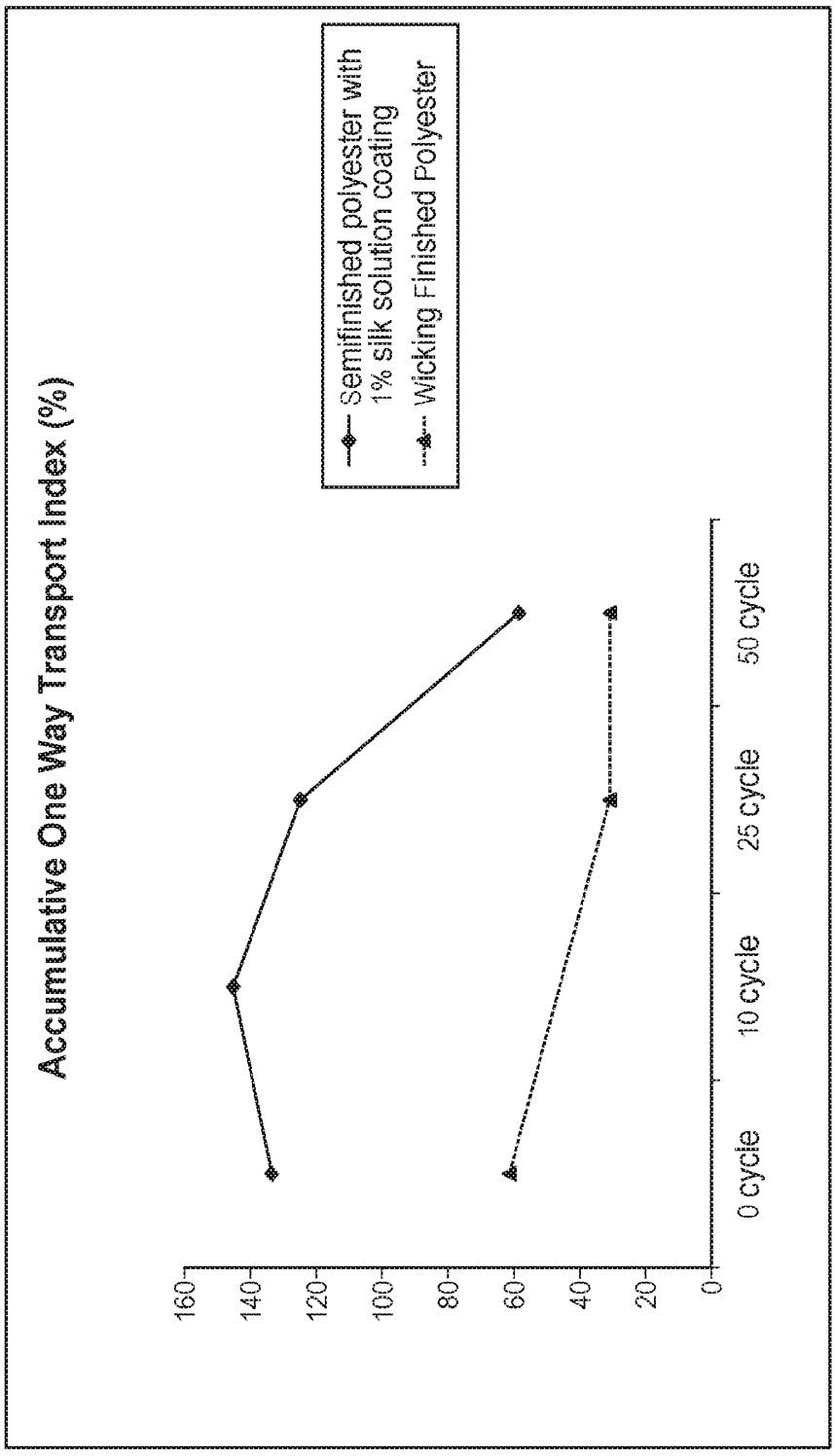

Accumulative One Way Transport Index (%)
Semifinished polyester with 1% silk solution coating
Wicking Finished Polyester
160
140
120
100
80
60
40
20
0
0 cycle
10 cycle
25 cycle
50 cycle

FIG. 93

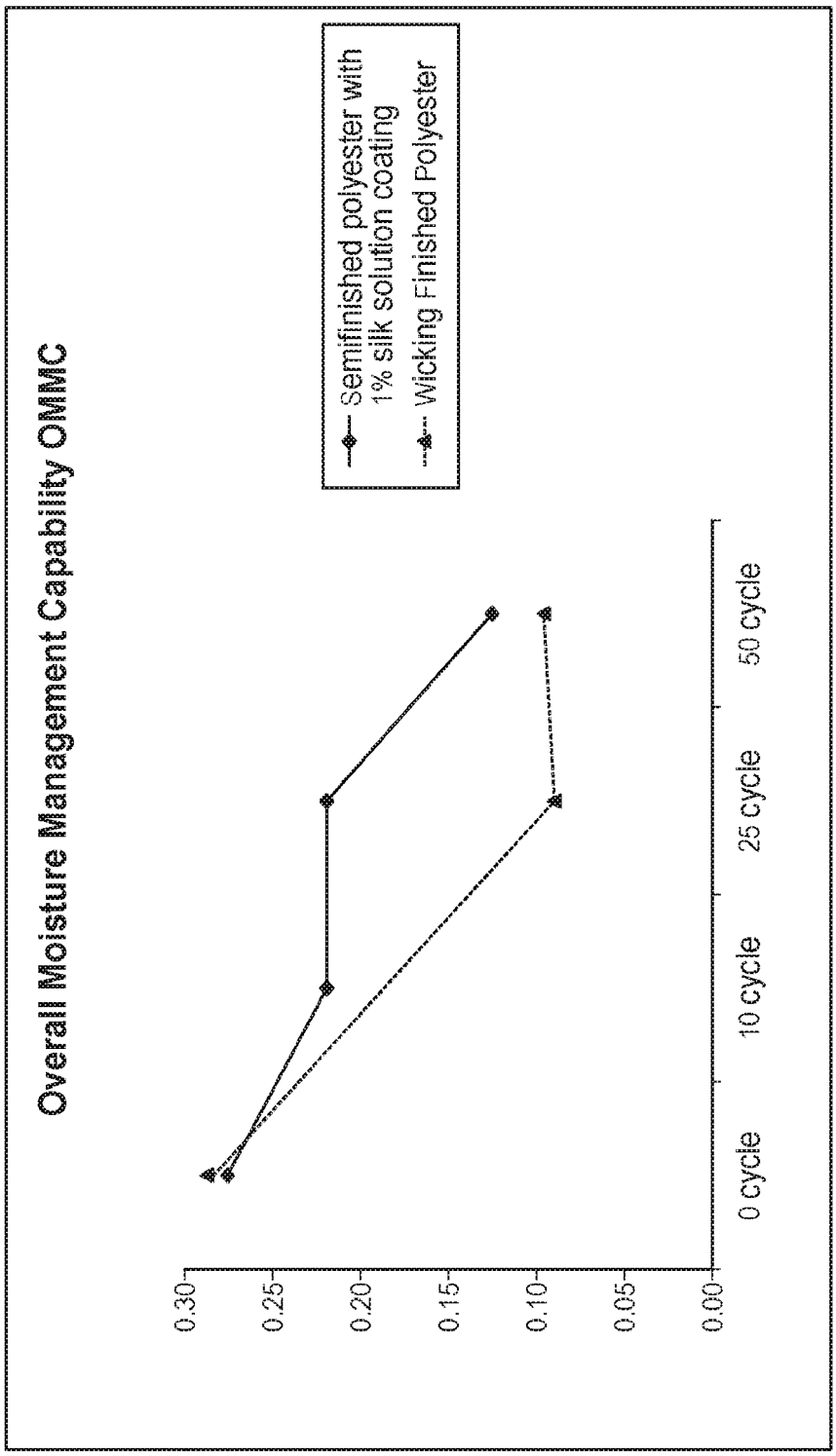

Overall Moisture Management Capability OMMC
Semifinished polyester with 1% silk solution coating
Wicking Finished Polyester
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0 cycle
10 cycle
25 cycle
50 cycle

FIG. 94

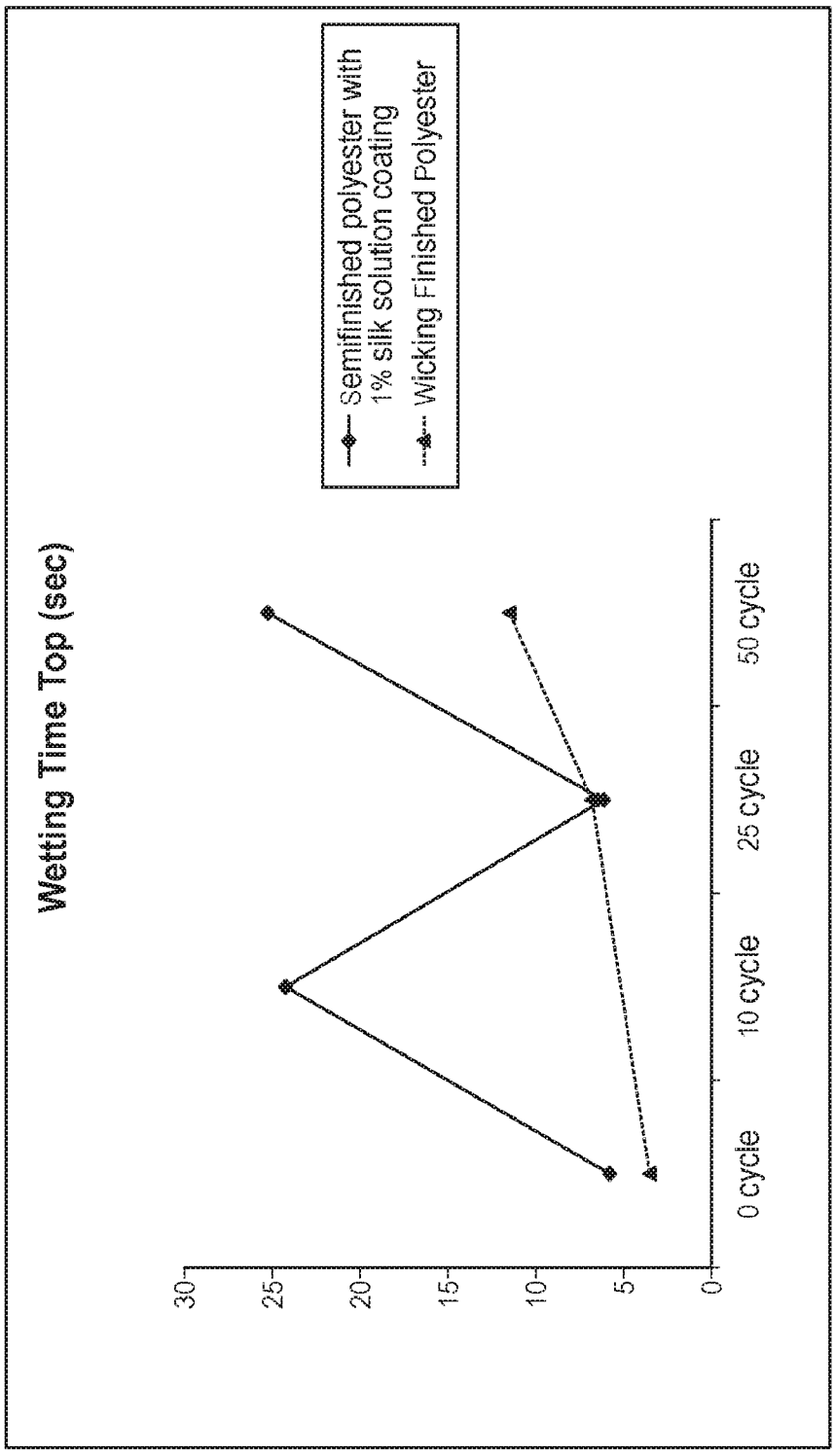

Wetting Time Top (sec)
Semifinished polyester with 1% silk solution coating
Wicking Finished Polyester
30
25
20
15
10
5
0
0 cycle
10 cycle
25 cycle
50 cycle

FIG. 95

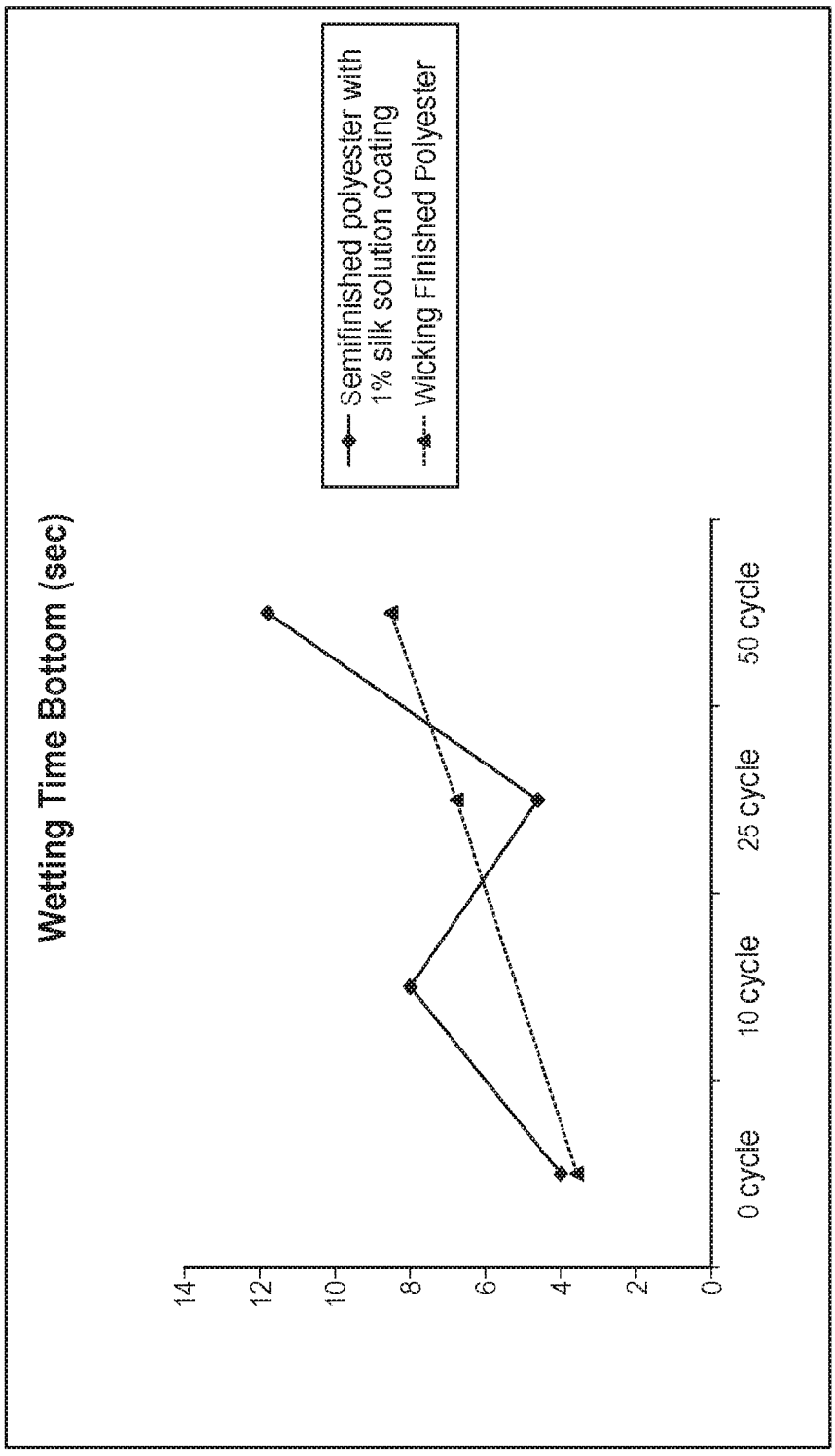

Wetting Time Bottom (sec)
Semifinished polyester with 1% silk solution coating
Wicking Finished Polyester
14
12
10
8
6
4
2
0
0 cycle
10 cycle
25 cycle
50 cycle

FIG. 96

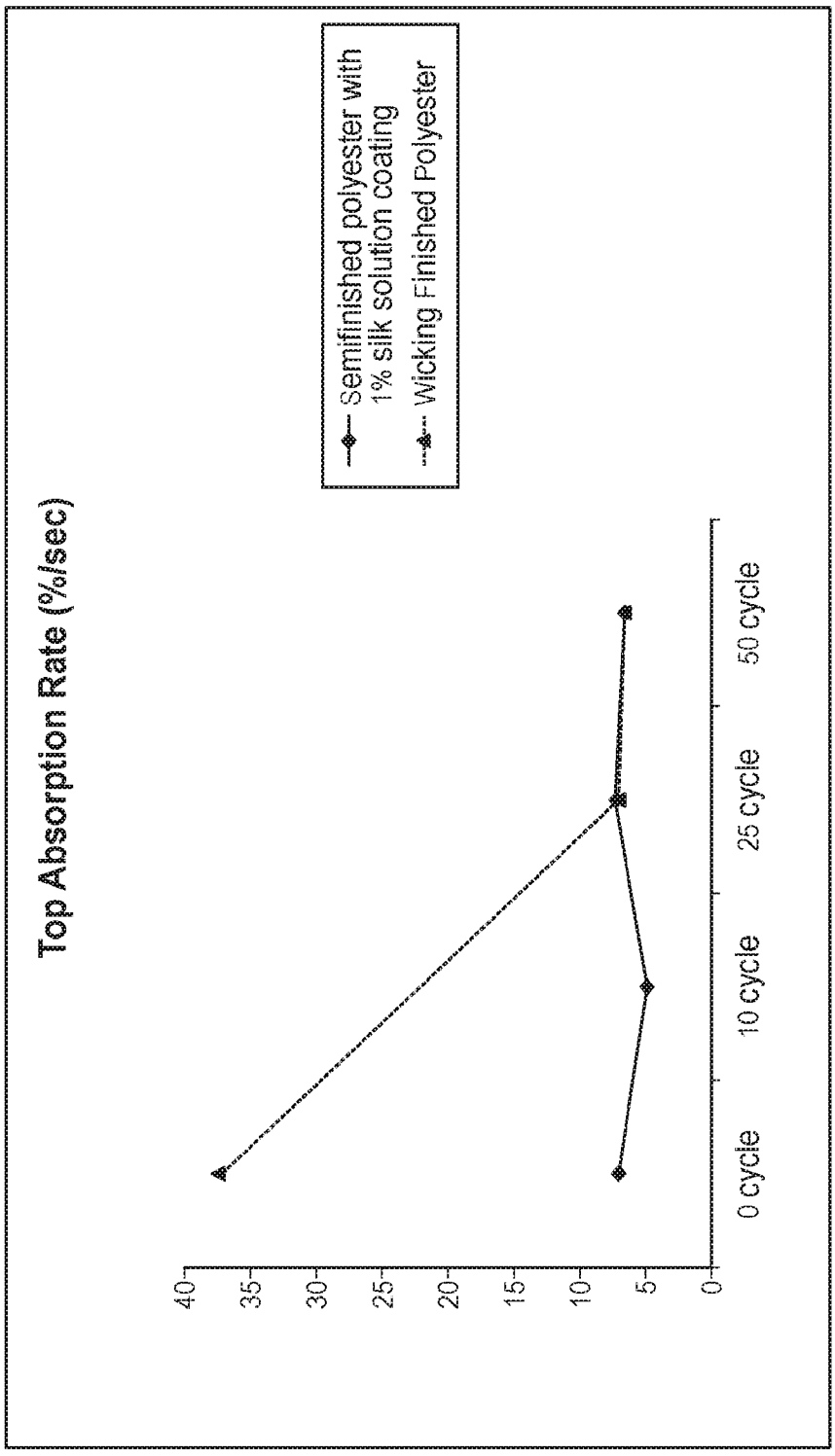

Top Absorption Rate (%/sec)
Semifinished polyester with 1% silk solution coating
Wicking Finished Polyester
40
35
30
25
20
15
10
5
0
0 cycle
10 cycle
25 cycle
50 cycle

FIG. 97

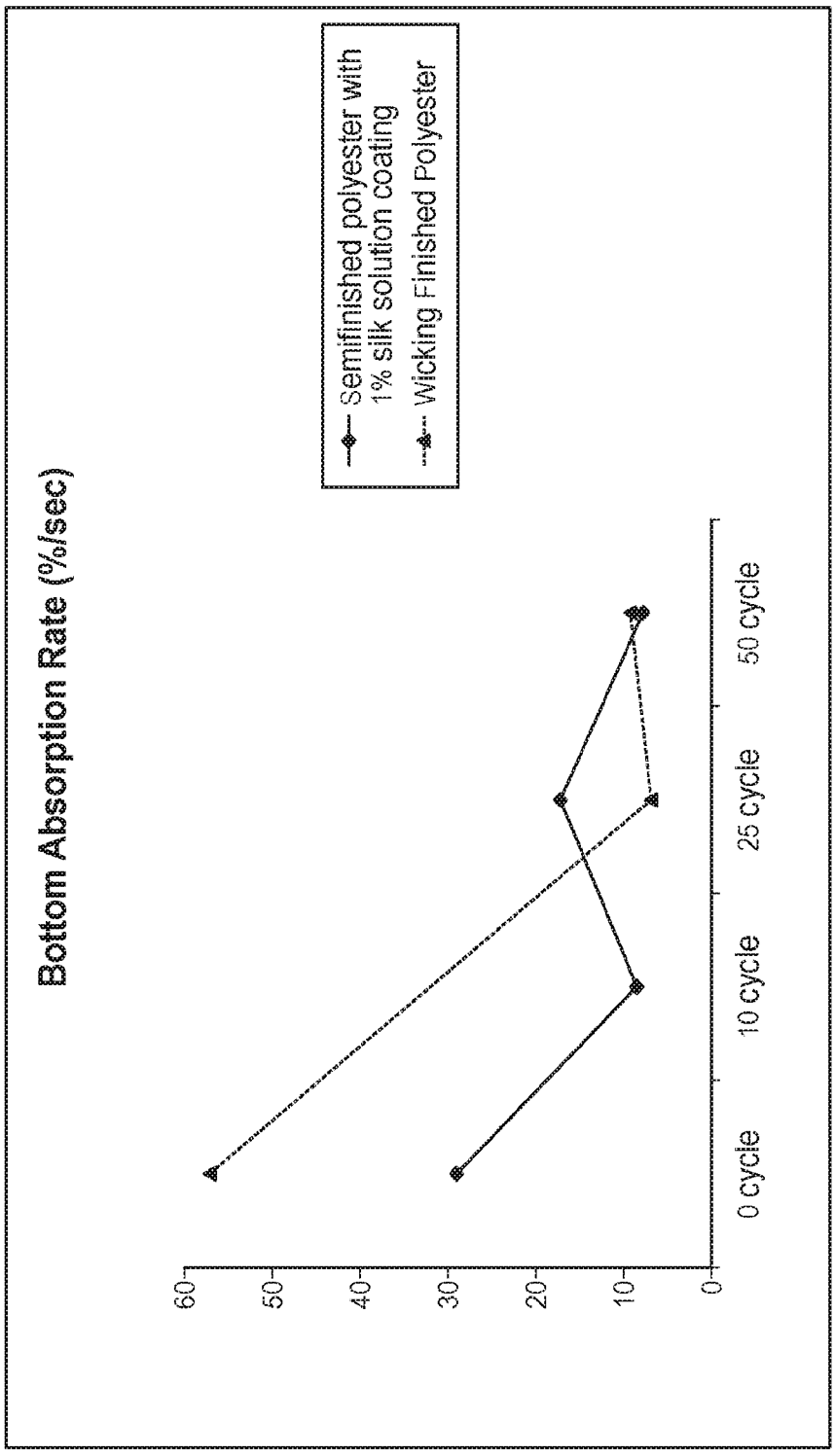

Bottom Absorption Rate (%/sec)
Semifinished polyester with 1% silk solution coating
Wicking Finished Polyester
60
50
40
30
20
10
0
0 cycle
10 cycle
25 cycle
50 cycle

FIG. 98

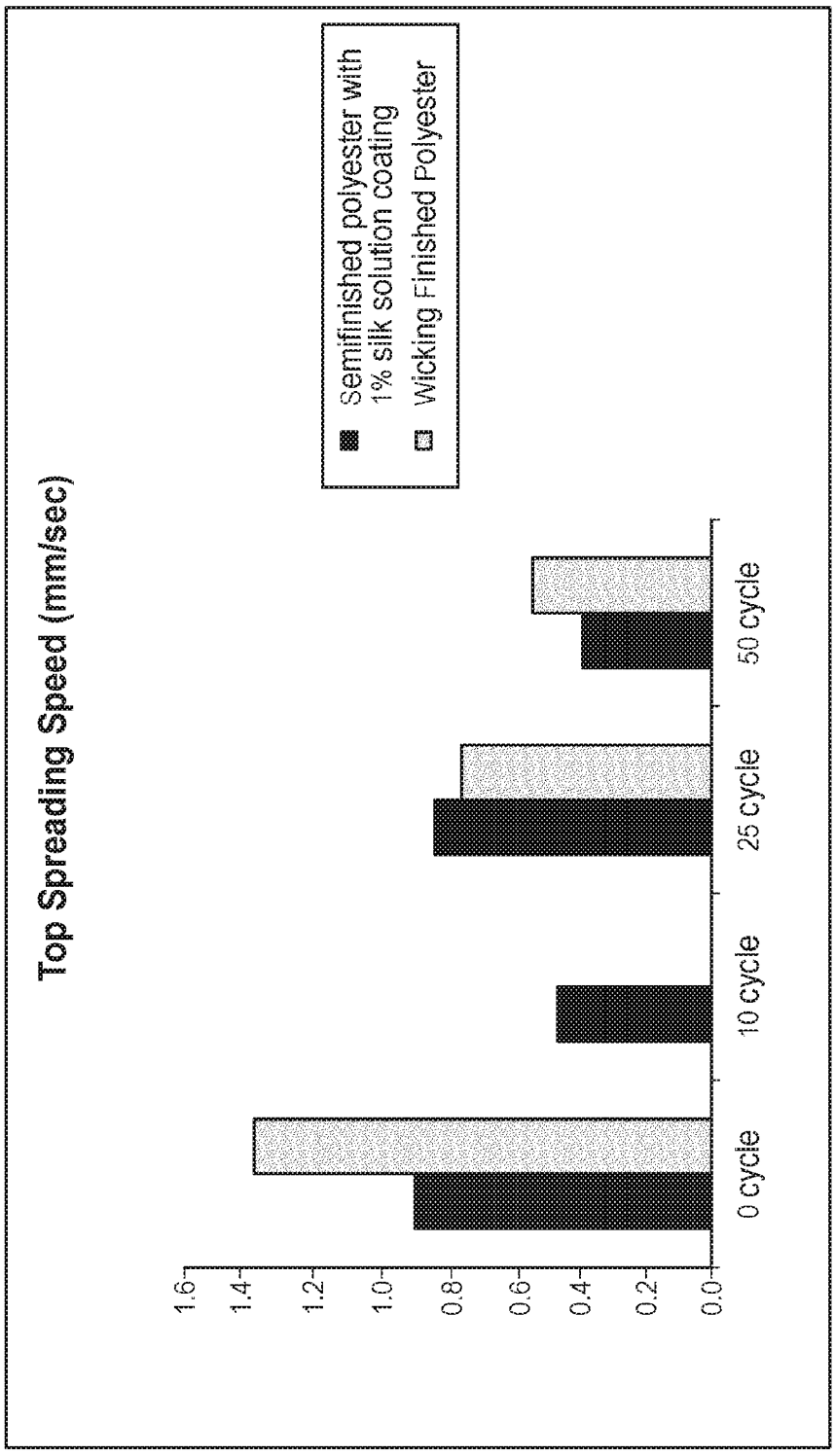

Top Spreading Speed (mm/sec)
Semifinished polyester with 1% silk solution coating
Wicking Finished Polyester
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0 cycle
10 cycle
25 cycle
50 cycle

FIG. 99

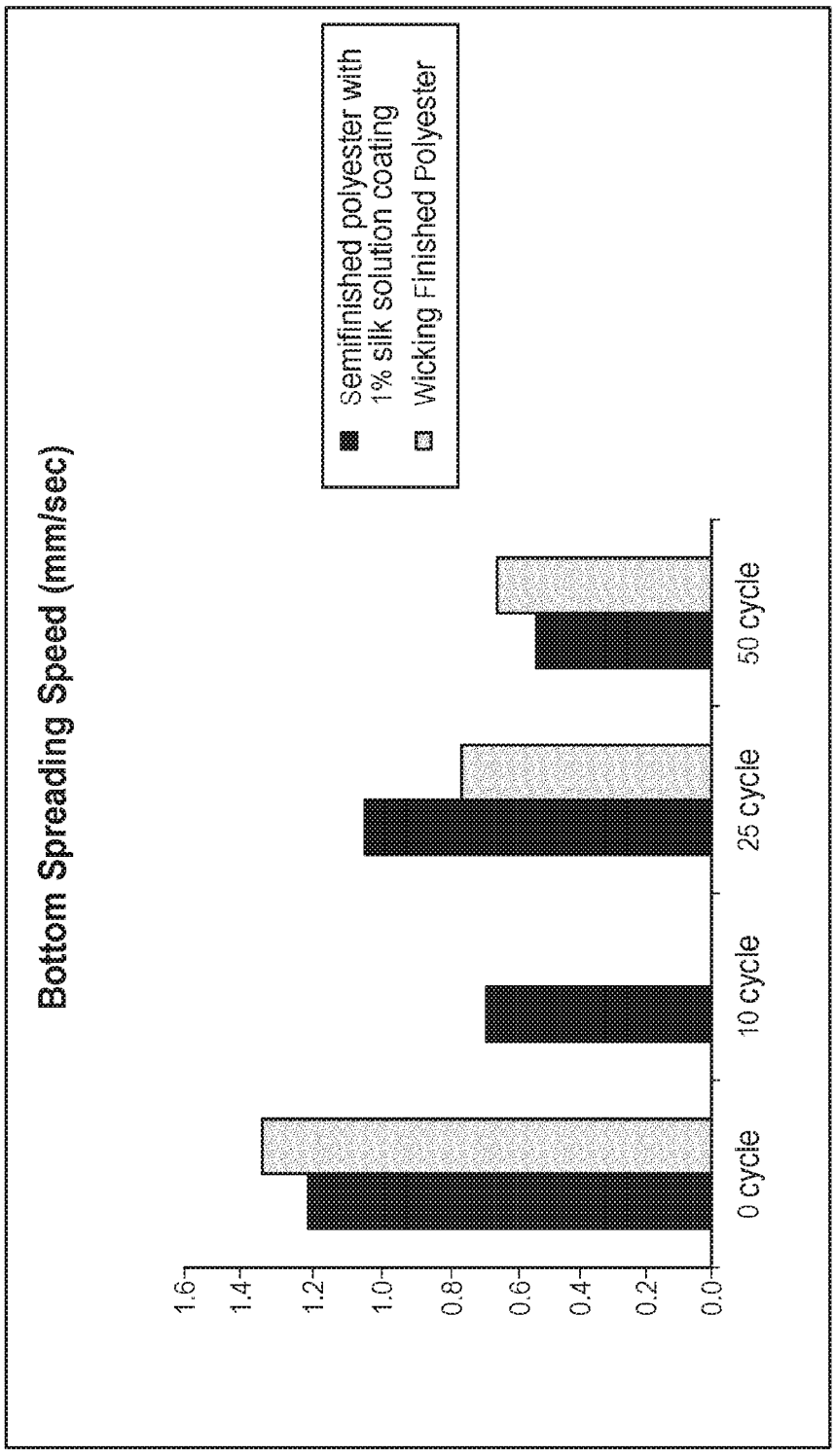

Bottom Spreading Speed (mm/sec)
Semifinished polyester with 1% silk solution coating
Wicking Finished Polyester
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0 cycle
10 cycle
25 cycle
50 cycle

FIG. 100

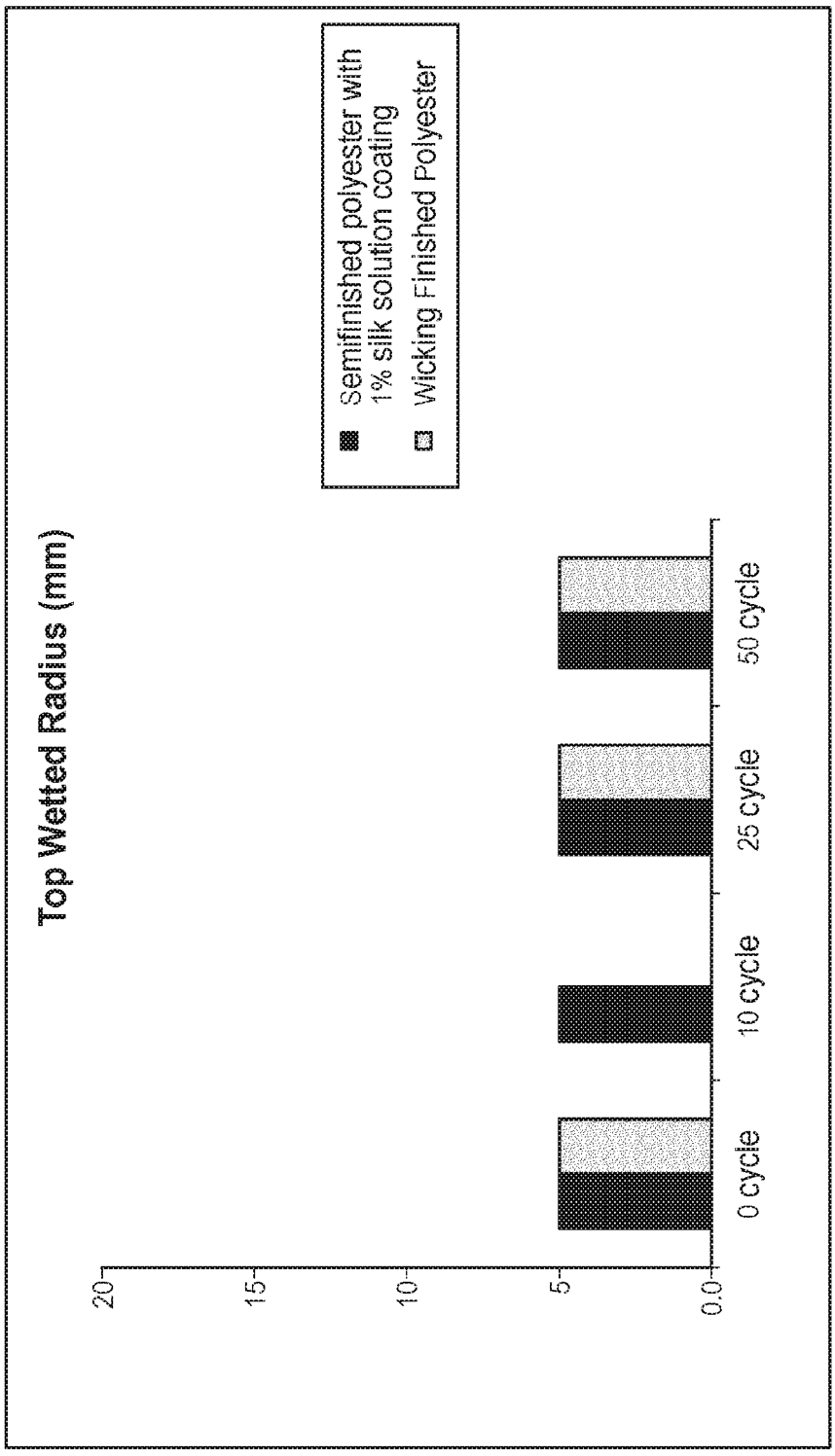

Top Wetted Radius (mm)
Semifinished polyester with 1% silk solution coating
Wicking Finished Polyester
20
15
10
5
0.0
0 cycle
10 cycle
25 cycle
50 cycle

FIG. 101

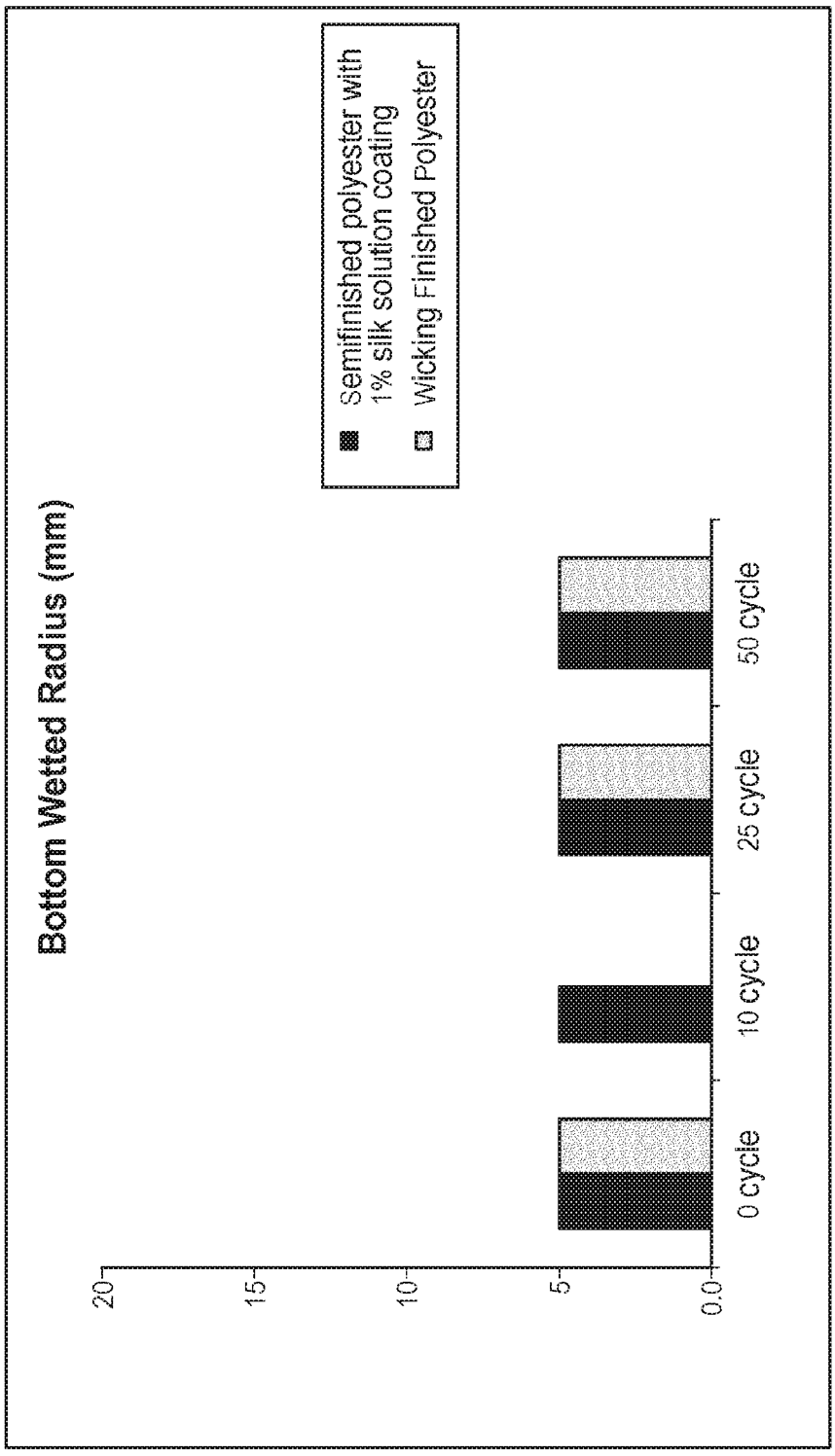

Bottom Wetted Radius (mm)
Semifinished polyester with 1% silk solution coating
Wicking Finished Polyester
20
15
10
5
0.0
0 cycle
10 cycle
25 cycle
50 cycle

FIG. 102

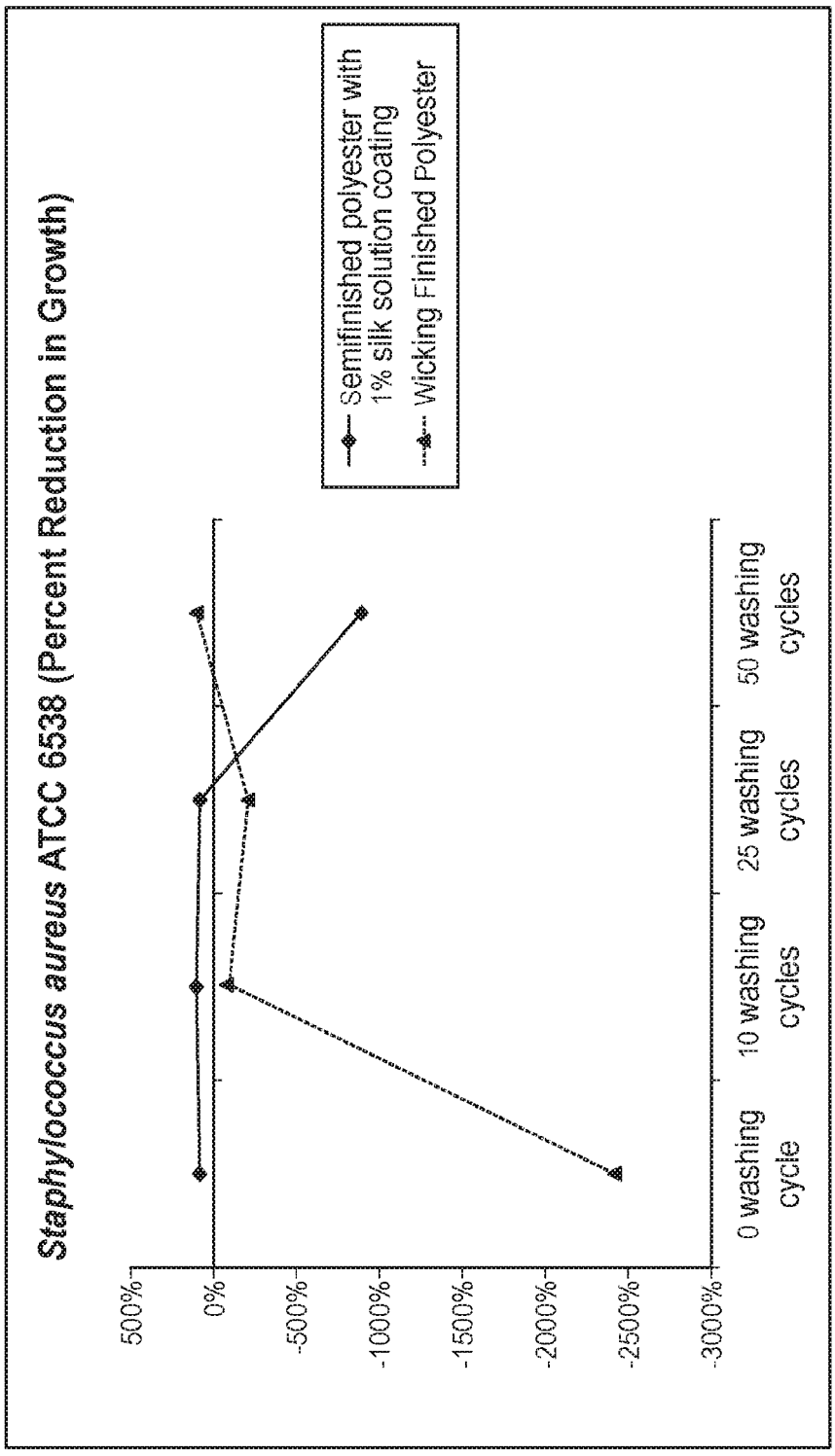

Staphylococcus aureus ATCC 6538 (Percent Reduction in Growth)
Semifinished polyester with 1% silk solution coating
Wicking Finished Polyester
500%
0%
-500%
-1000%
-1500%
-2000%
-2500%
-3000%
0 washing cycle
10 washing cycles
25 washing cycles
50 washing cycles

FIG. 103

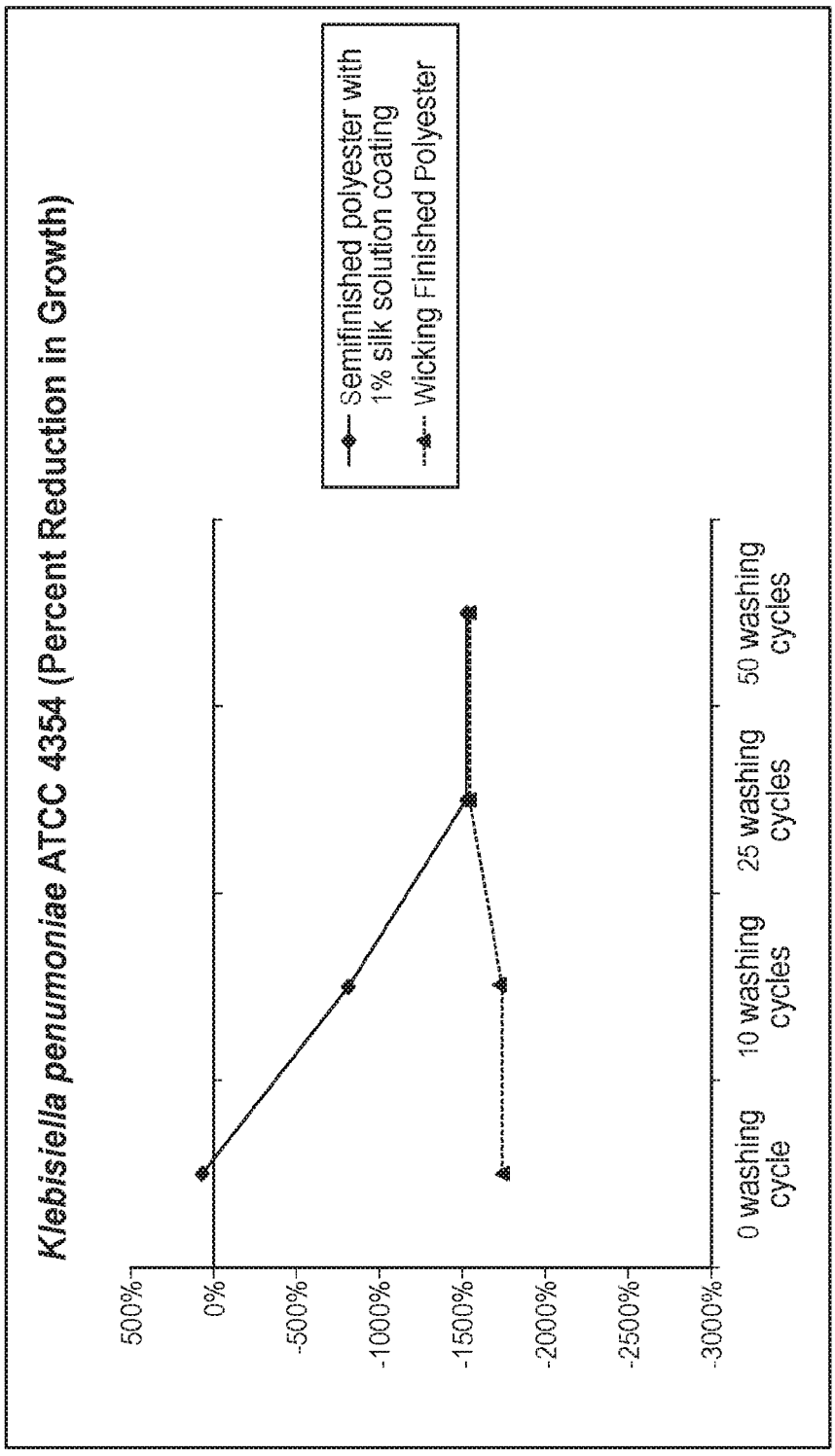

Klebisiella penumoniae ATCC 4354 (Percent Reduction in Growth)
Semifinished polyester with 1% silk solution coating
Wicking Finished Polyester
500%
0%
-500%
-1000%
-1500%
-2000%
-2500%
-3000%
0 washing cycle
10 washing cycles
25 washing cycles
50 washing cycles

FIG. 104

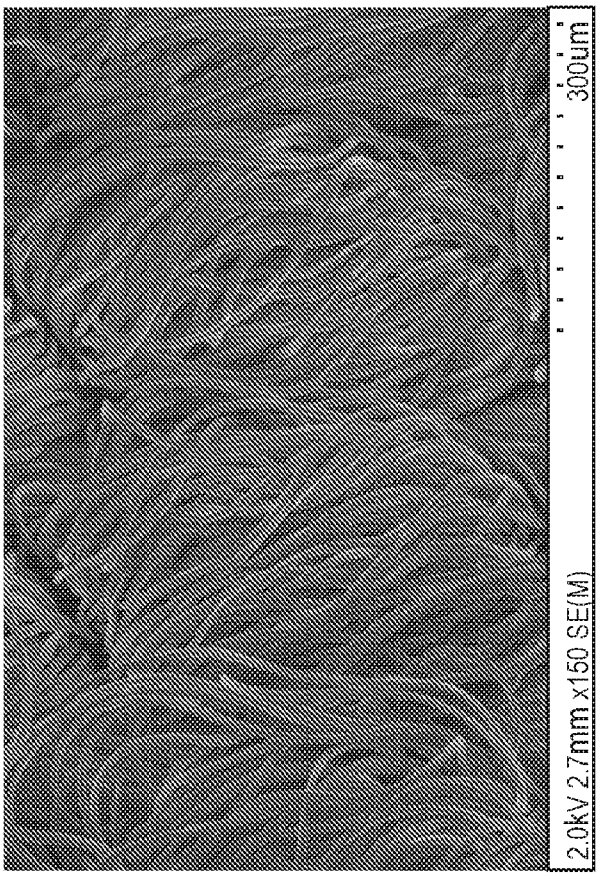


FIG. 105

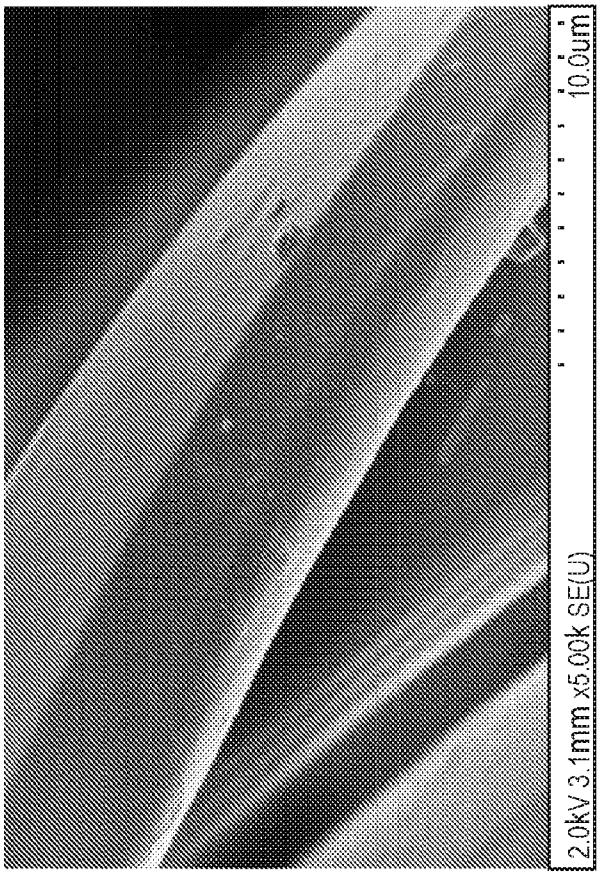


FIG. 106

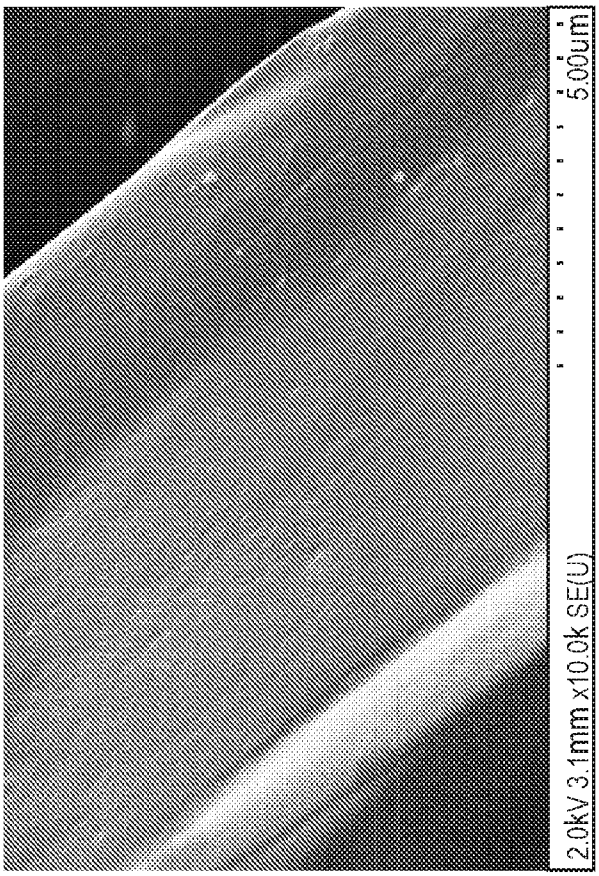


FIG. 107

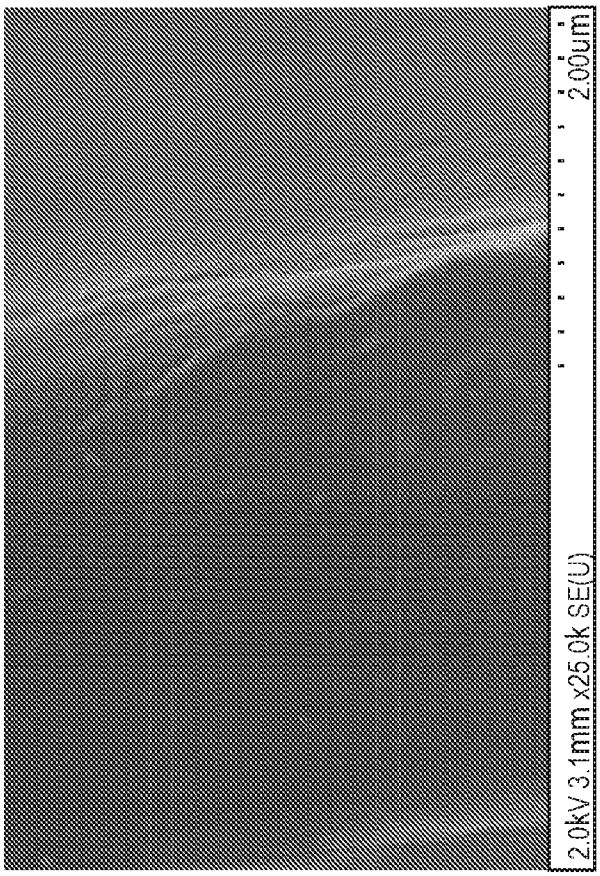


FIG. 108

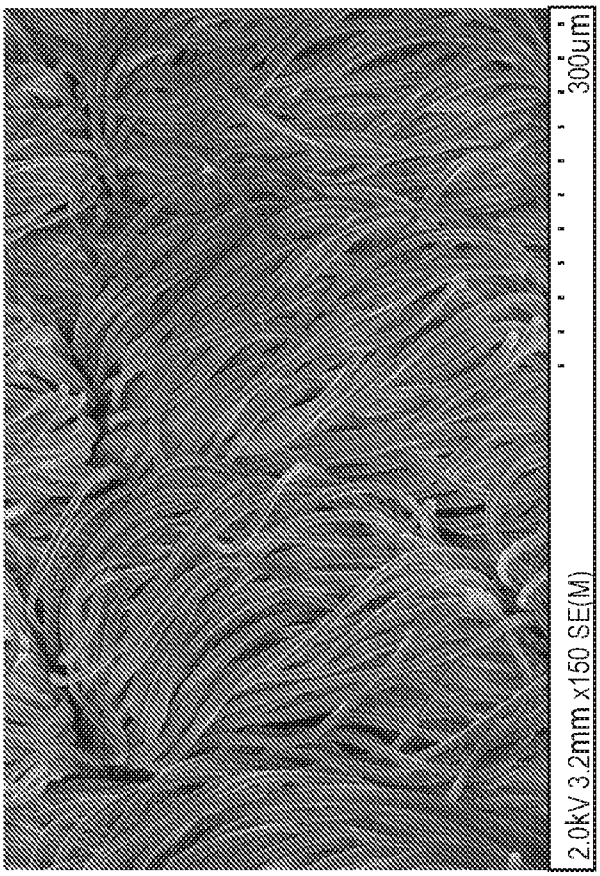


FIG. 109

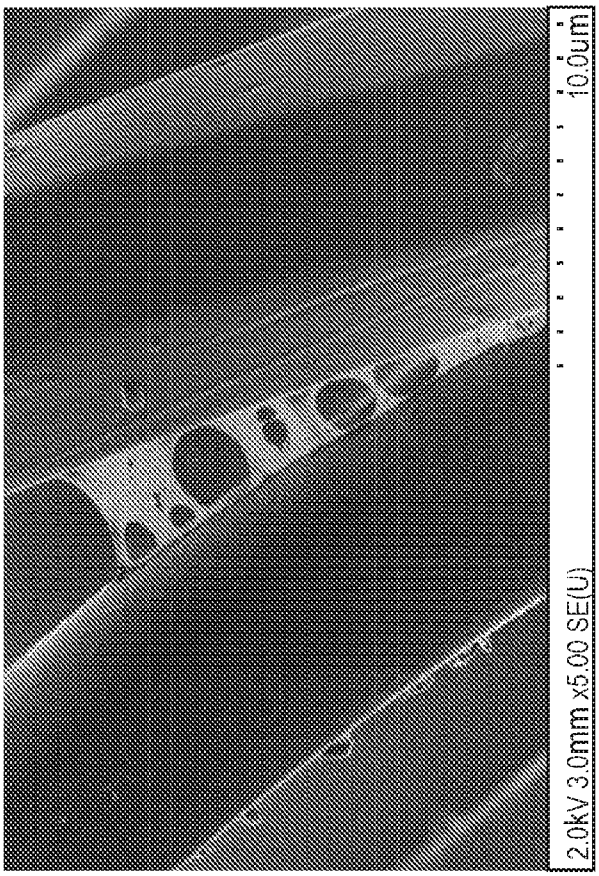
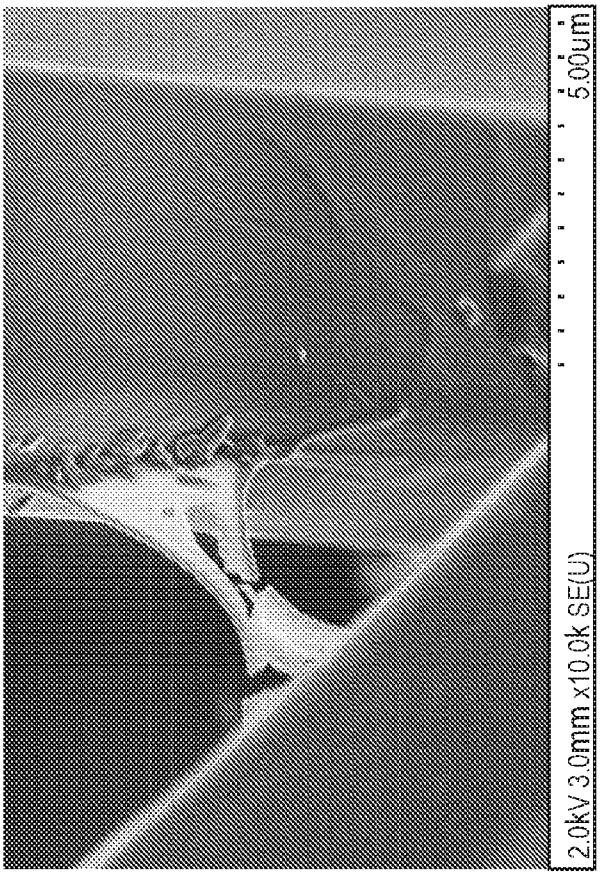


FIG. 110



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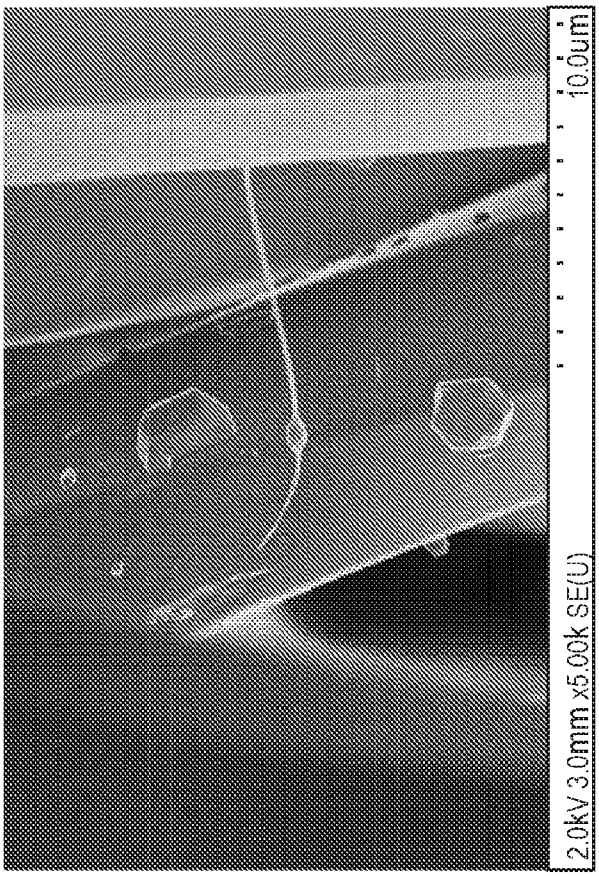


FIG. 112

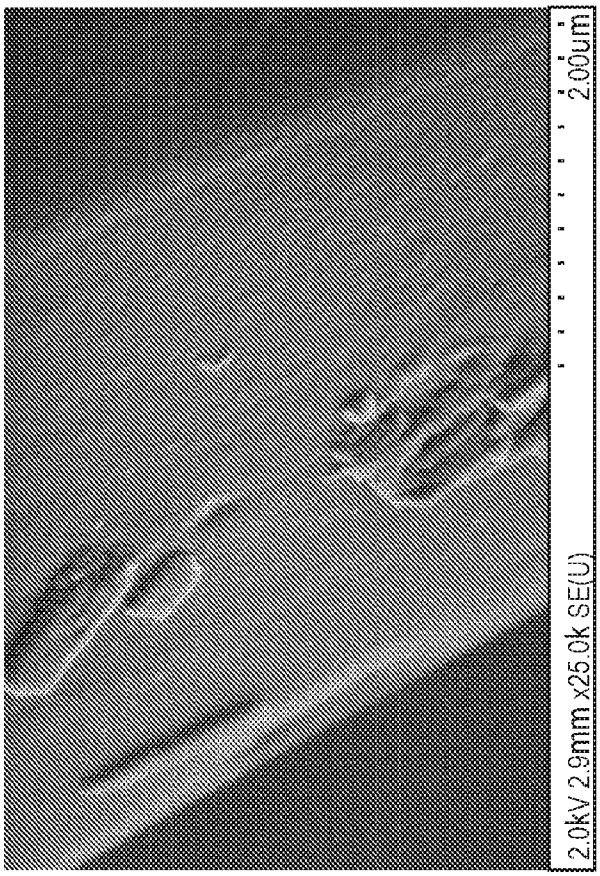


FIG. 113

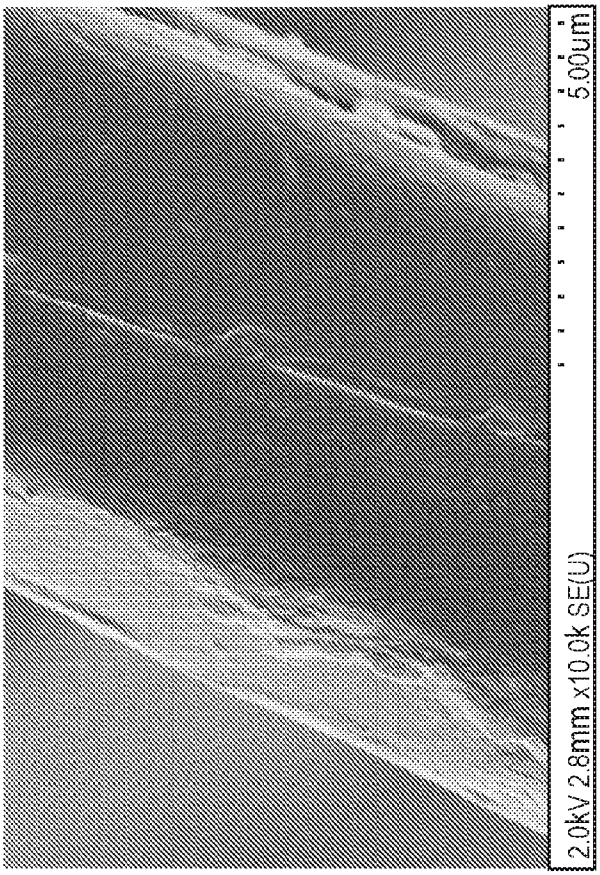


FIG. 114

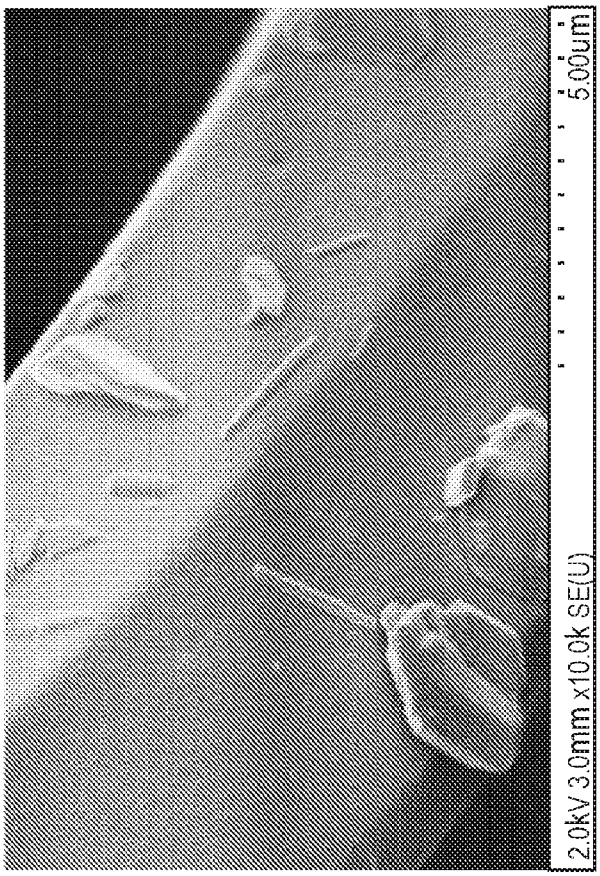


FIG. 115

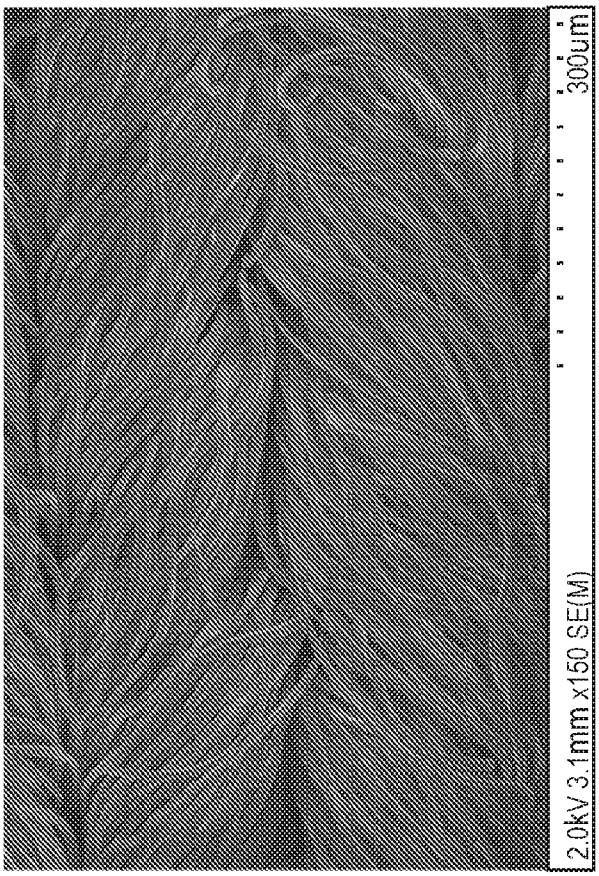


FIG. 116

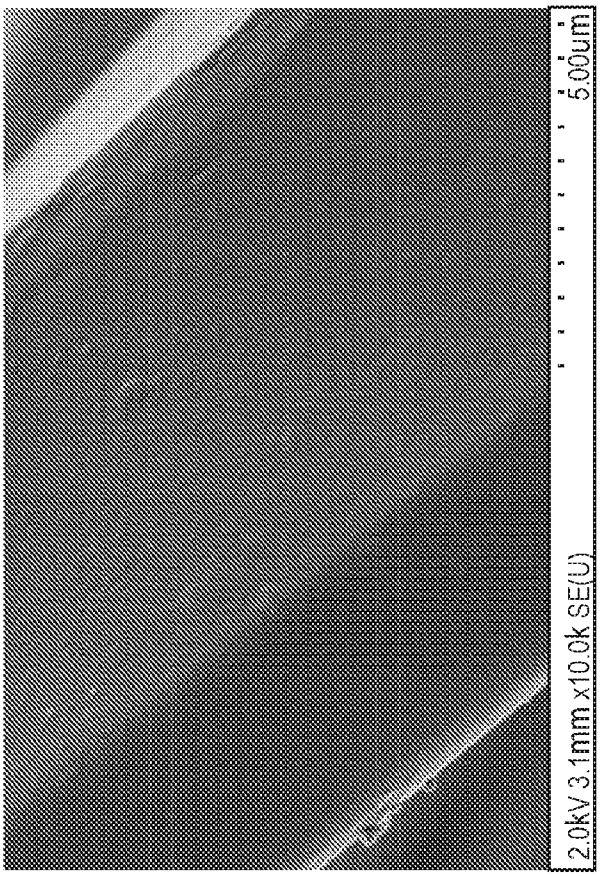


FIG. 117

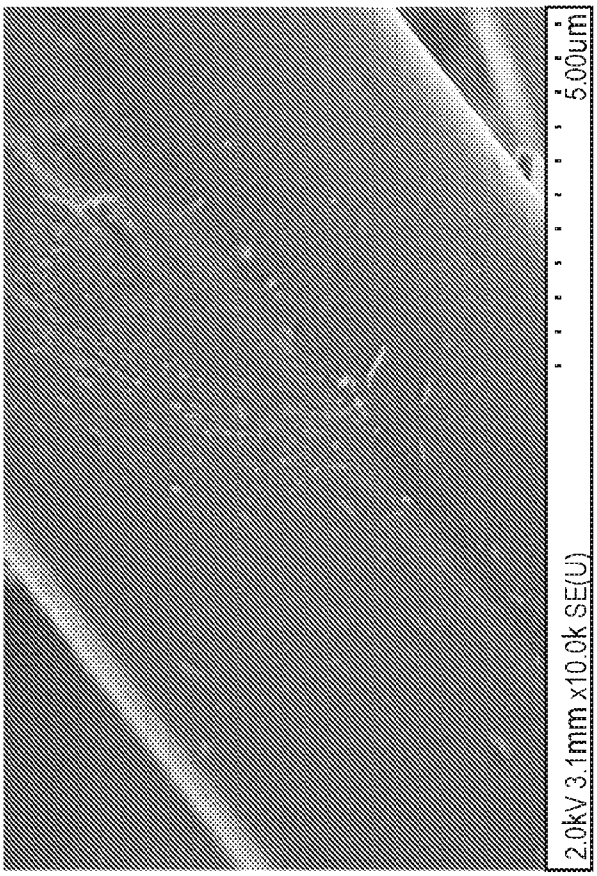


FIG. 118

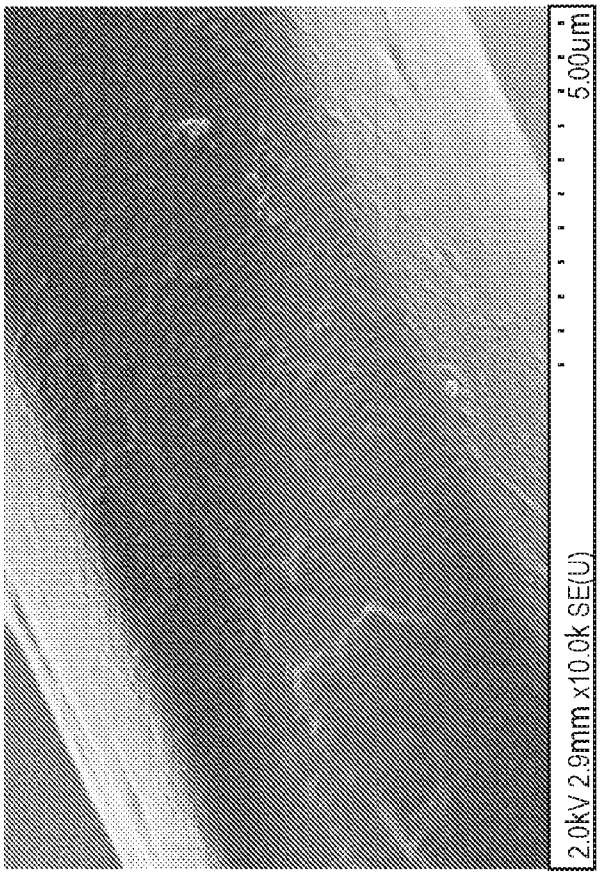


FIG. 119

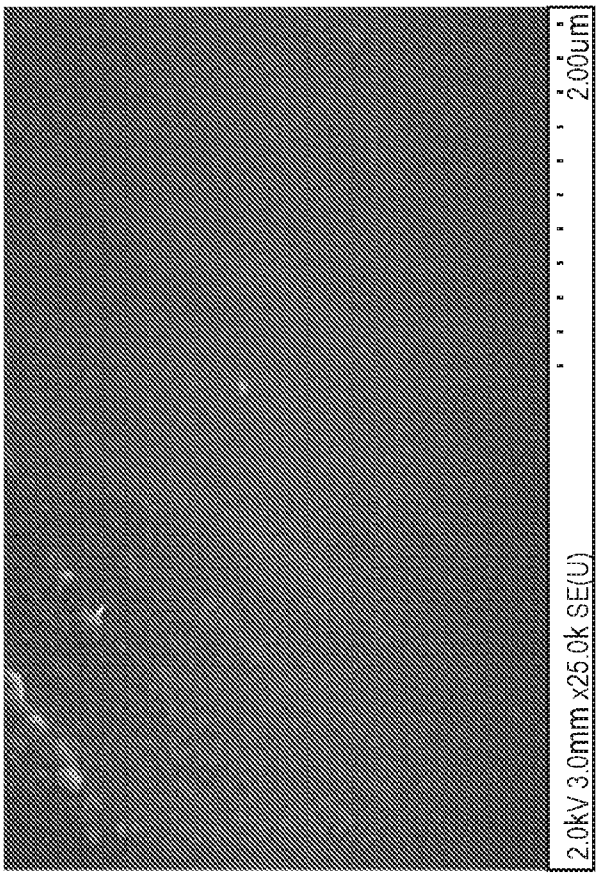


FIG. 120

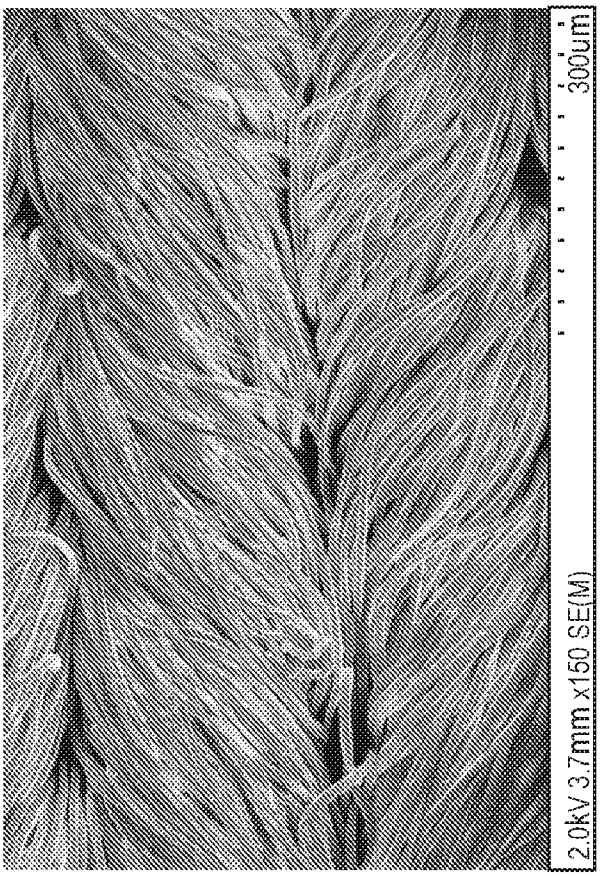


FIG. 121

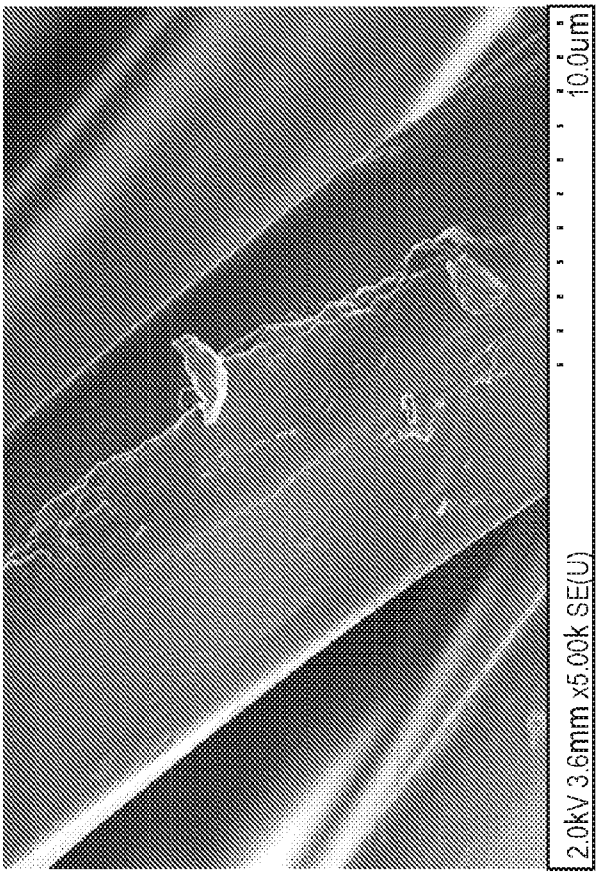


FIG. 122

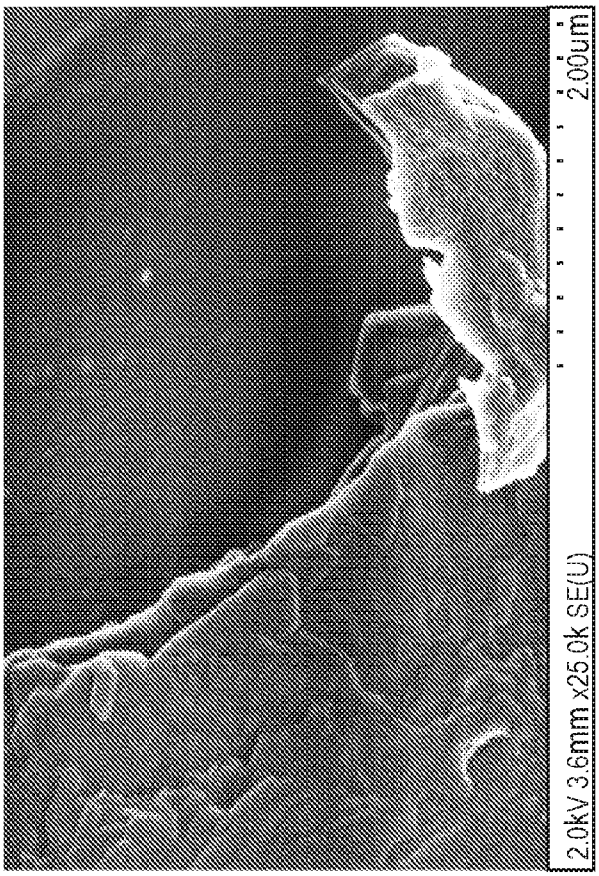


FIG. 123

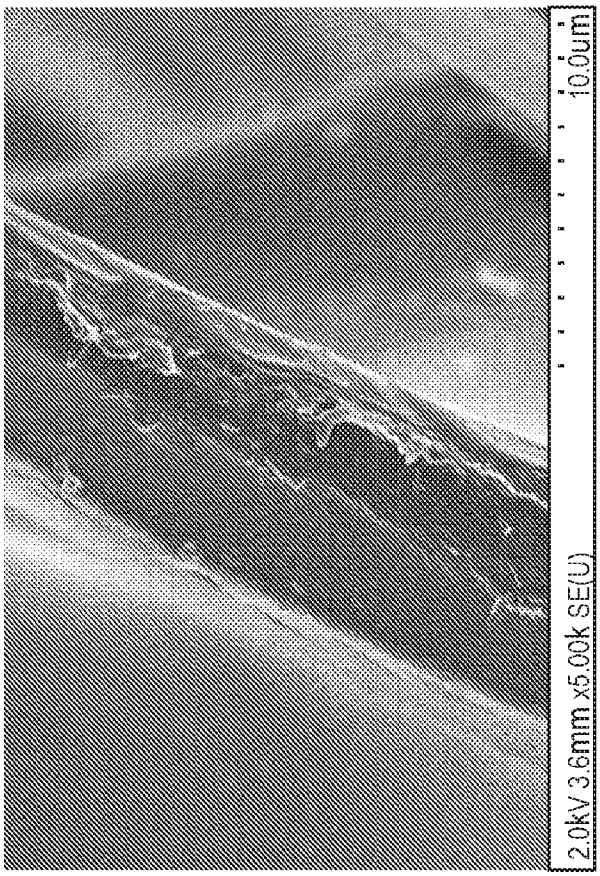


FIG. 124

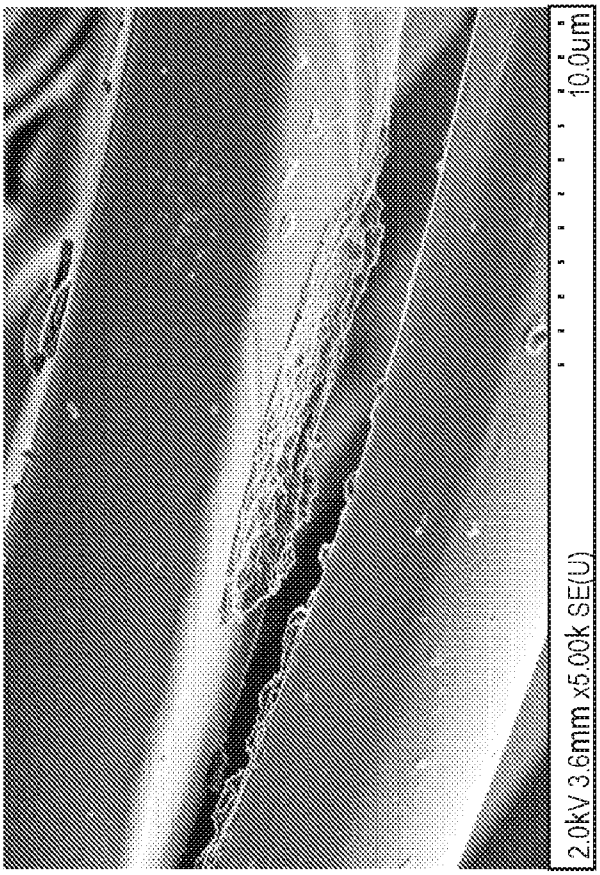


FIG. 125

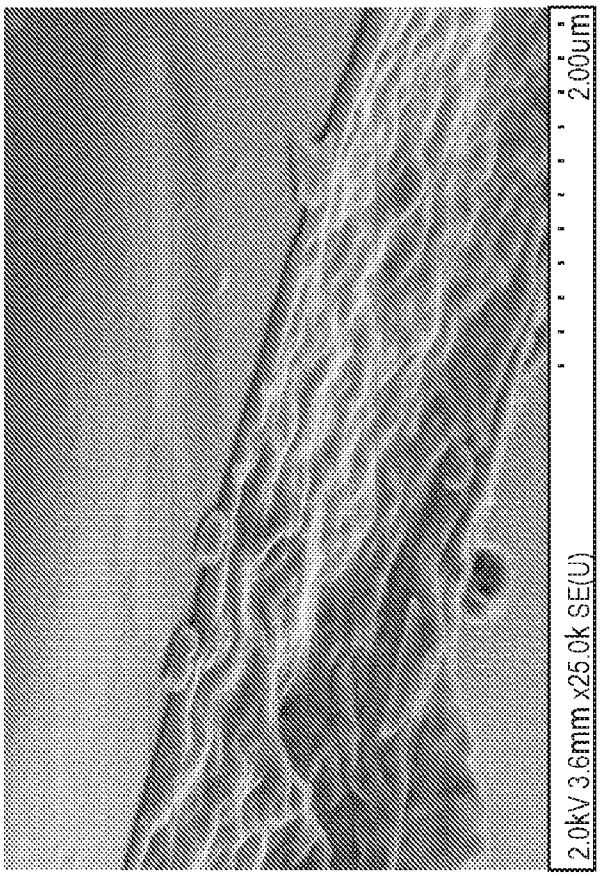


FIG. 126

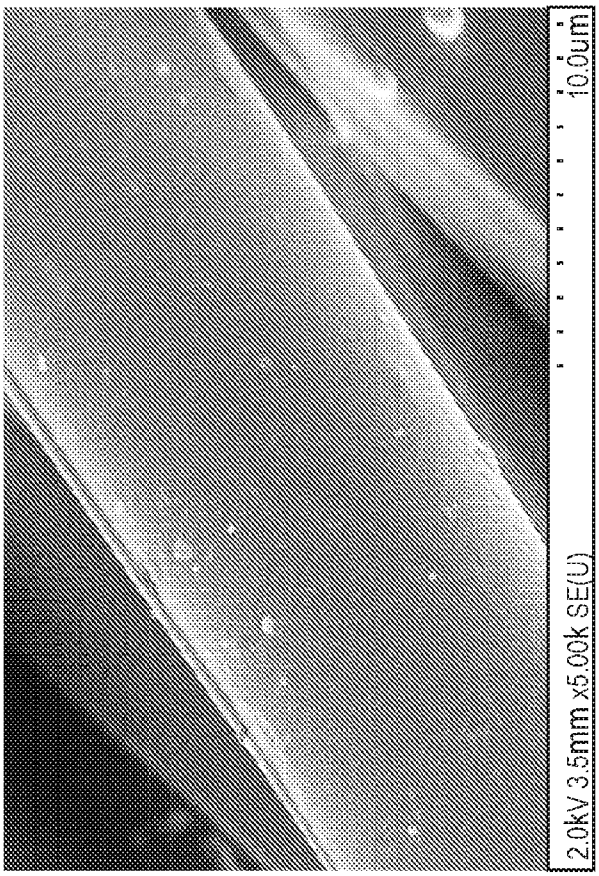


FIG. 127

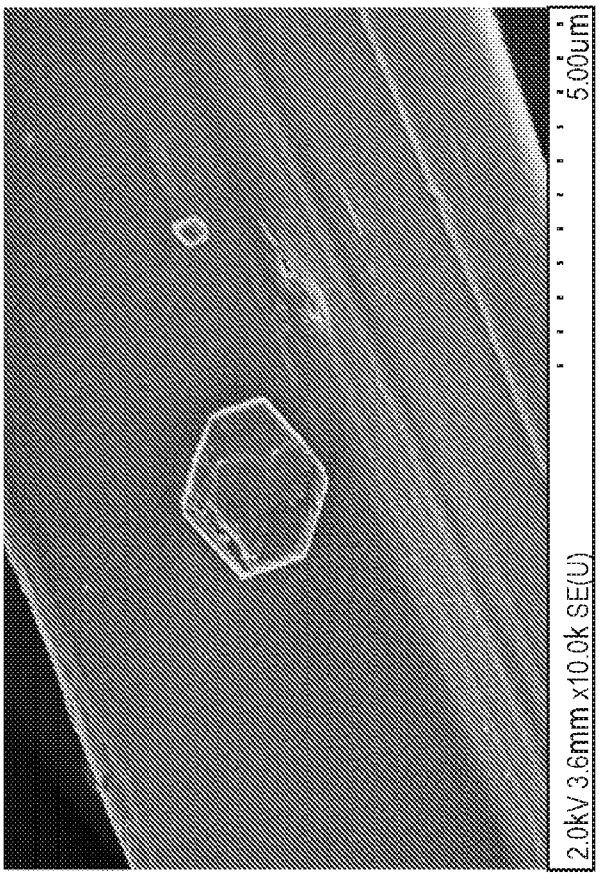
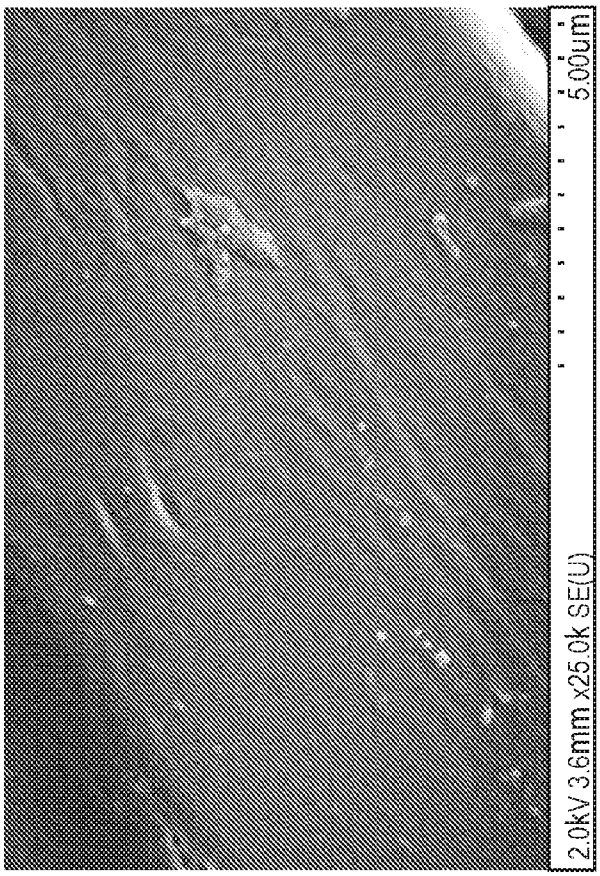


FIG. 128



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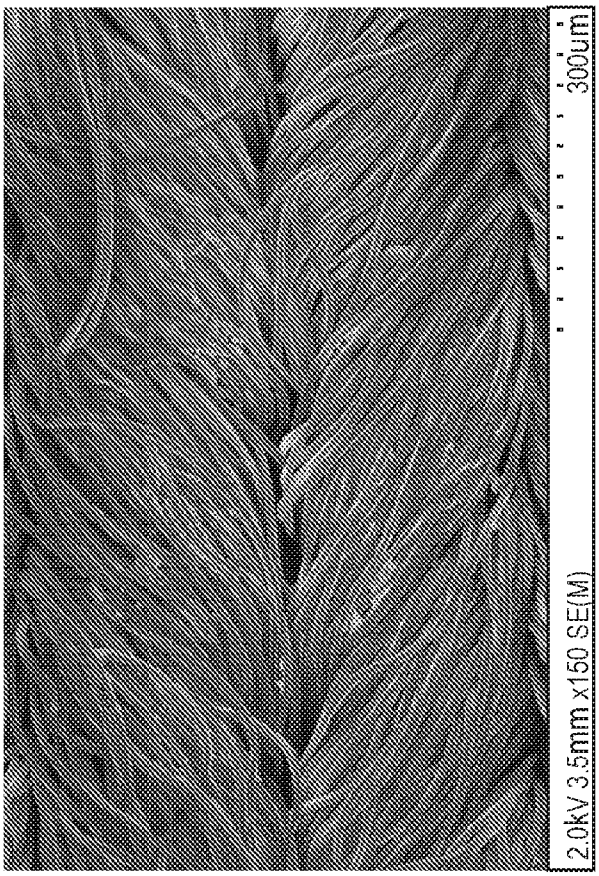

FIG. 130

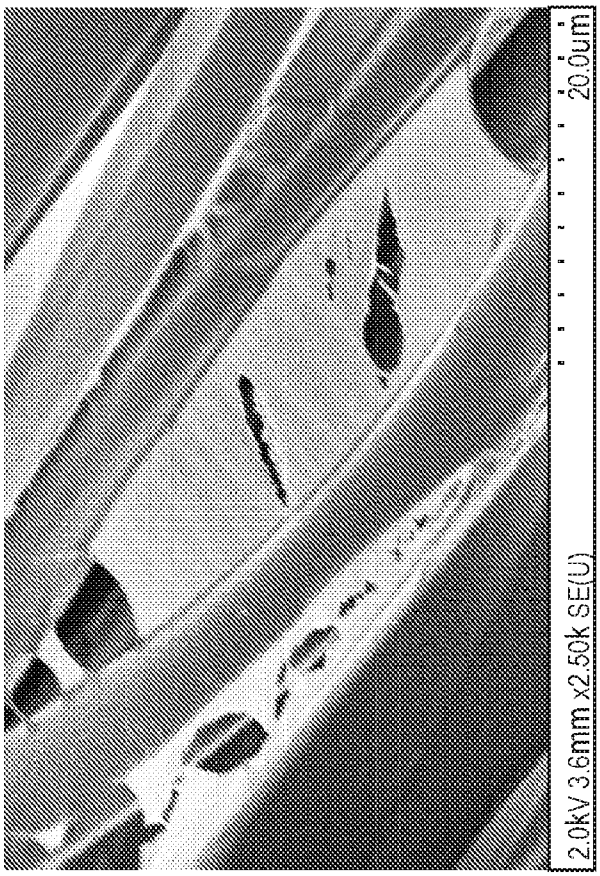

FIG. 131

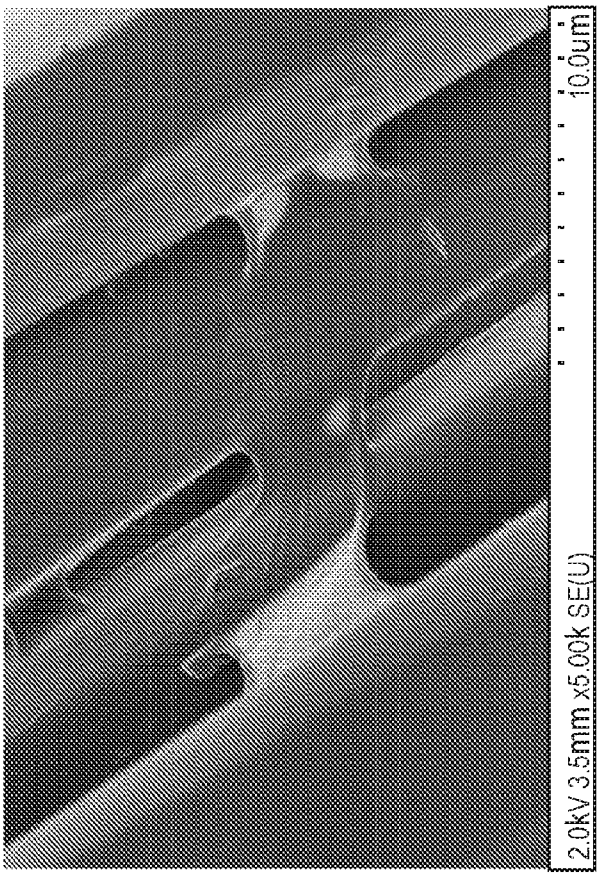

FIG. 132

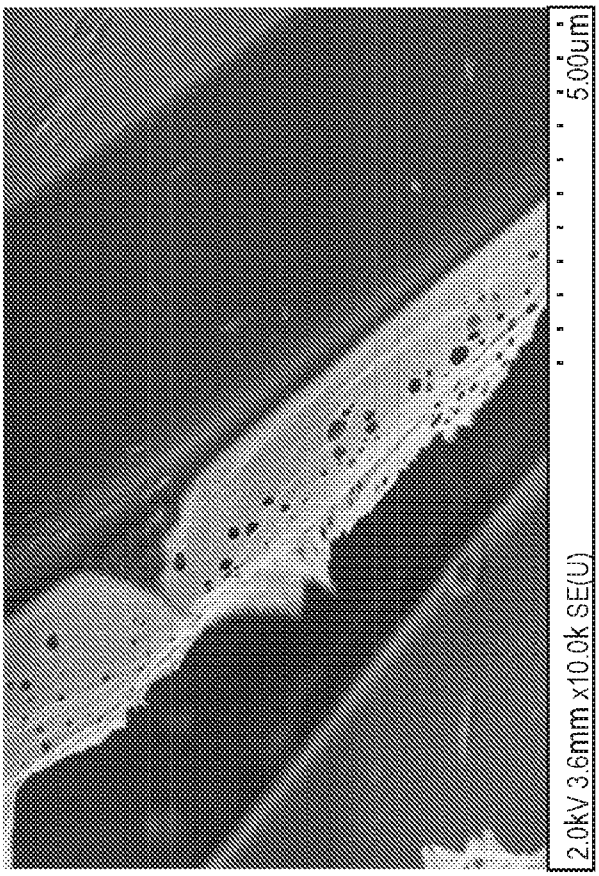

FIG. 133

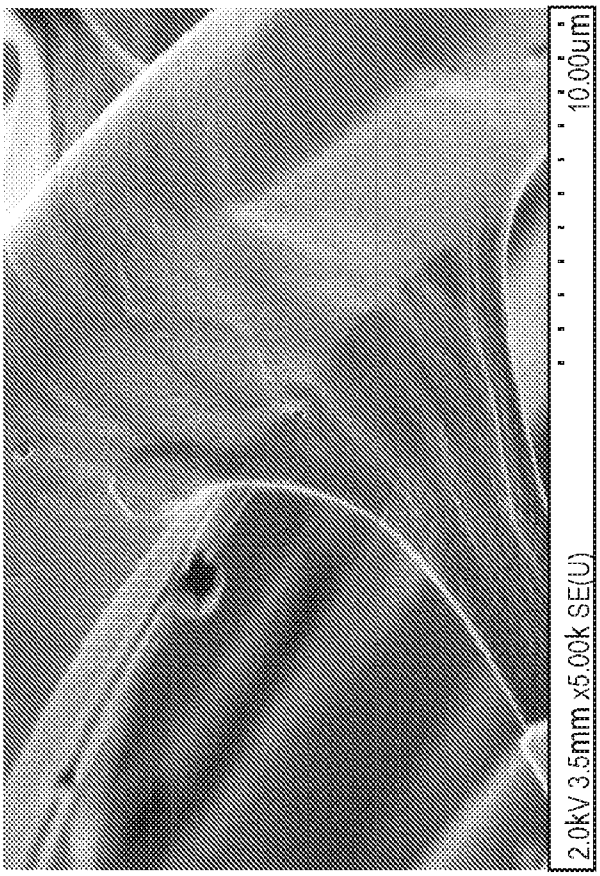

FIG. 134

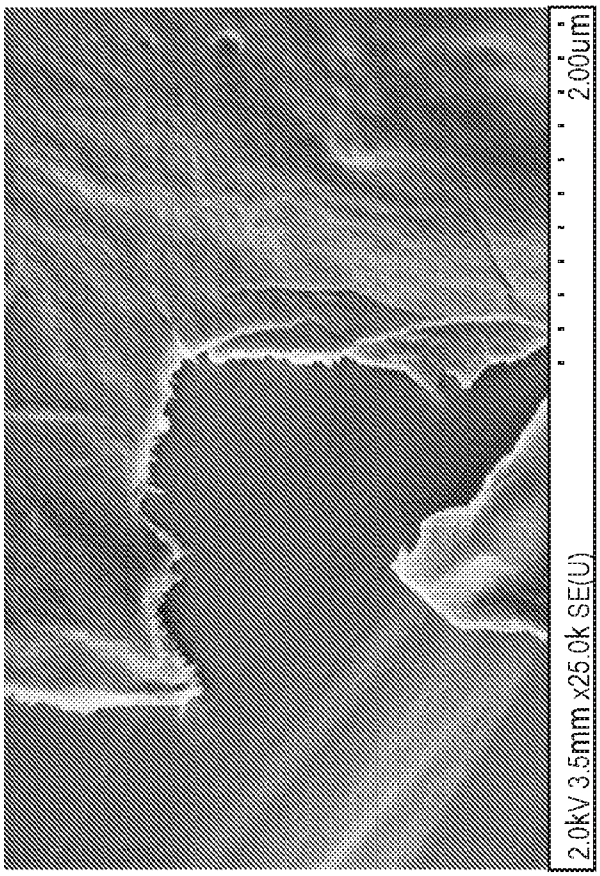

FIG. 135

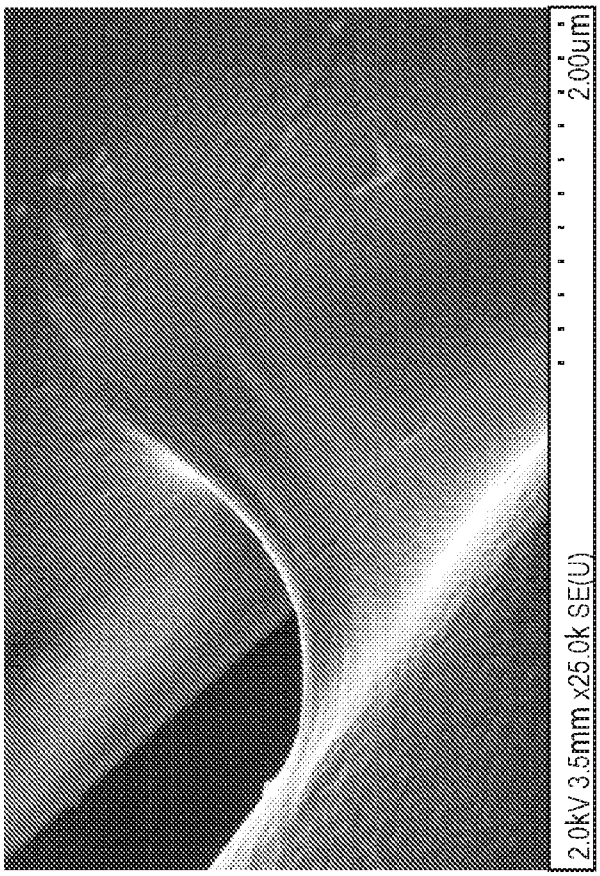

FIG. 136

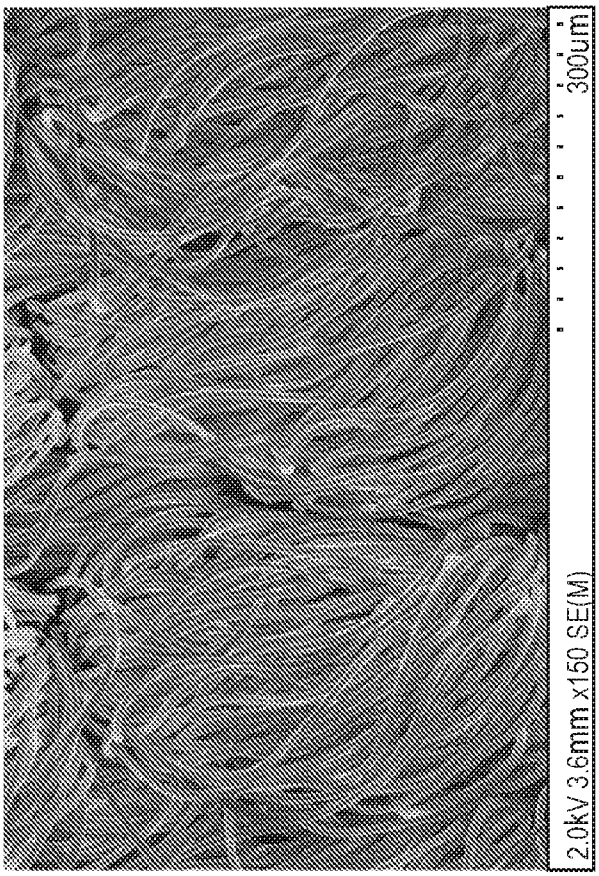

FIG. 137

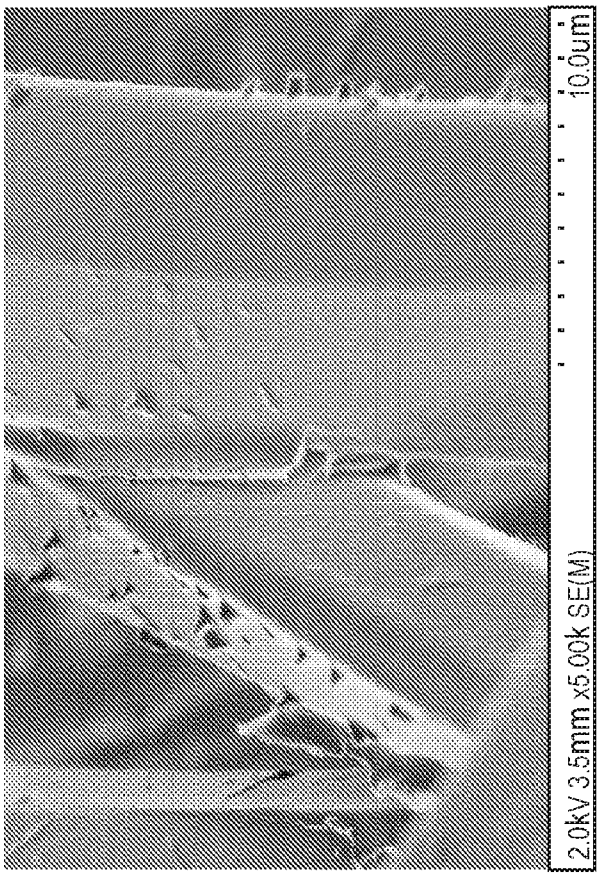

FIG. 138

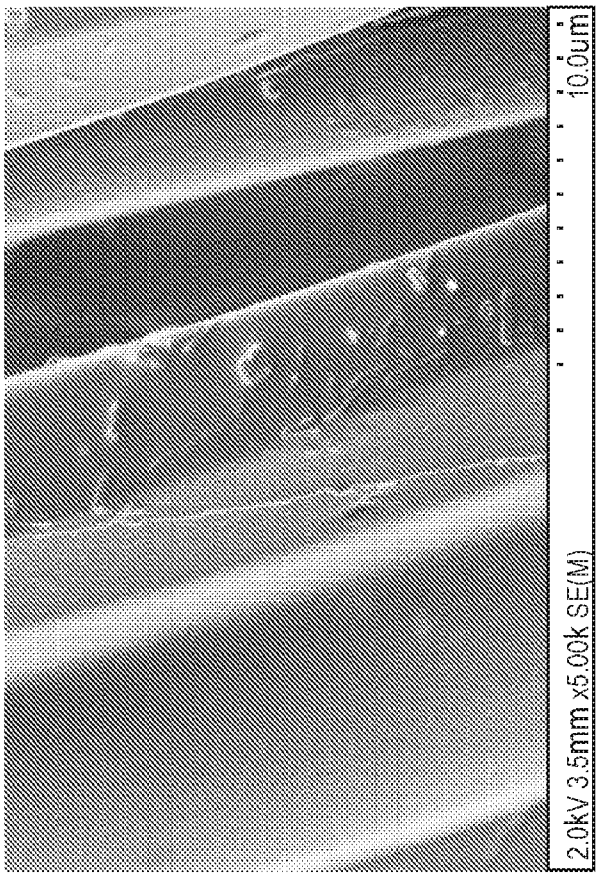

FIG. 139

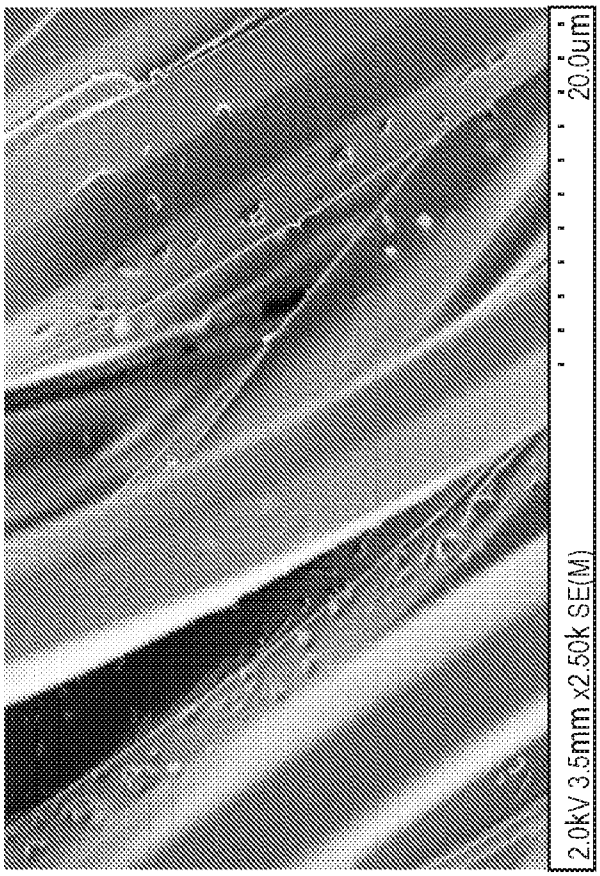

FIG. 140

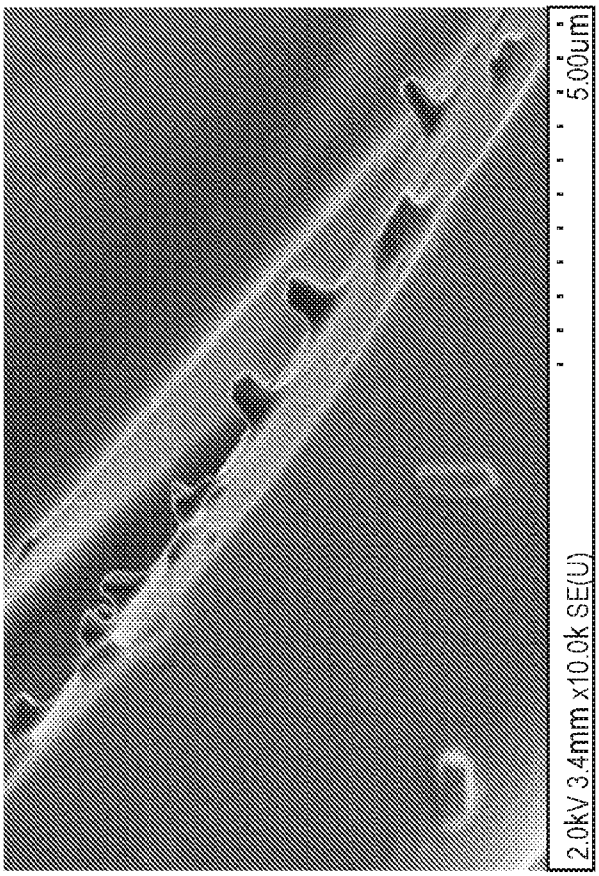

FIG. 141

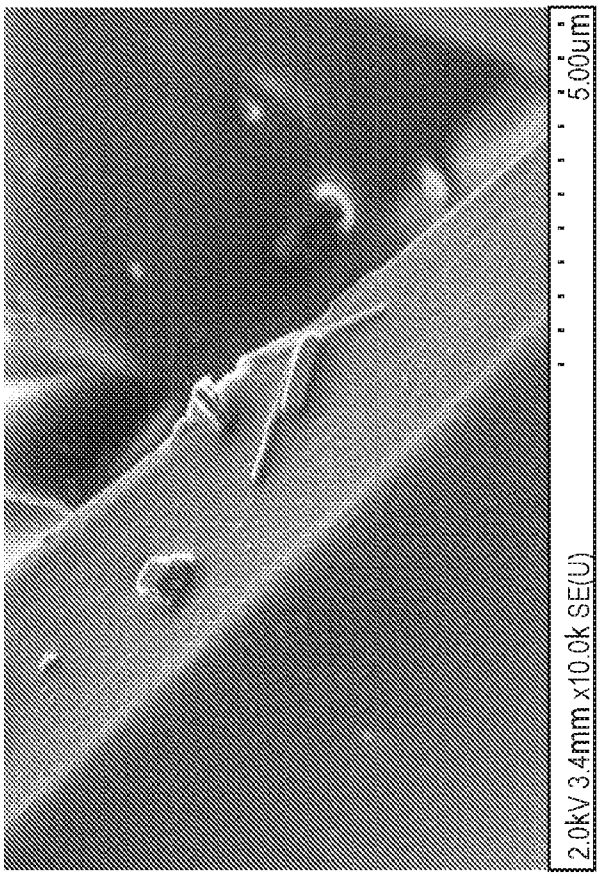

FIG. 142

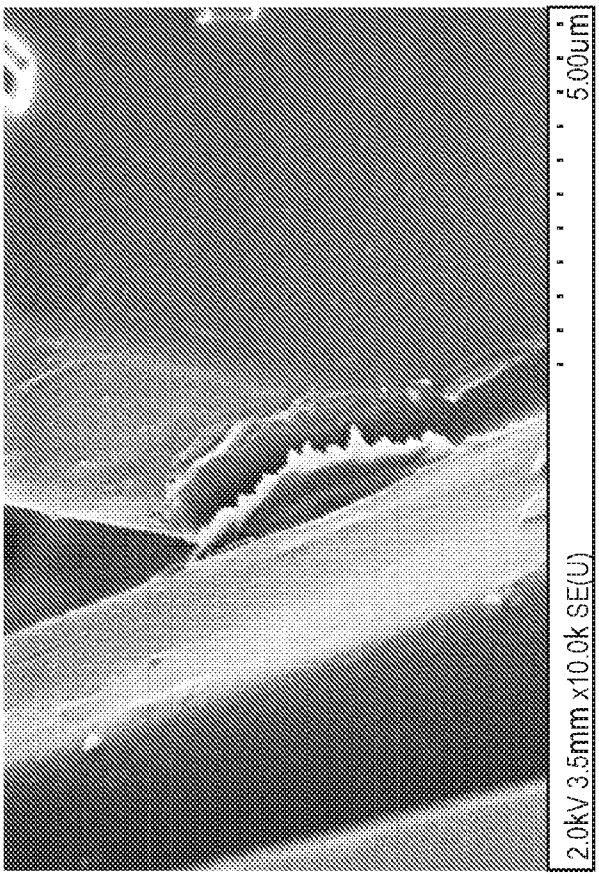

FIG. 143

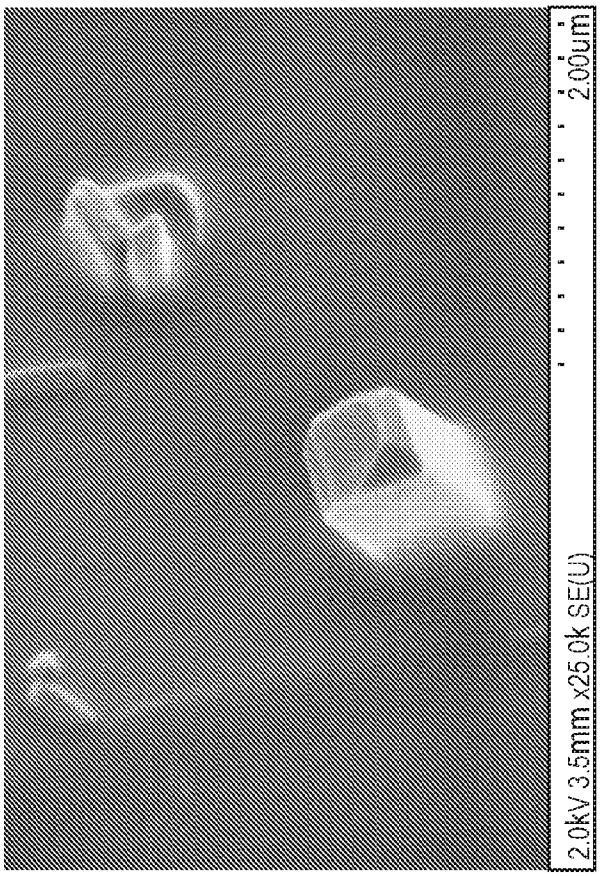

FIG. 144

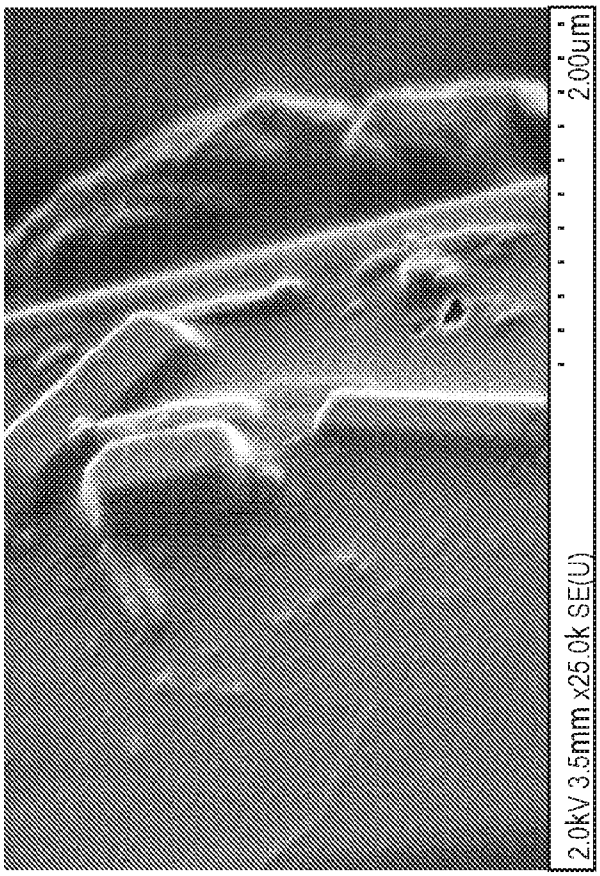

FIG. 145

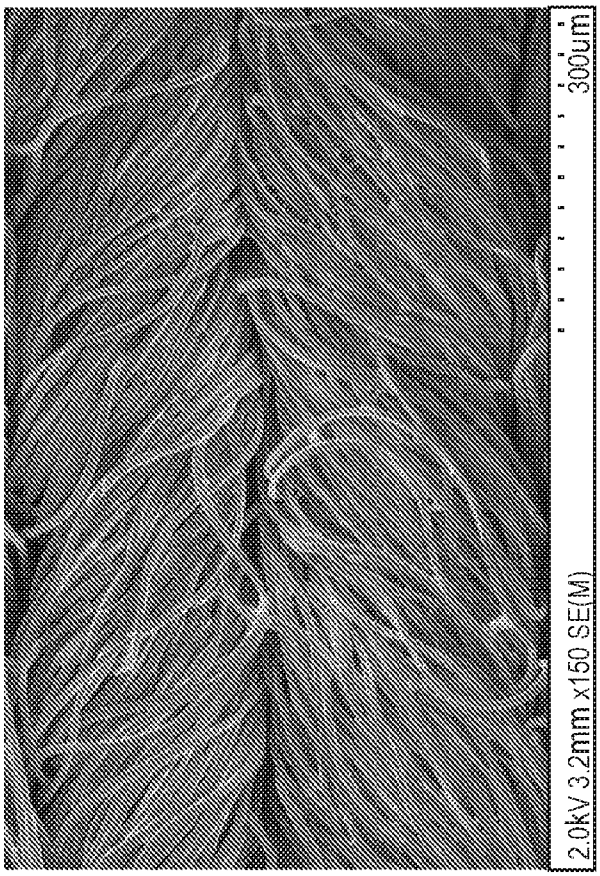

FIG. 146

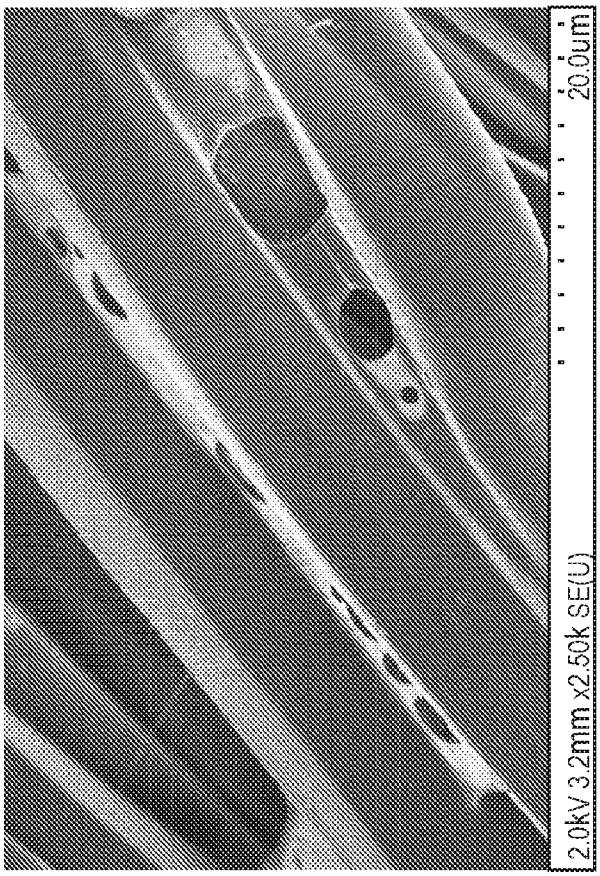

FIG. 147

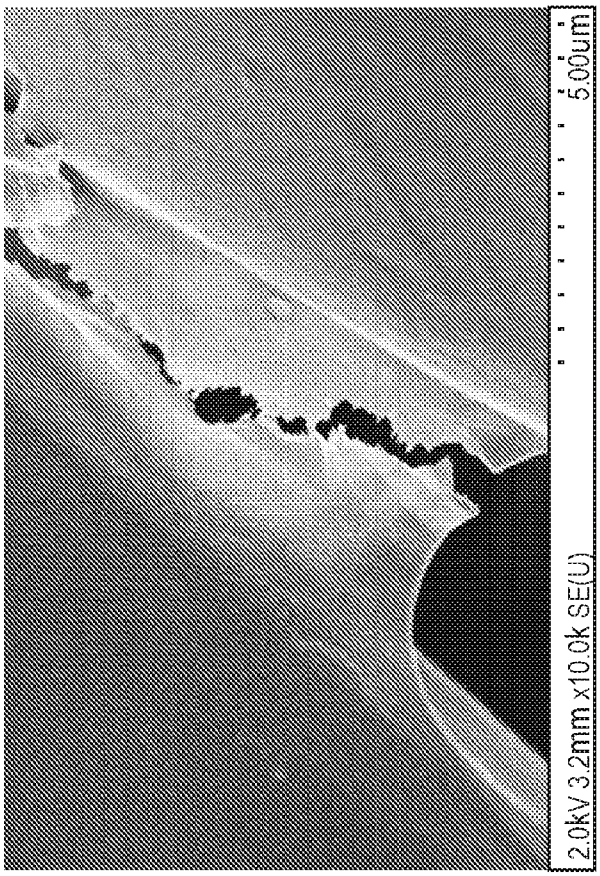

FIG. 148

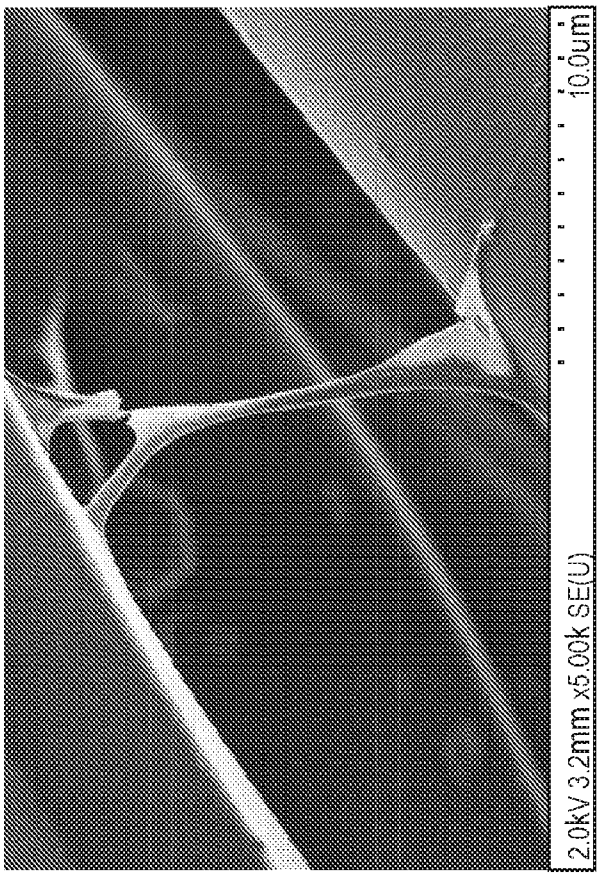

FIG. 149

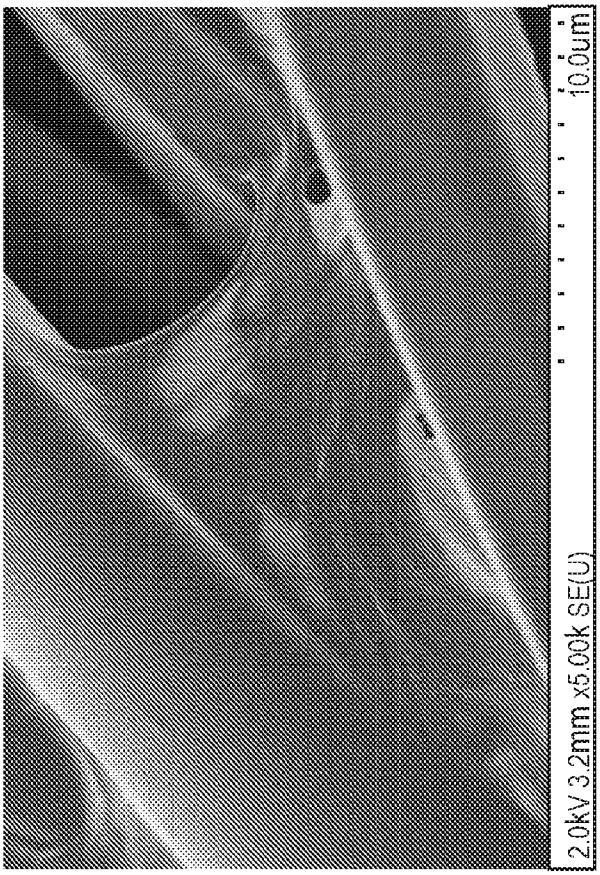

FIG. 150

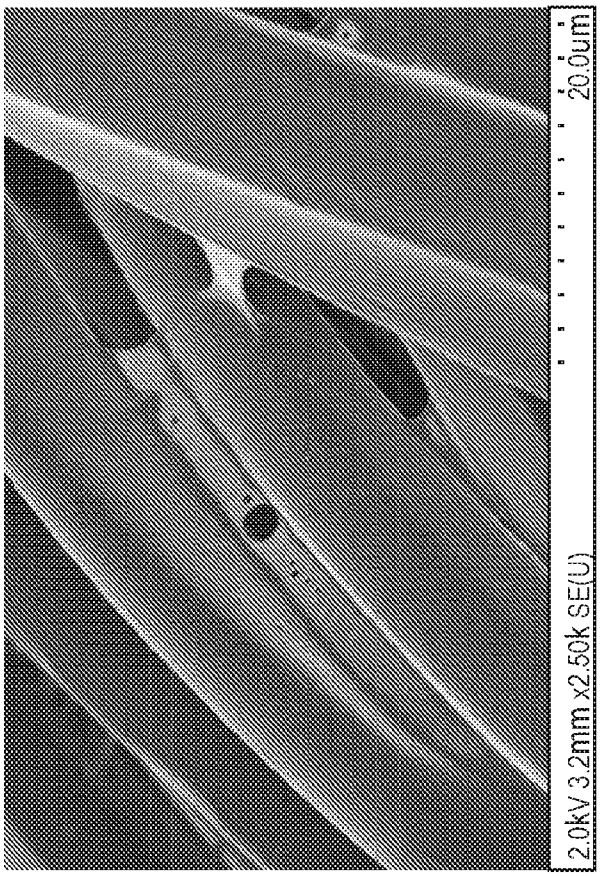

FIG. 151

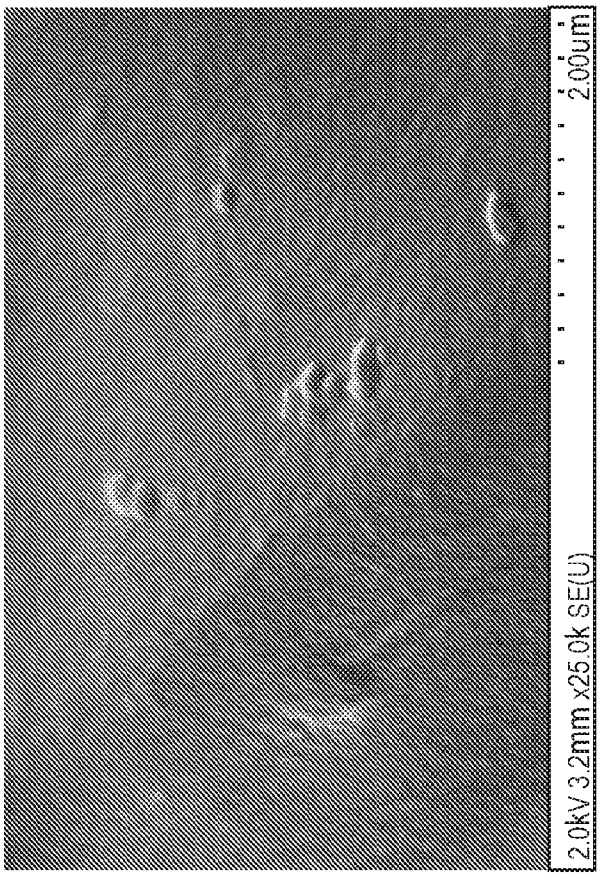

FIG. 152

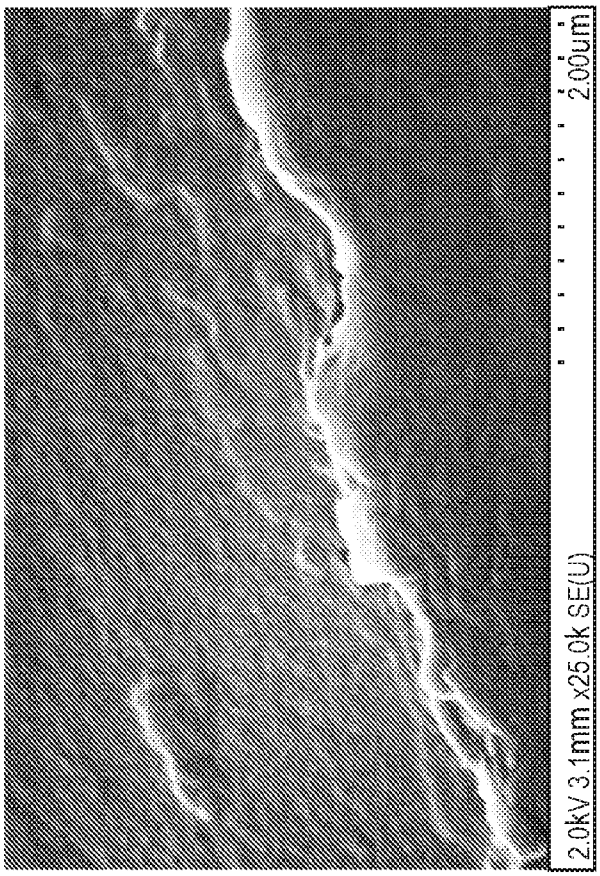

FIG. 153

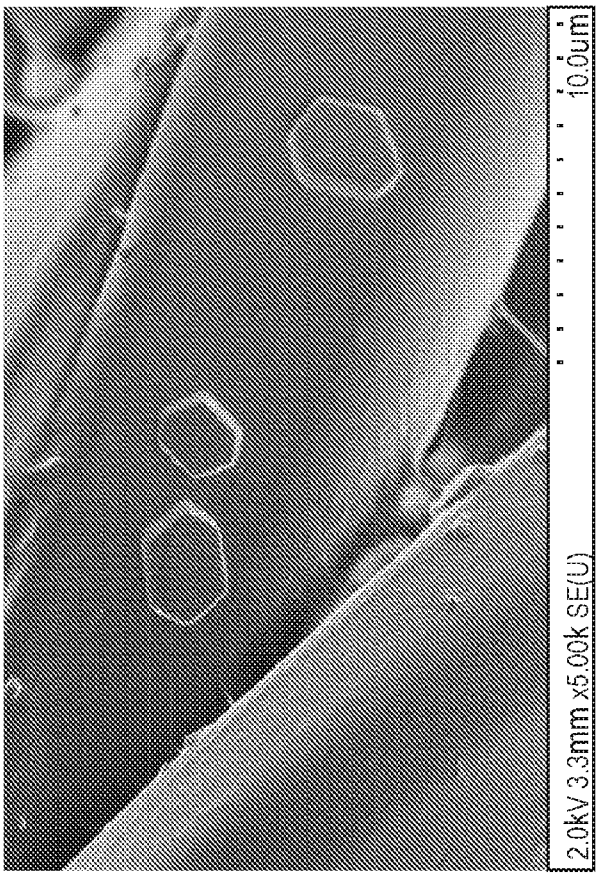

FIG. 154

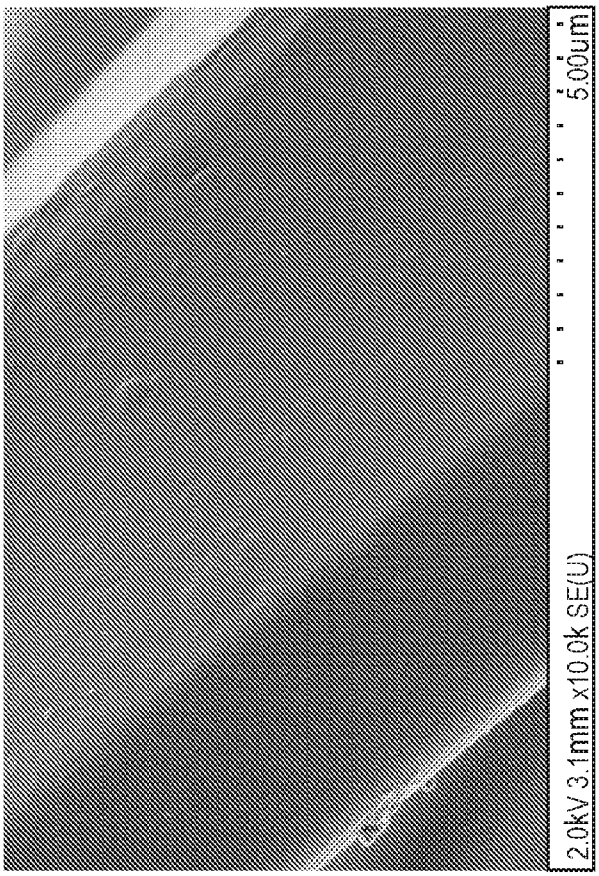

FIG. 155

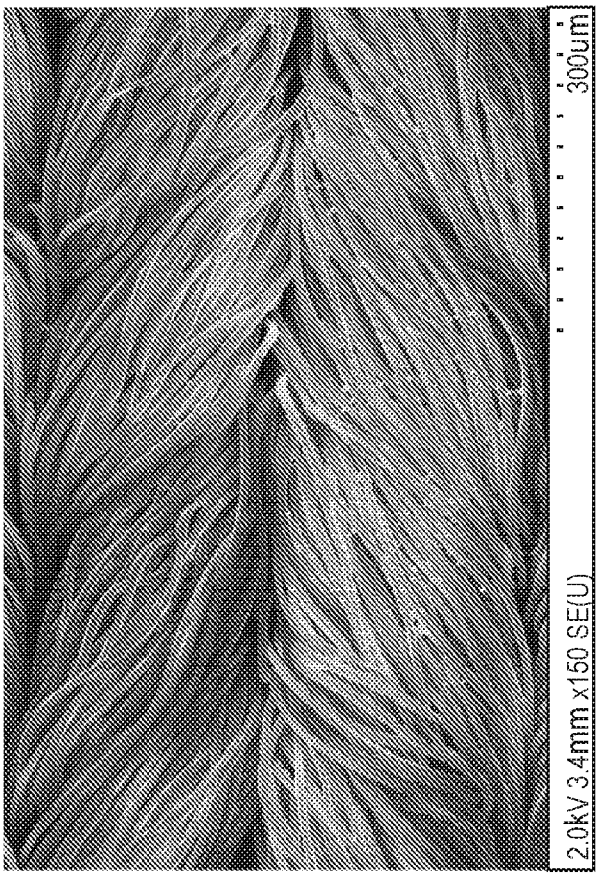

FIG. 156

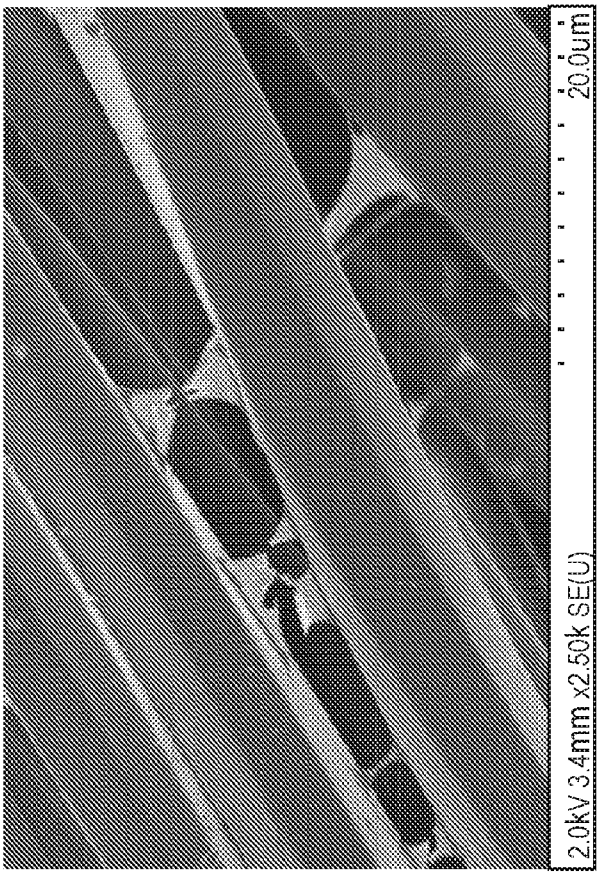

FIG. 157

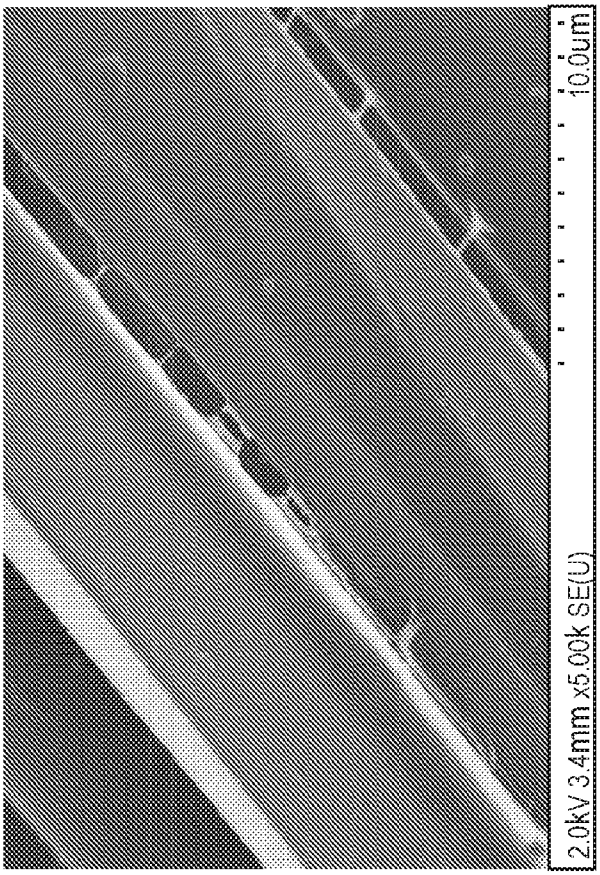

FIG. 158

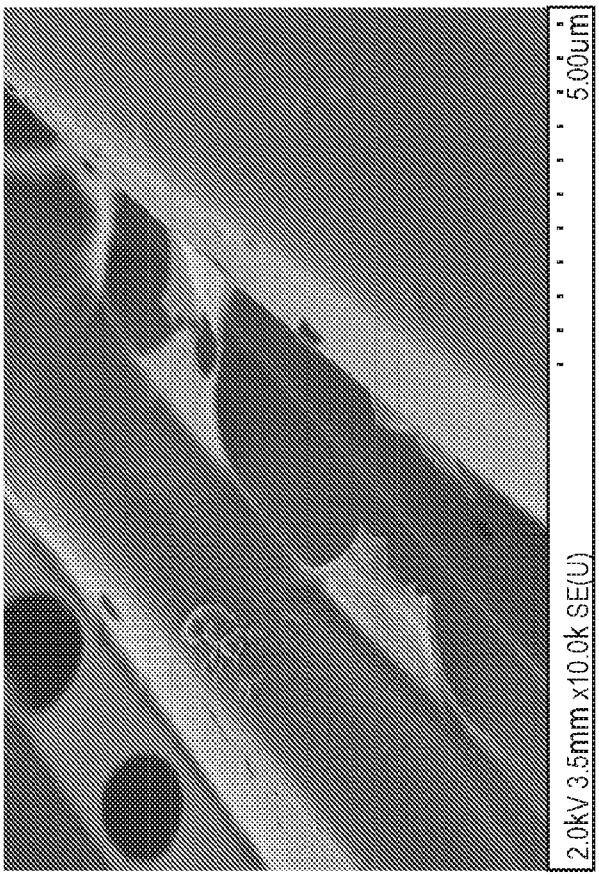

FIG. 159

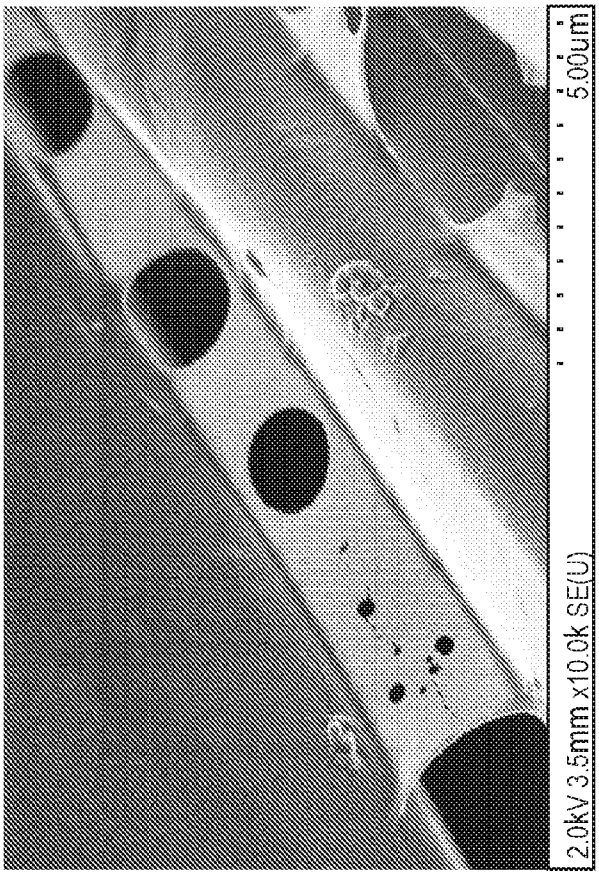

FIG. 160

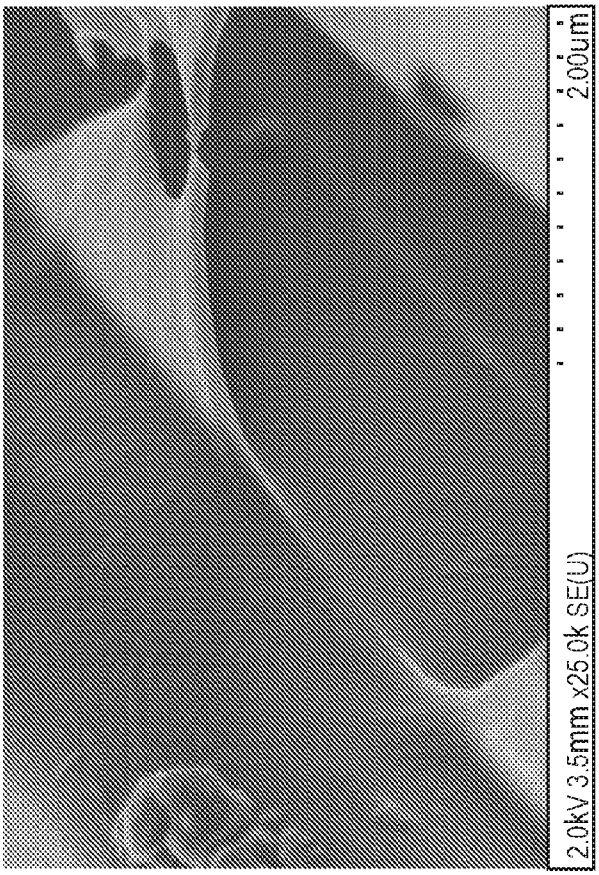

FIG. 161

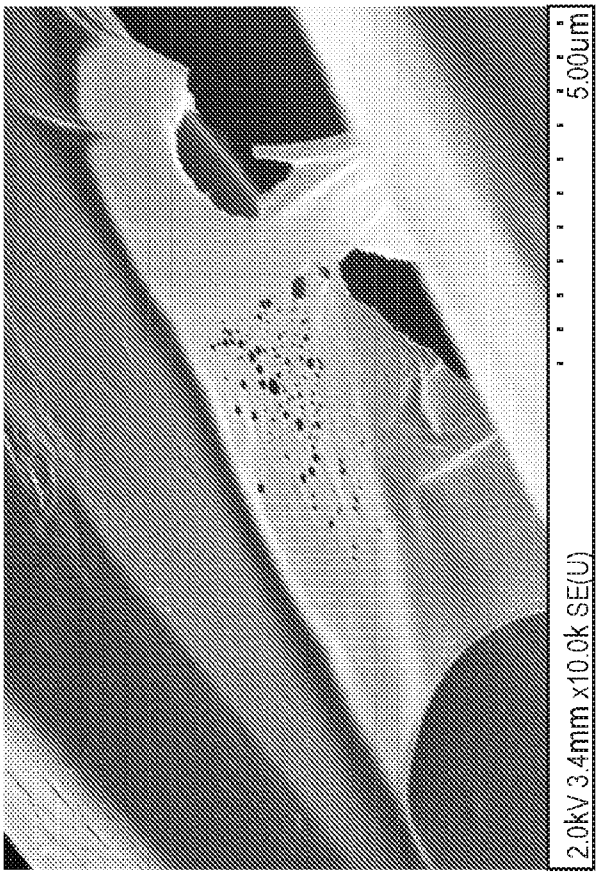

FIG. 162

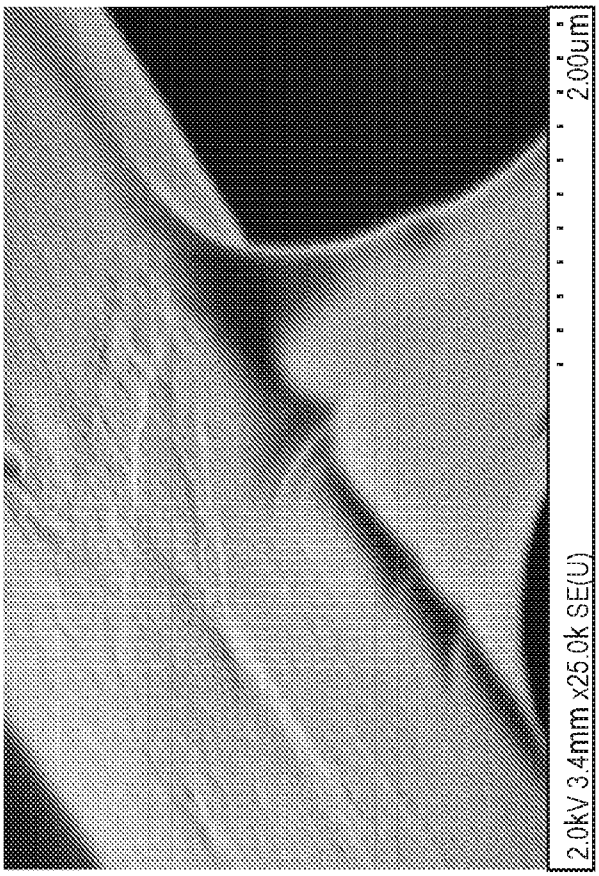

FIG. 163

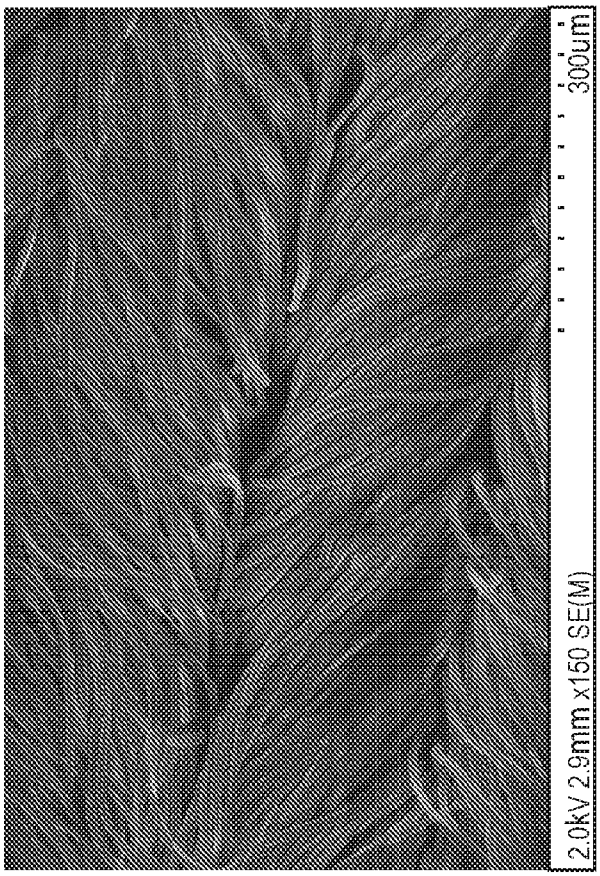

FIG. 164

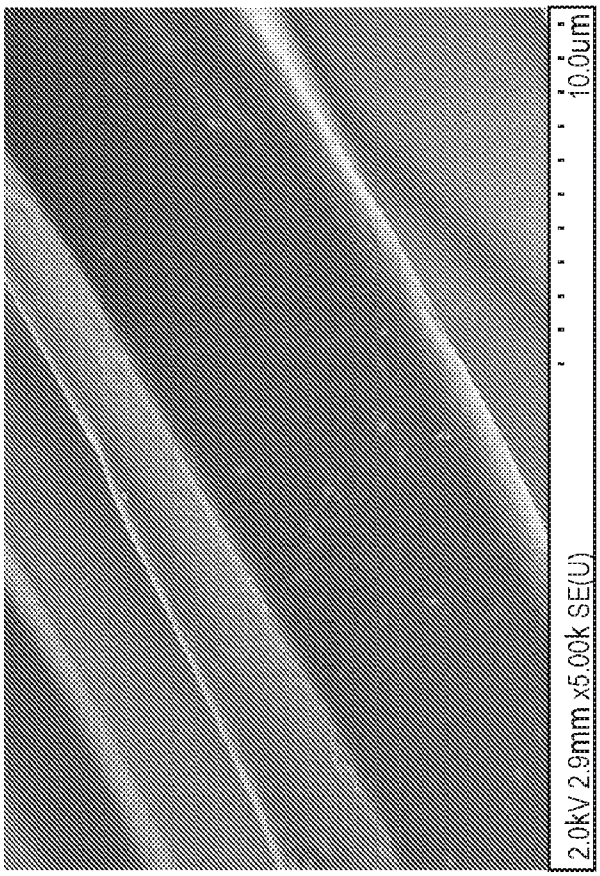

FIG. 165

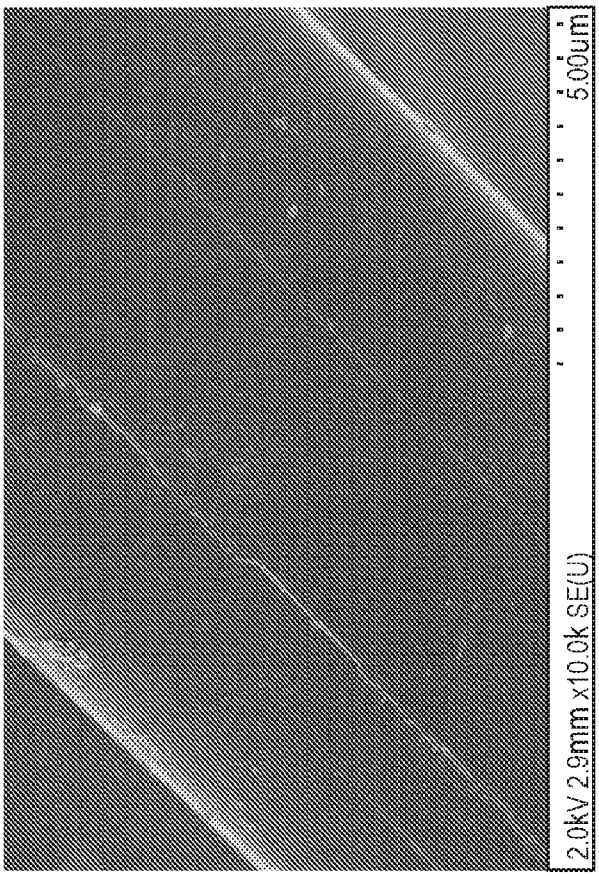

FIG. 166

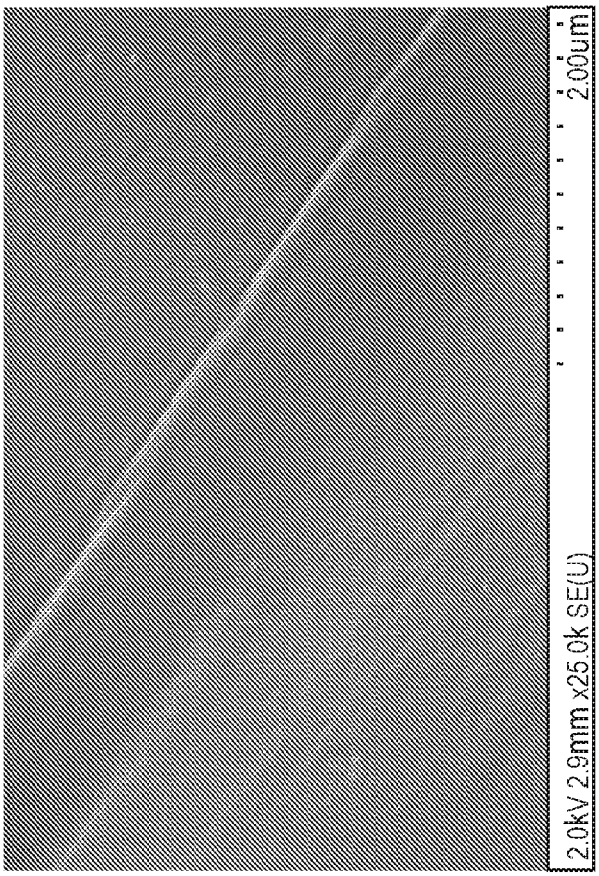

FIG. 167

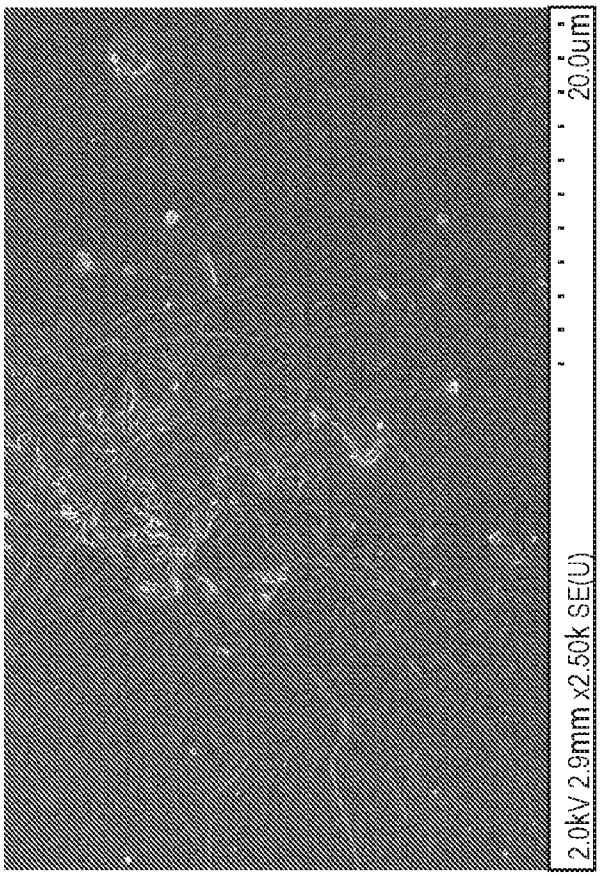

FIG. 168

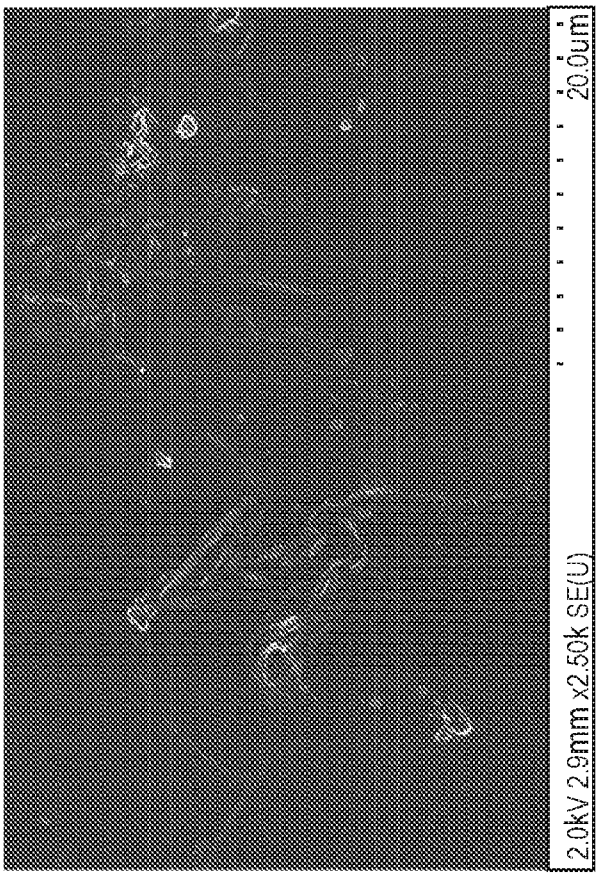

FIG. 169

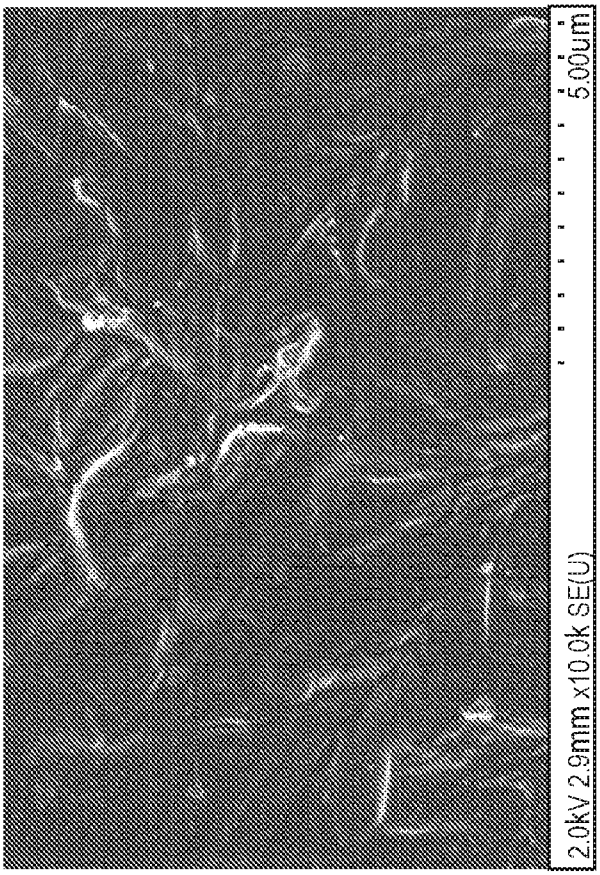

FIG. 170

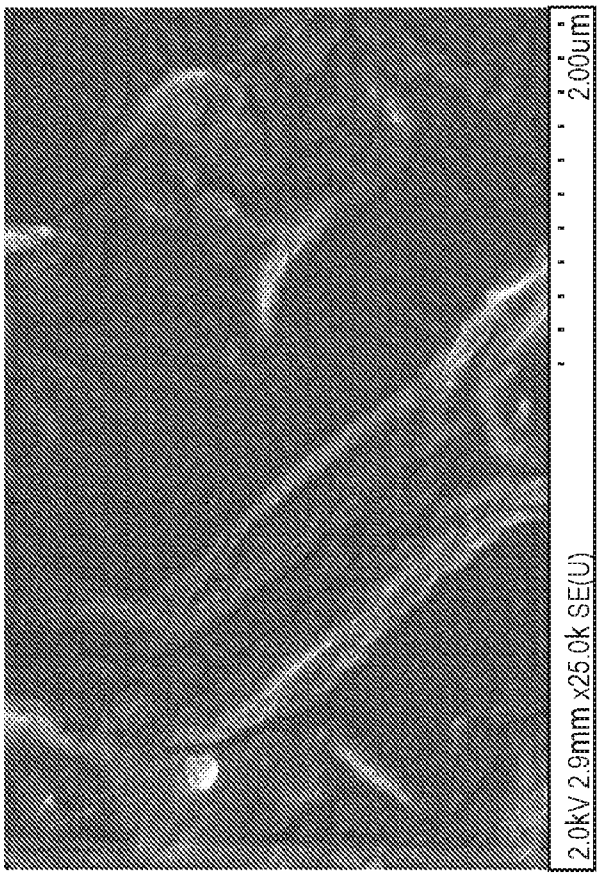

FIG. 171

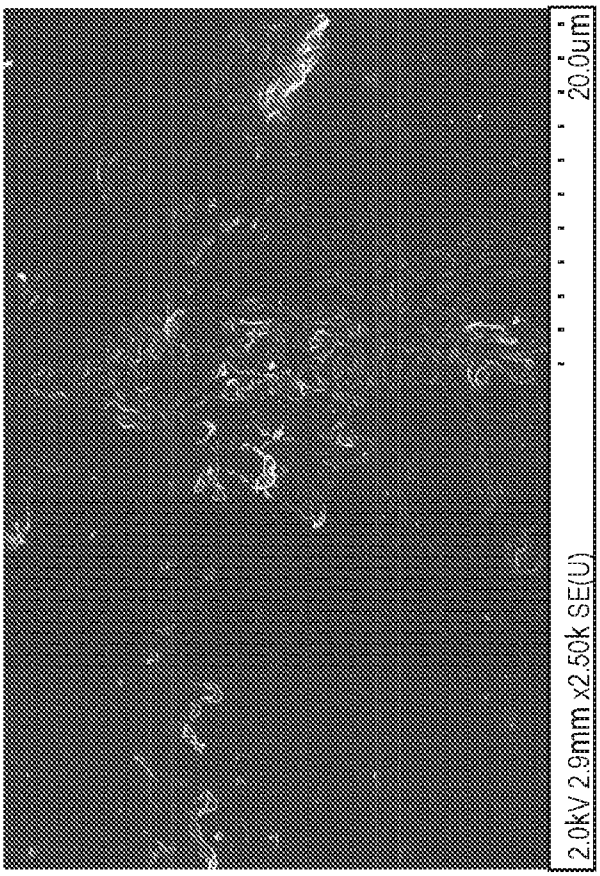

FIG. 172

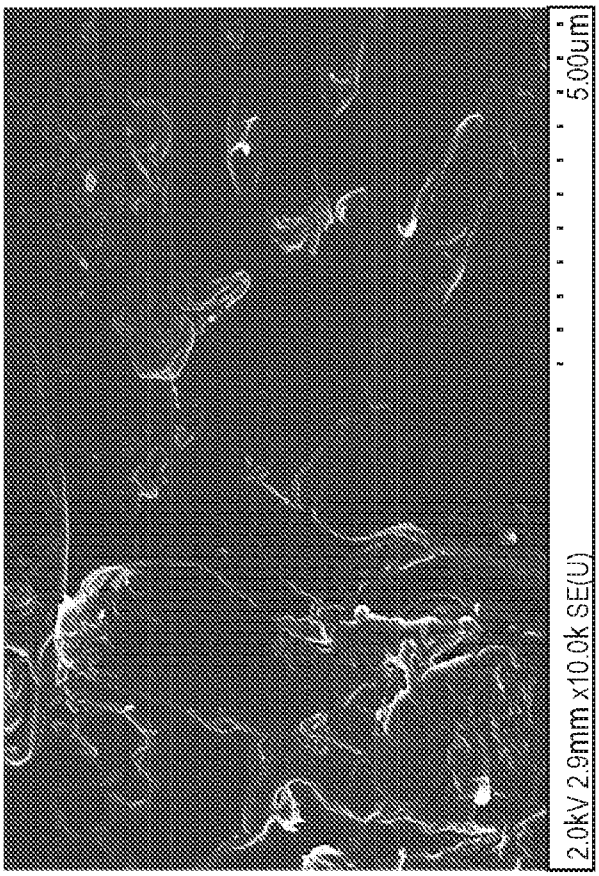

FIG. 173

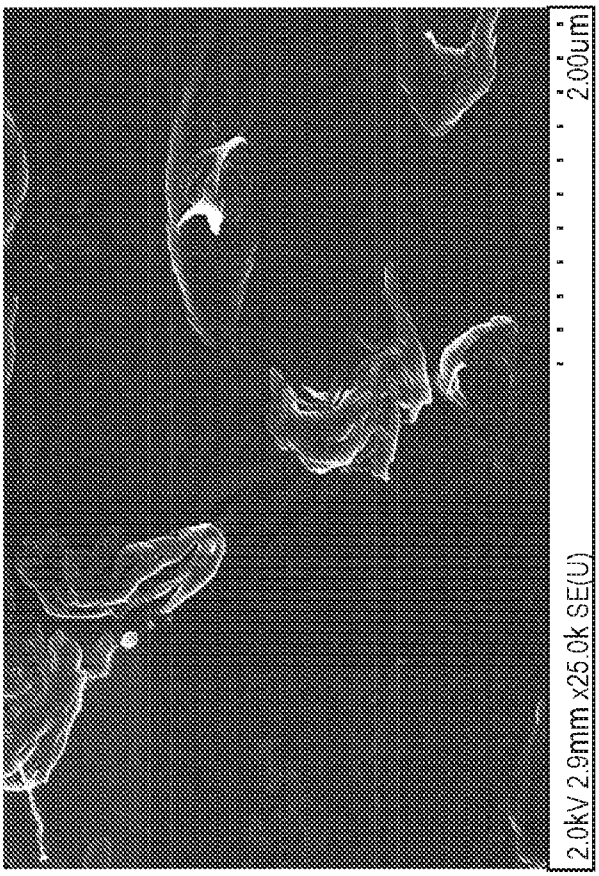

FIG. 174

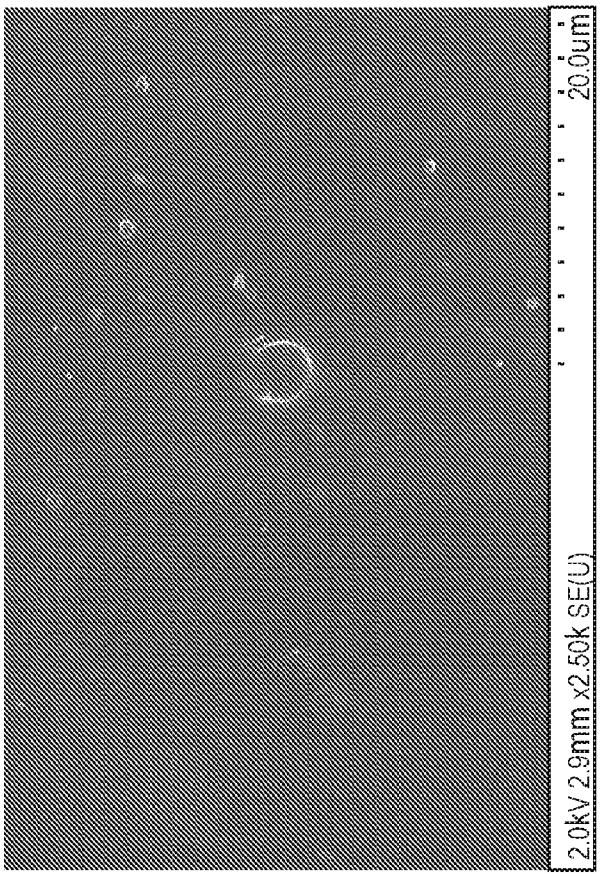

FIG. 175

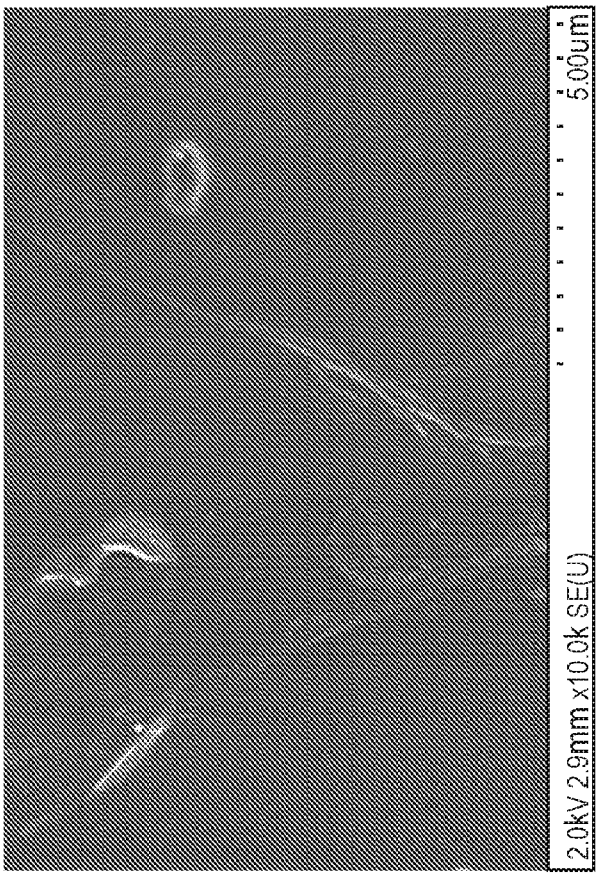

FIG. 176

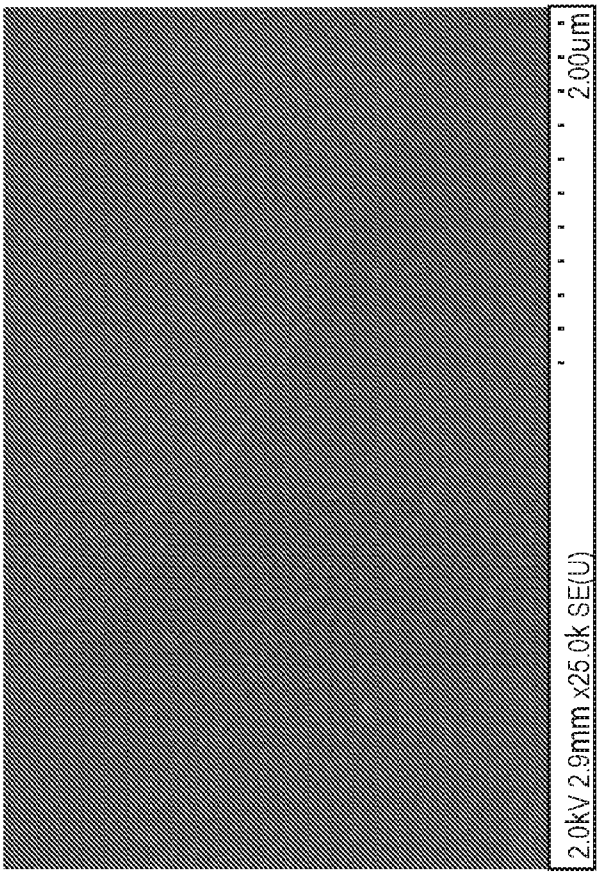

FIG. 177

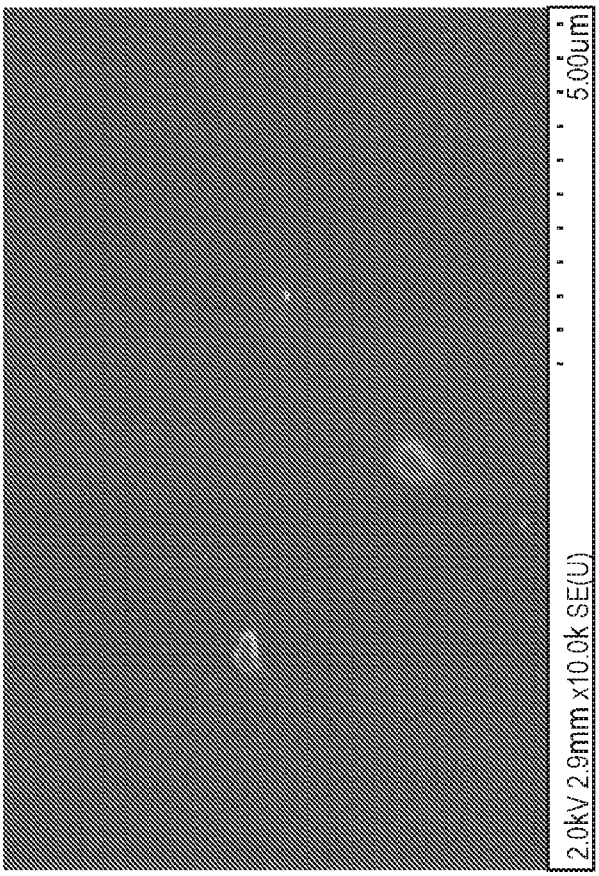

FIG. 178



FIG. 179

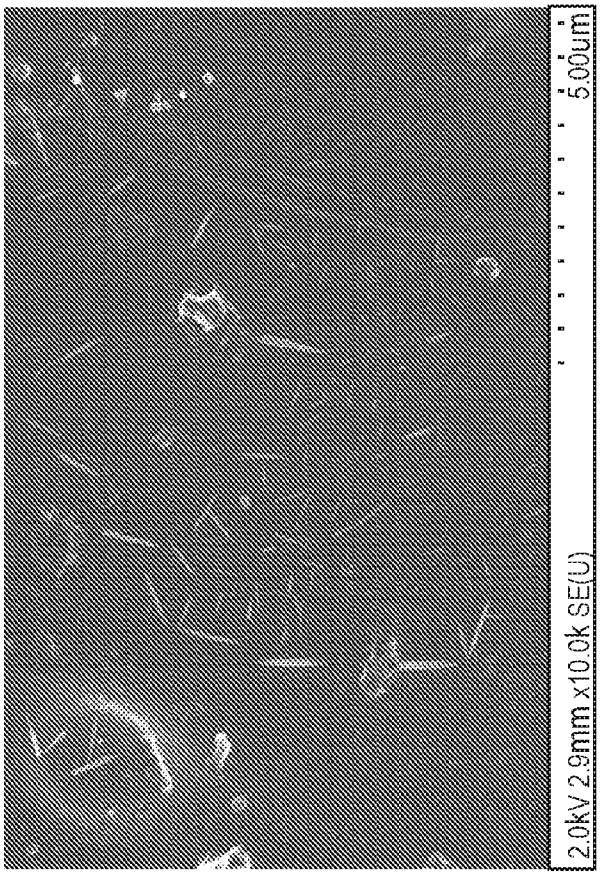

FIG. 180

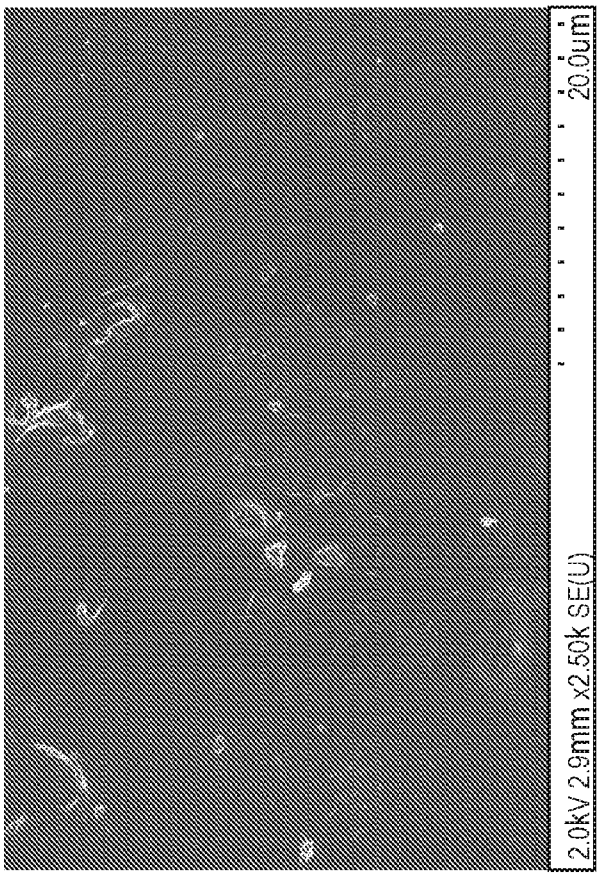

FIG. 181

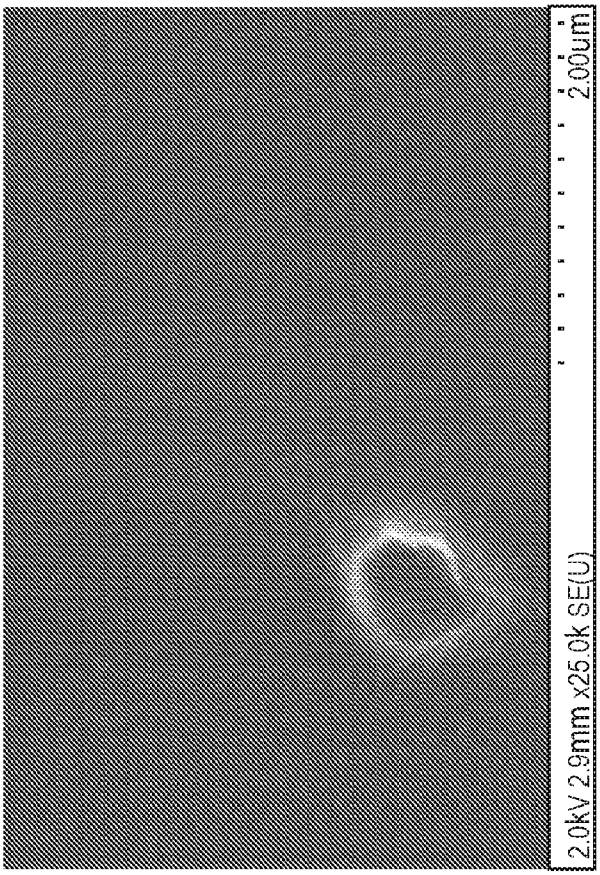

FIG. 182

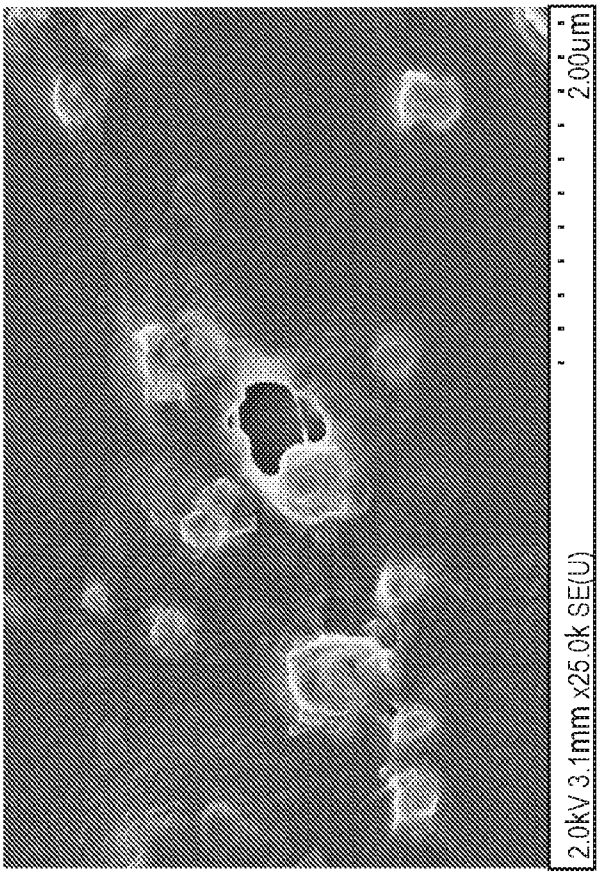

FIG. 183

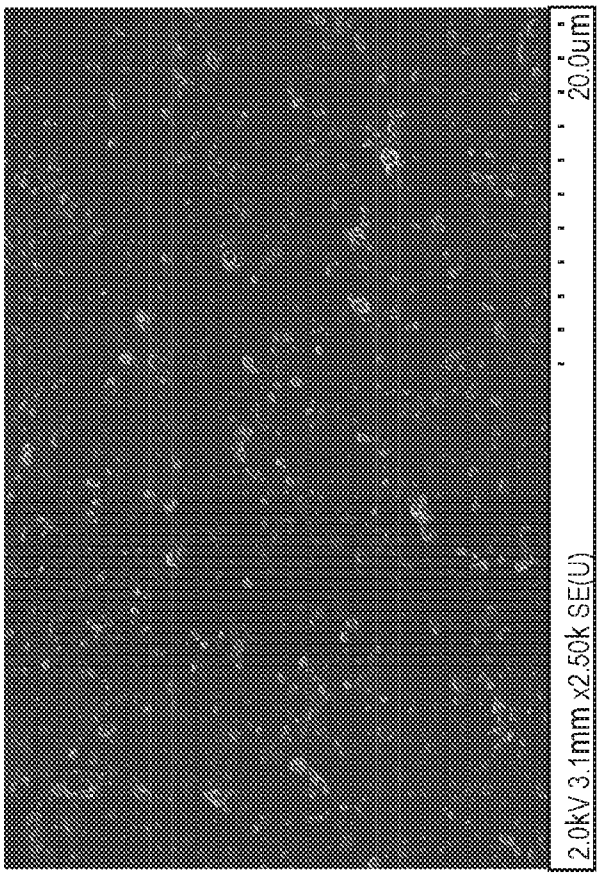

FIG. 184

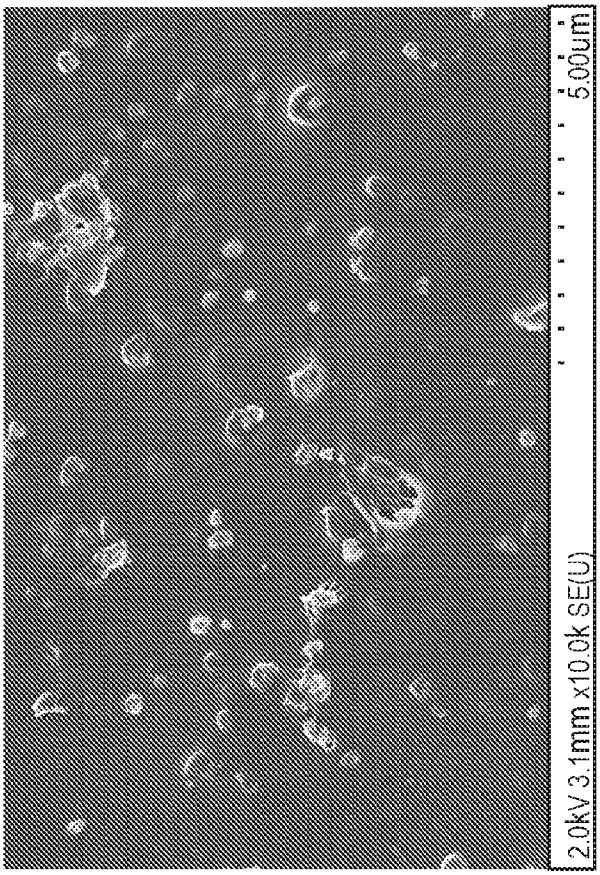

FIG. 185

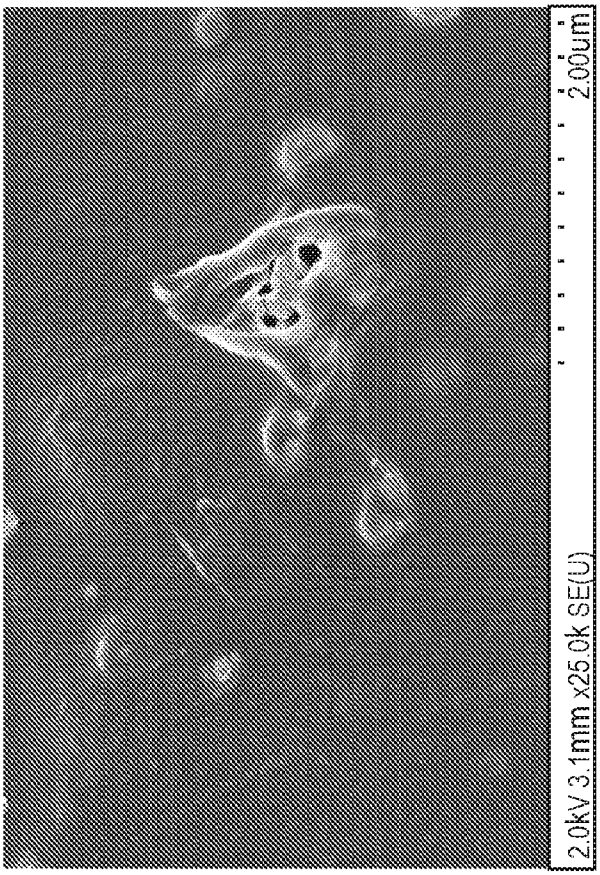

FIG. 186

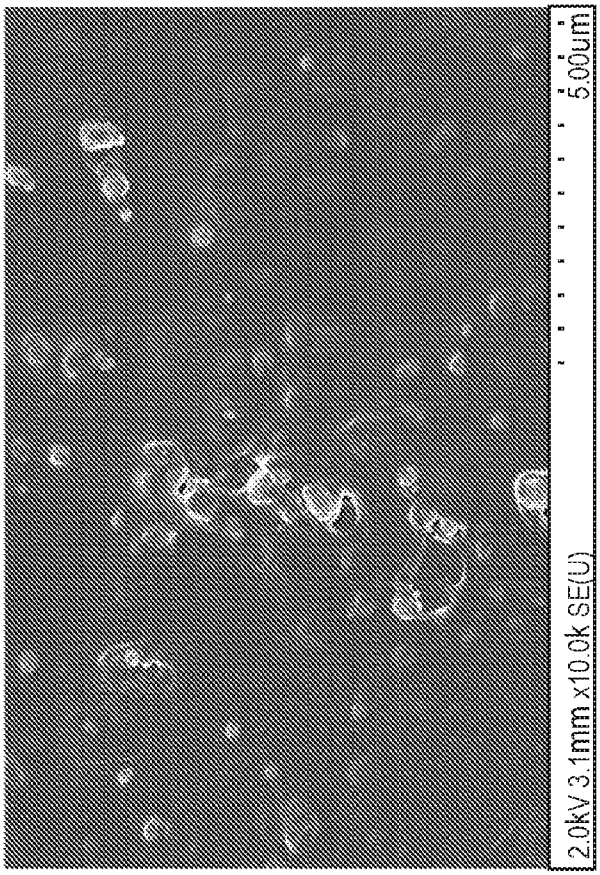

FIG. 187

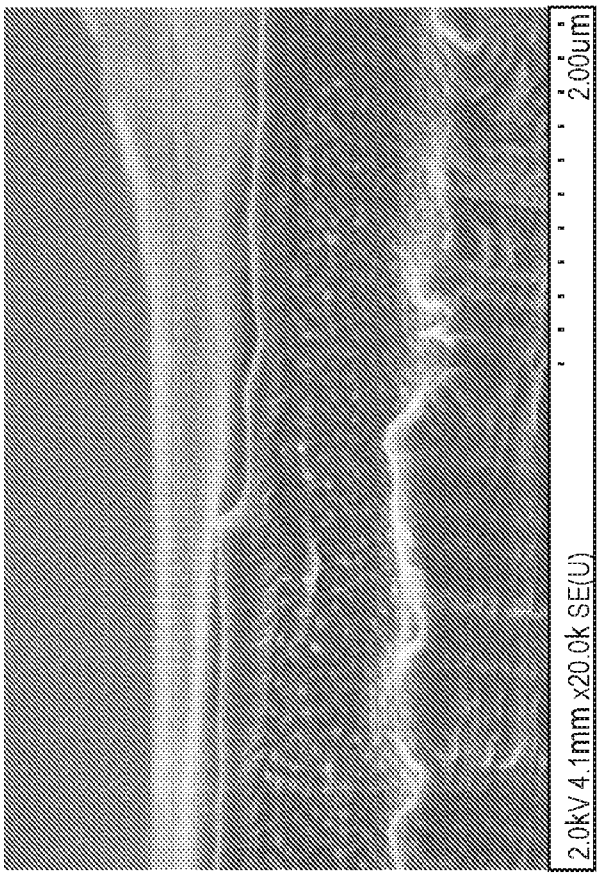

FIG. 188

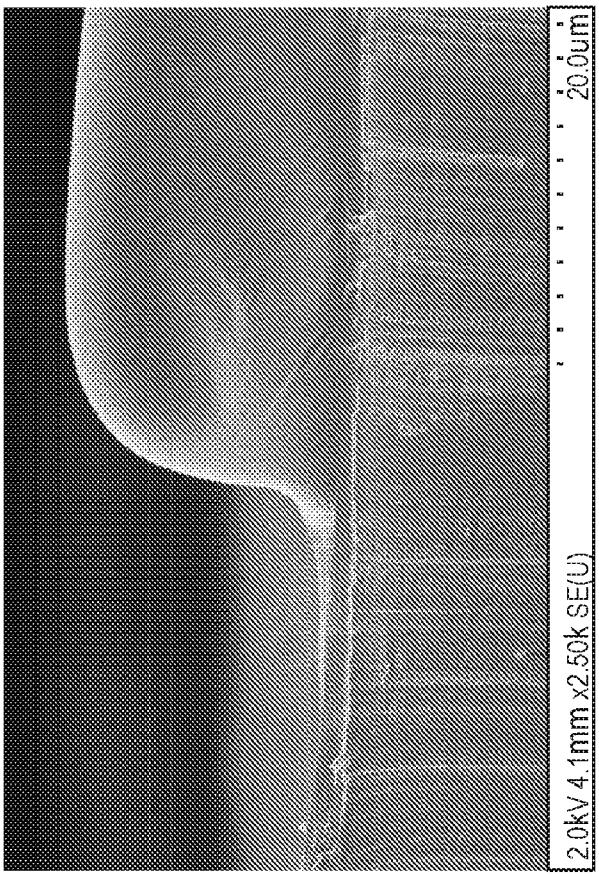

FIG. 189

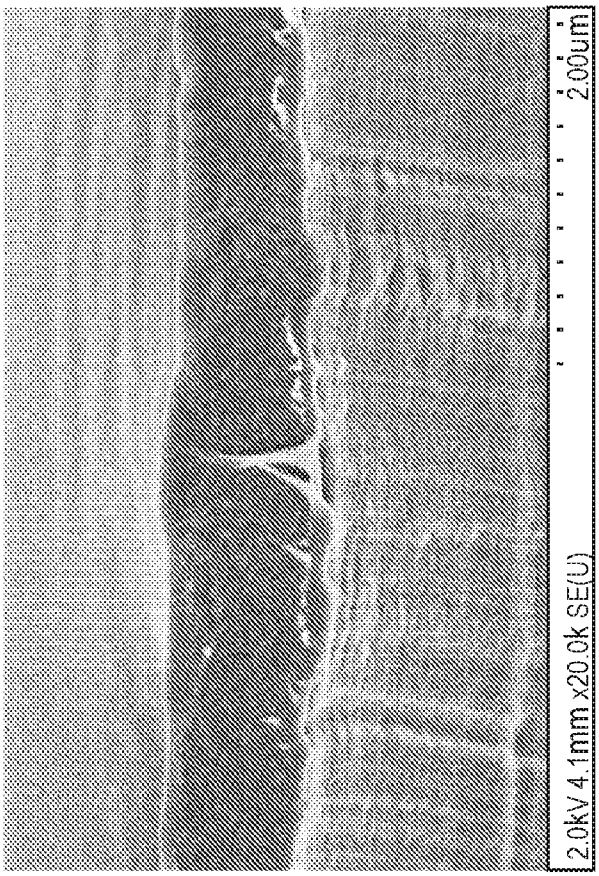

FIG. 190

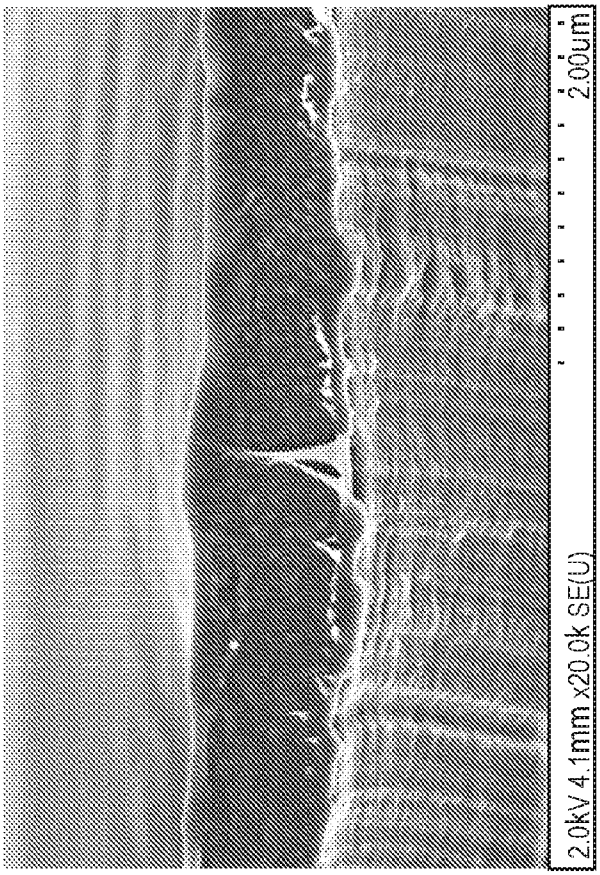

FIG. 191

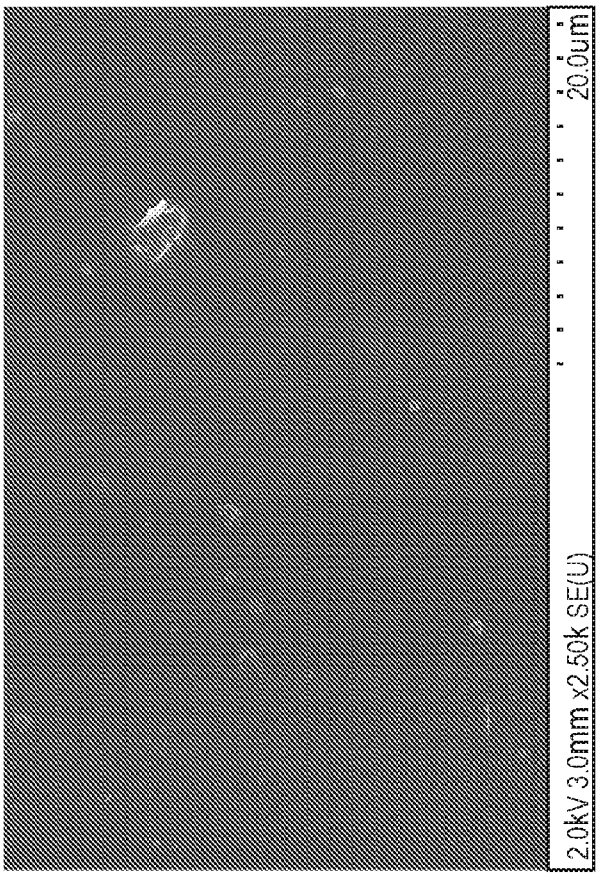

FIG. 192

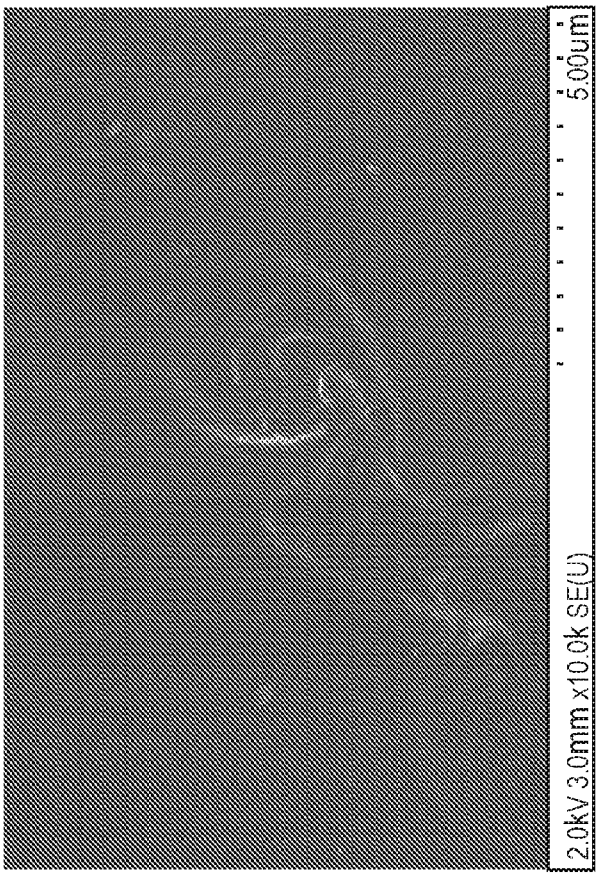

FIG. 193

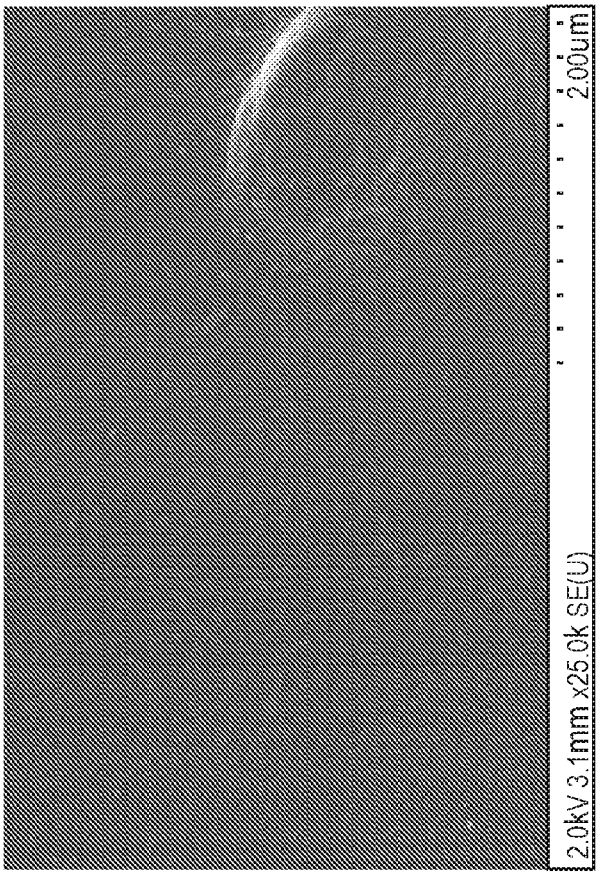

FIG. 194

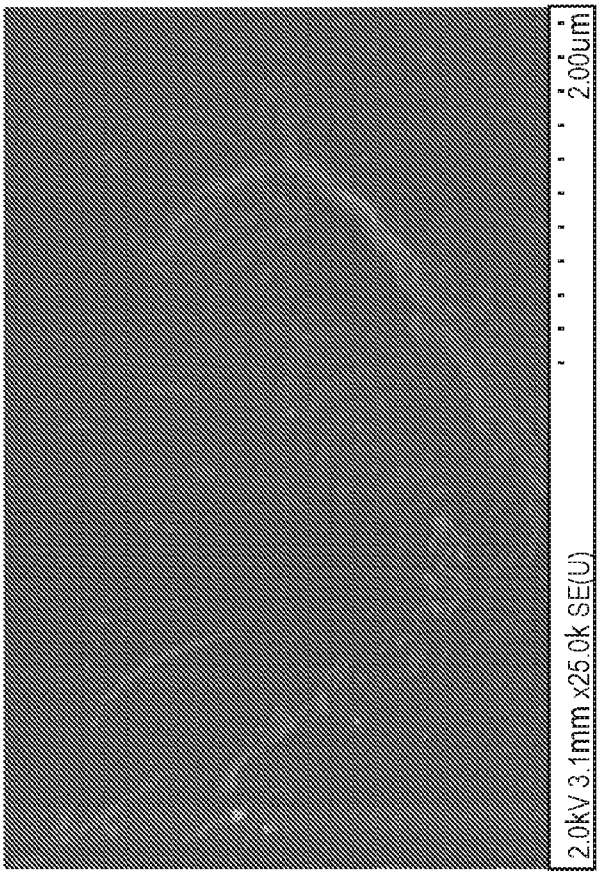

FIG. 195



FIG. 196

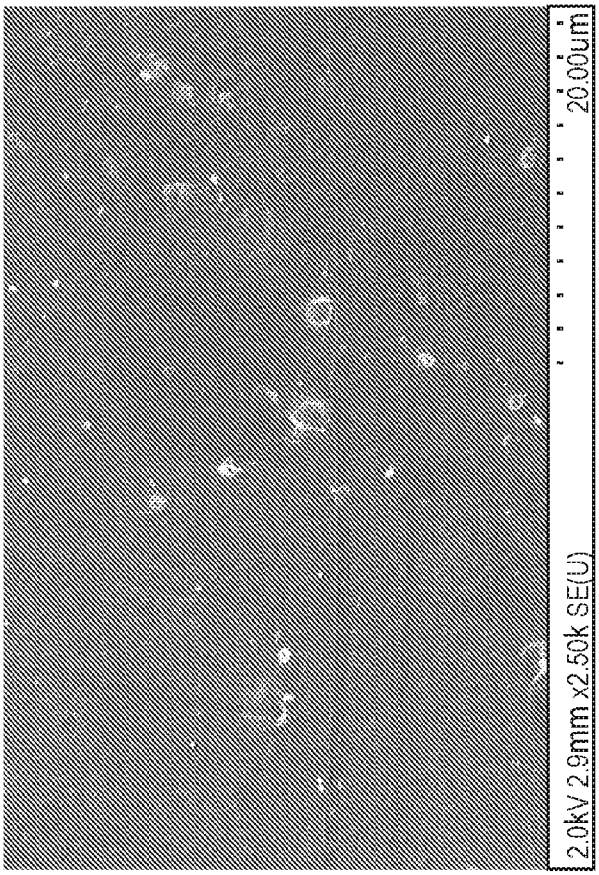

FIG. 197



FIG. 198



FIG. 199

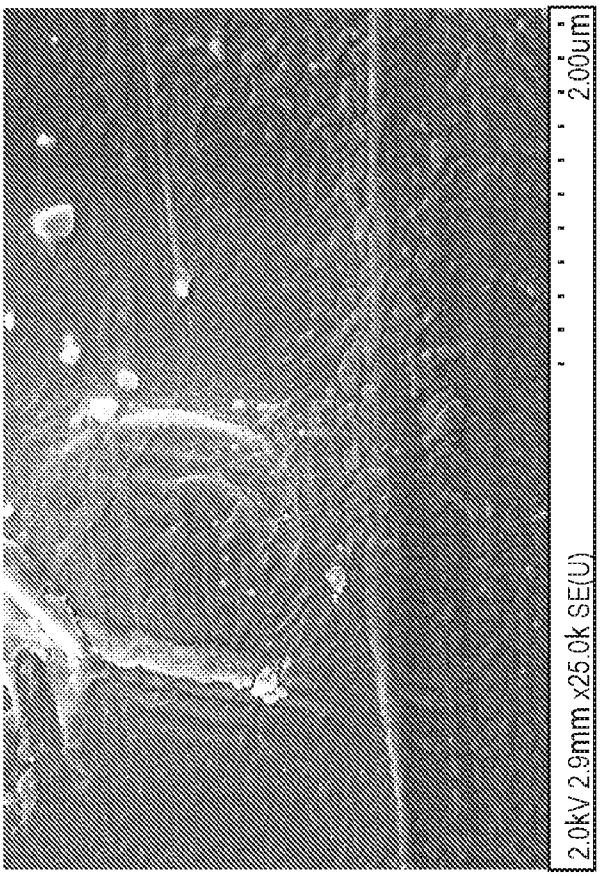

FIG. 200

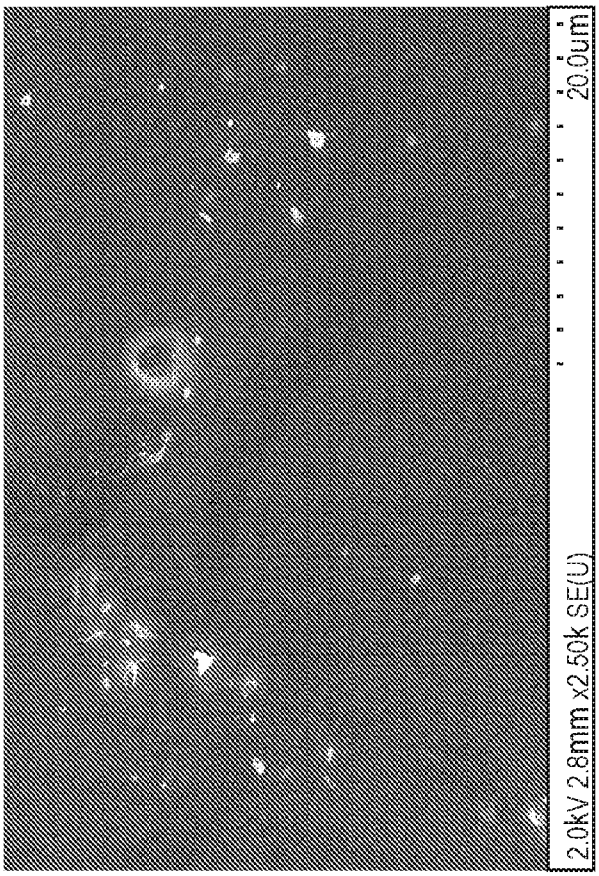

FIG. 201

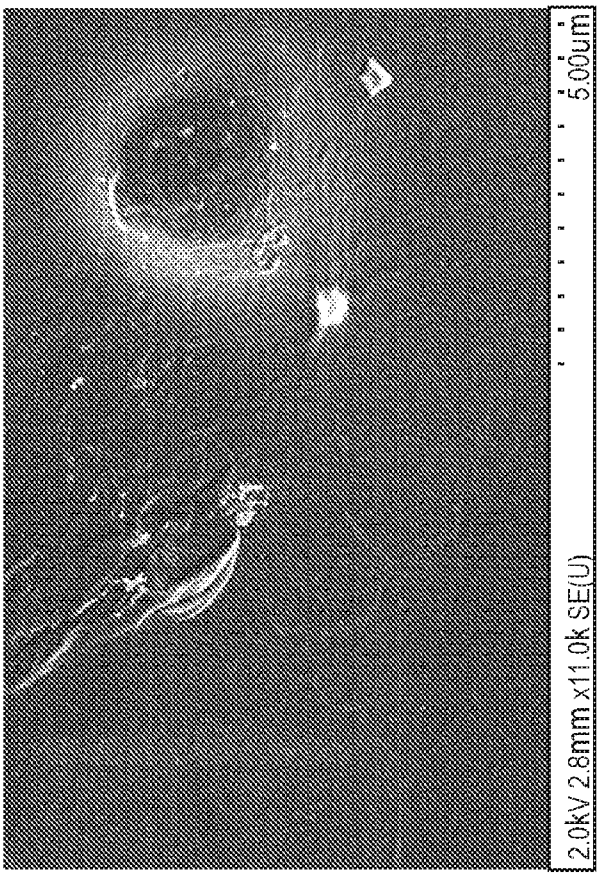

FIG. 202



FIG. 203

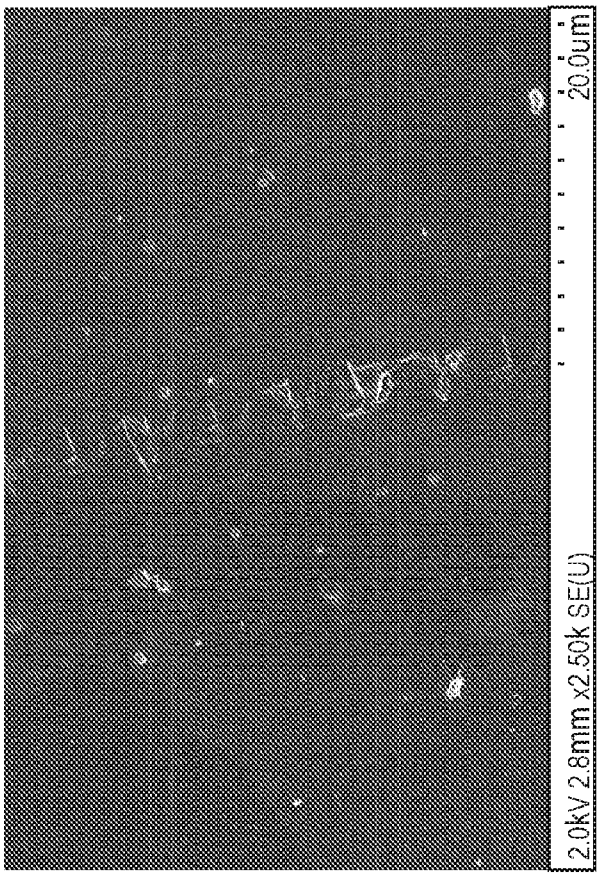

FIG. 204

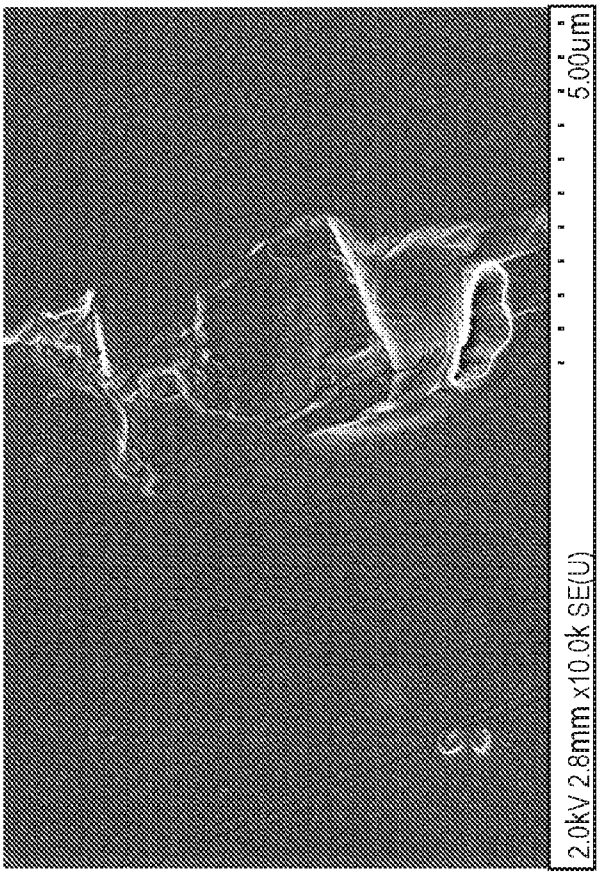

FIG. 205

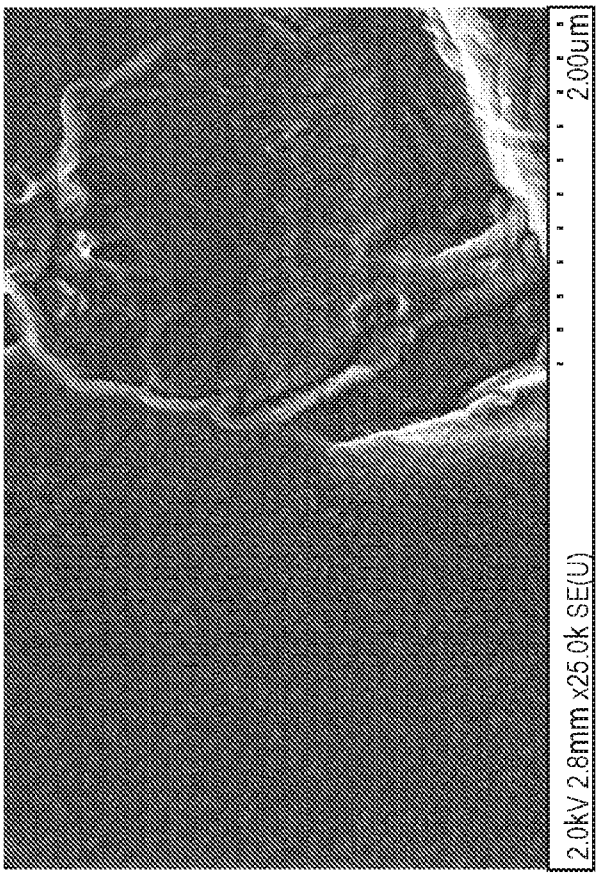

FIG. 206

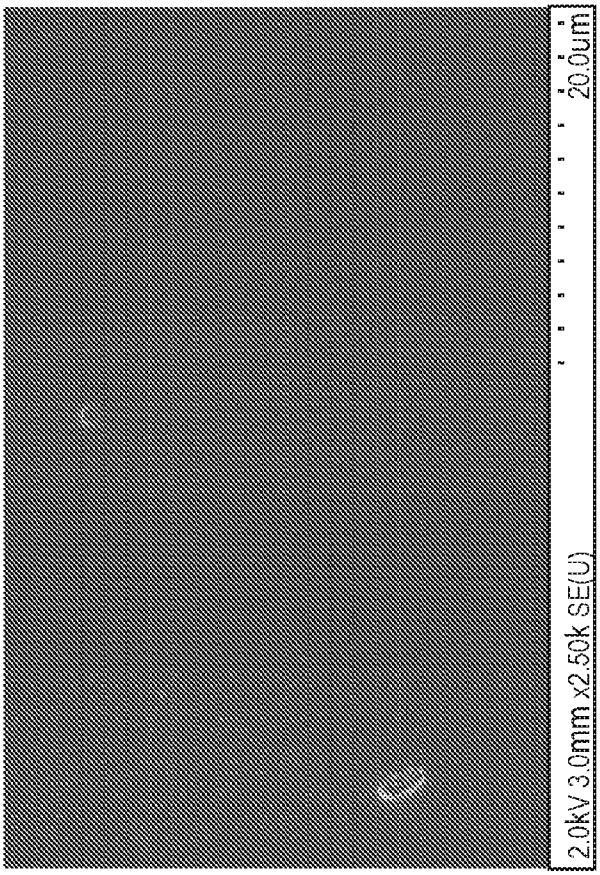

FIG. 207

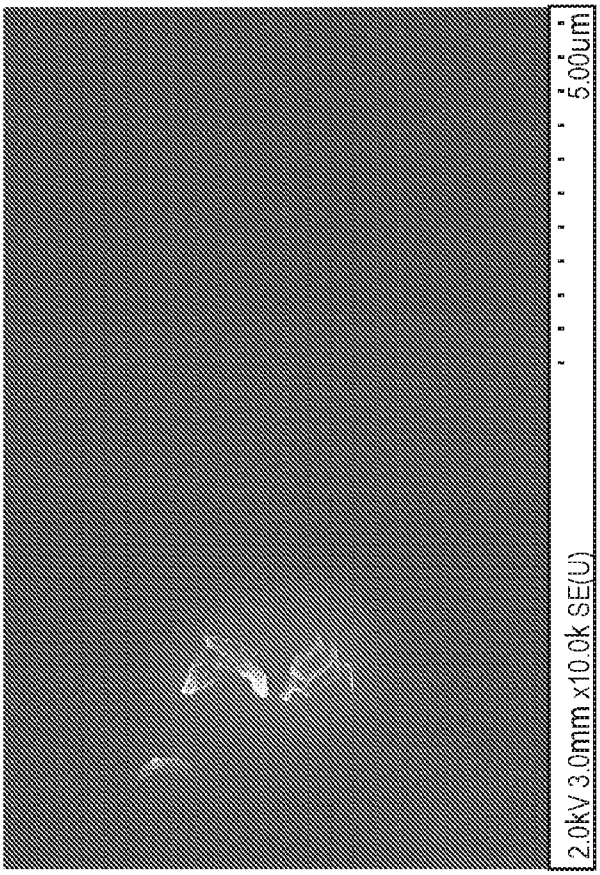

FIG. 208

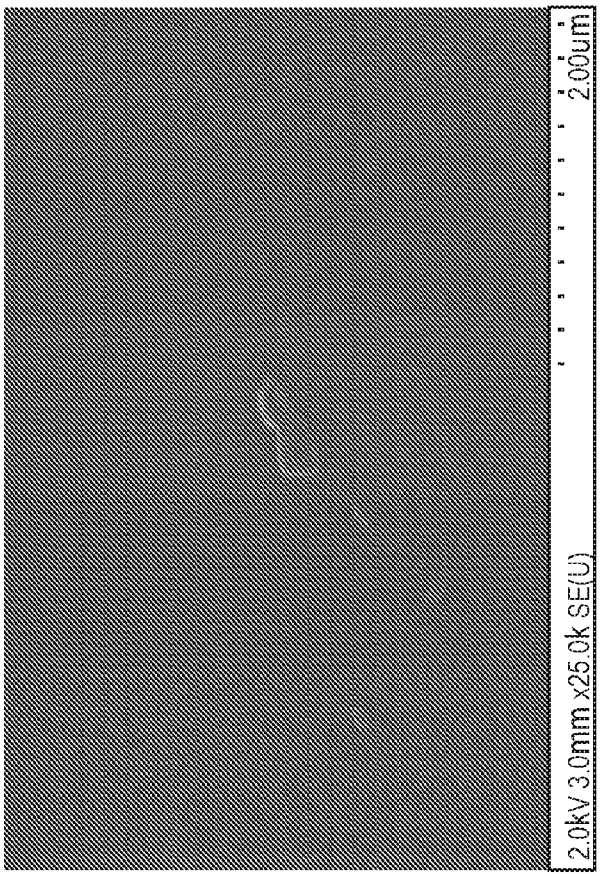

FIG. 209

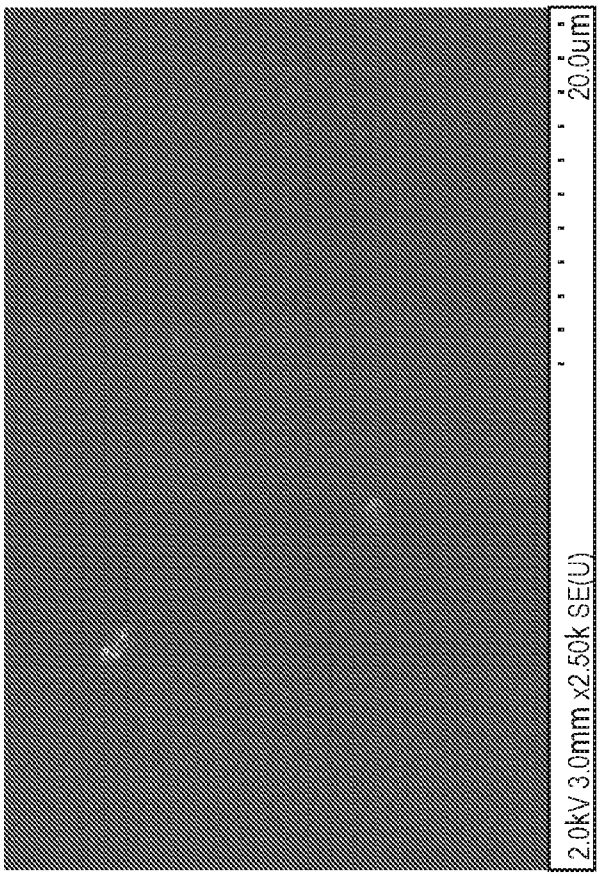

FIG. 210

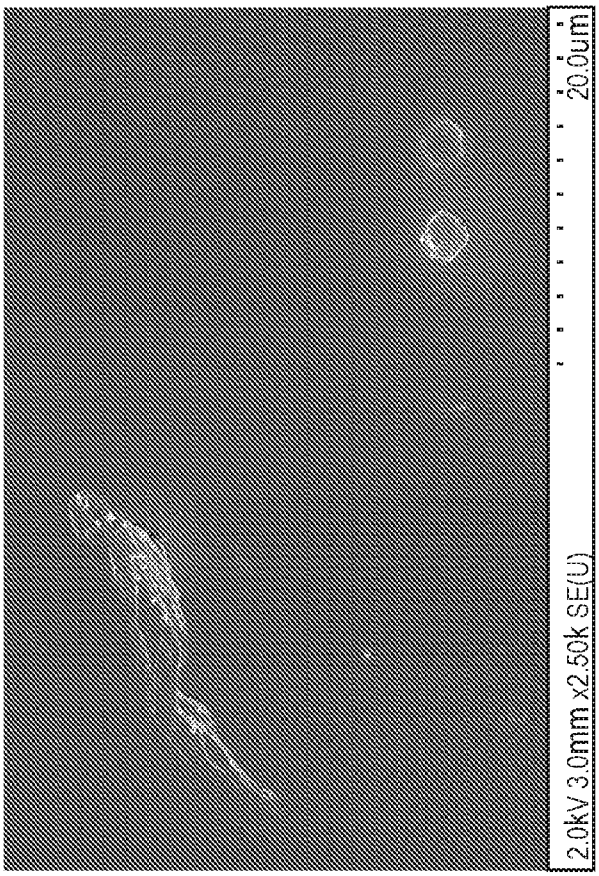

FIG. 211

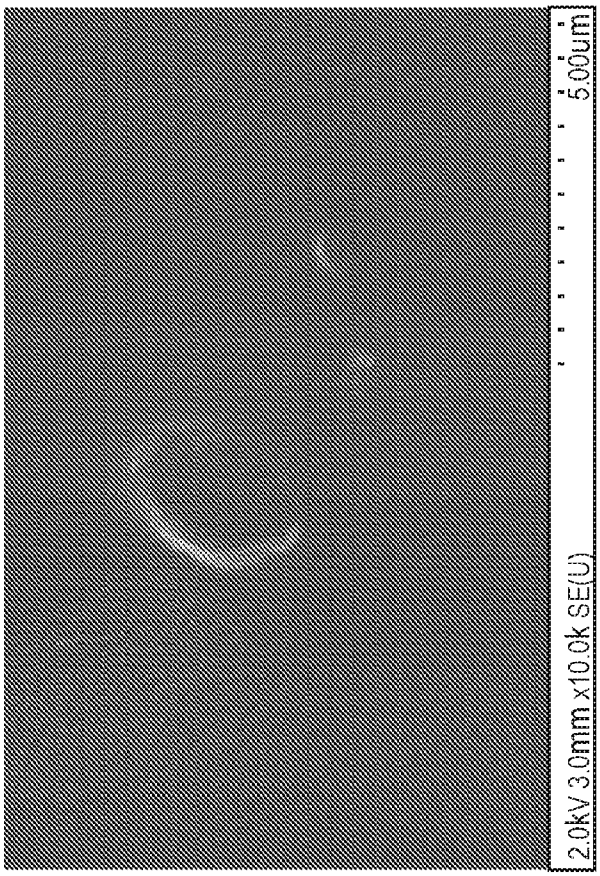

FIG. 212

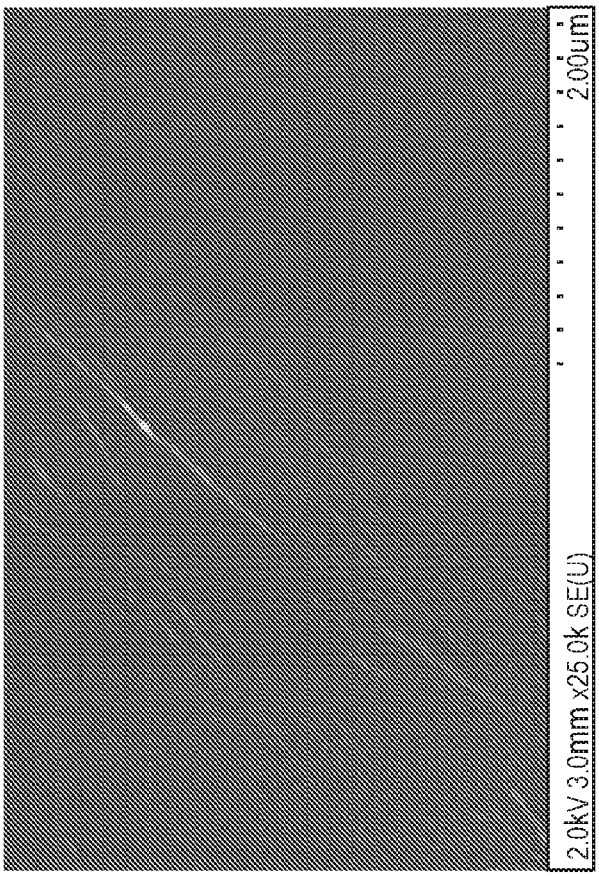

FIG. 213

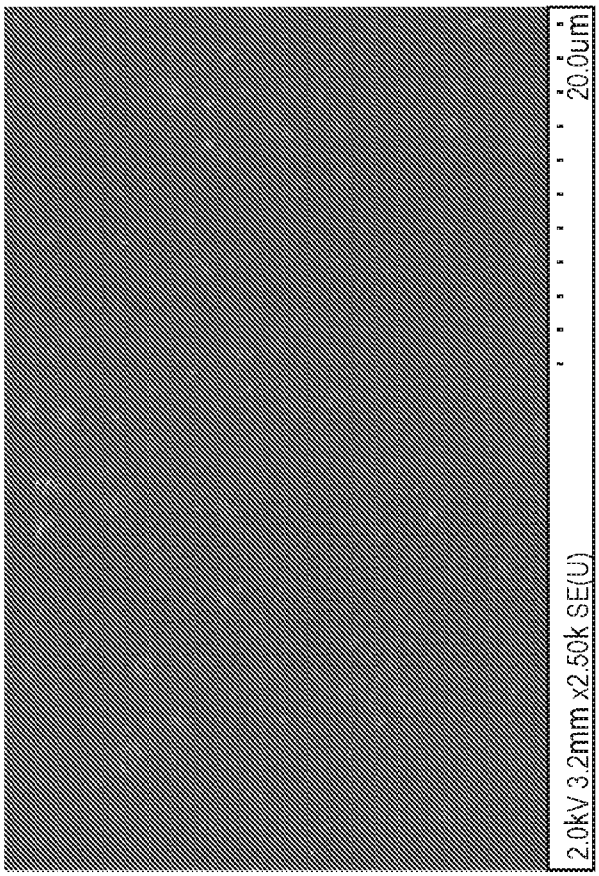

FIG. 214

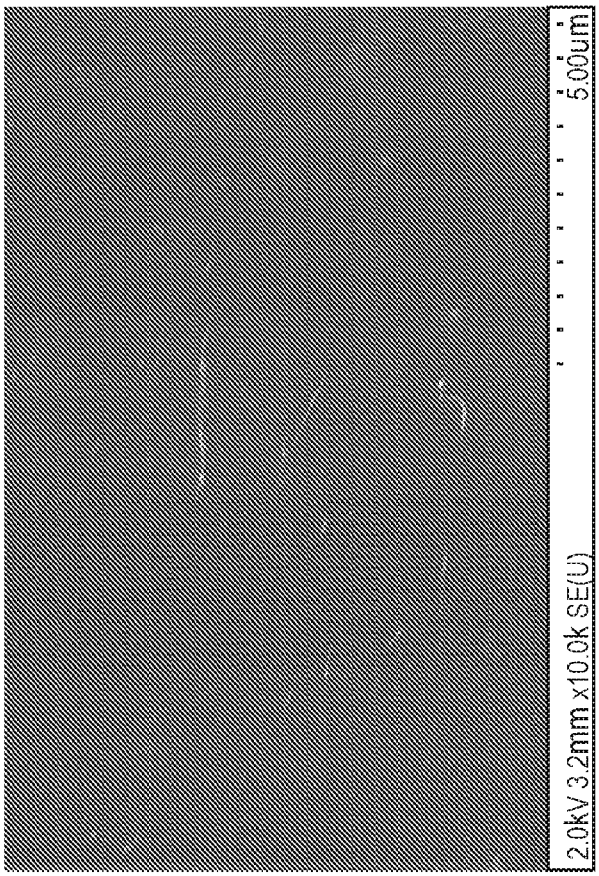

FIG. 215



FIG. 216



FIG. 217

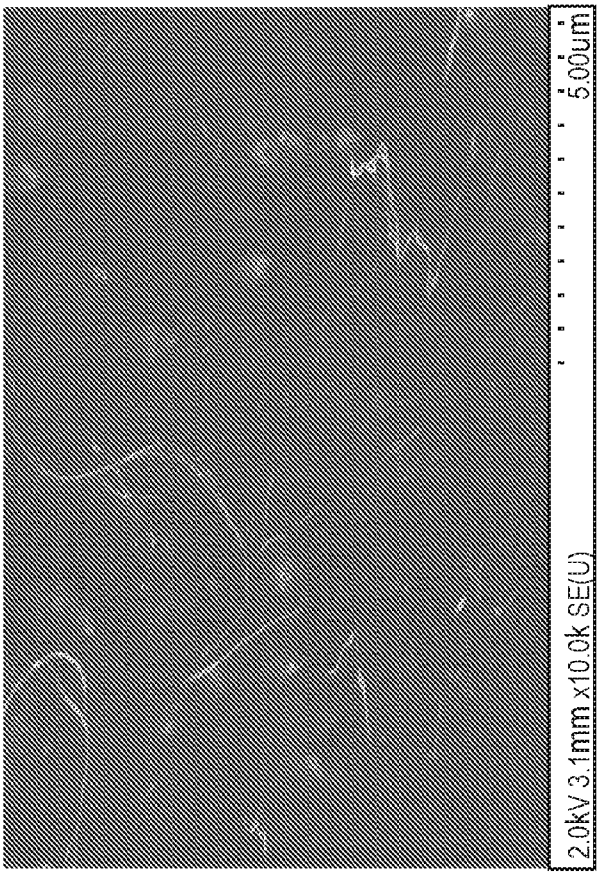

FIG. 218

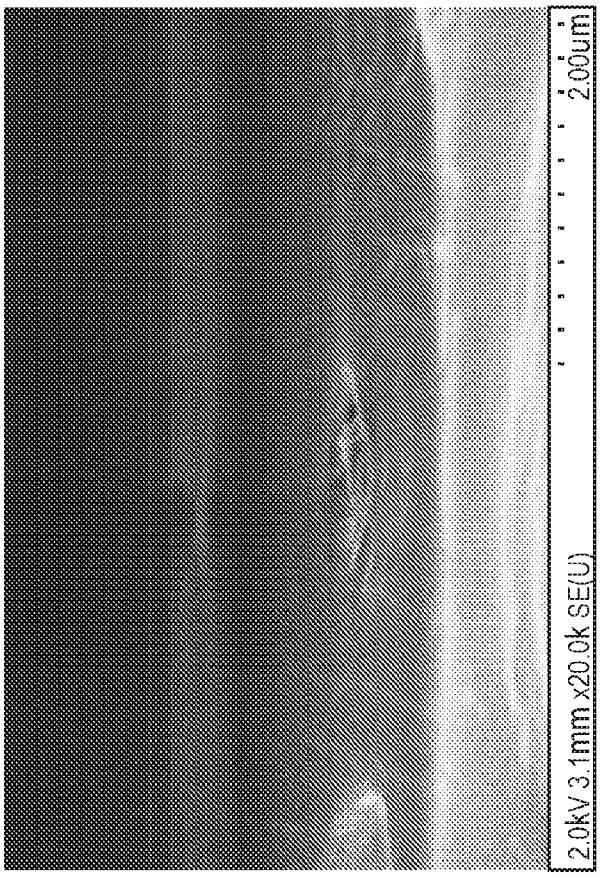

FIG. 219

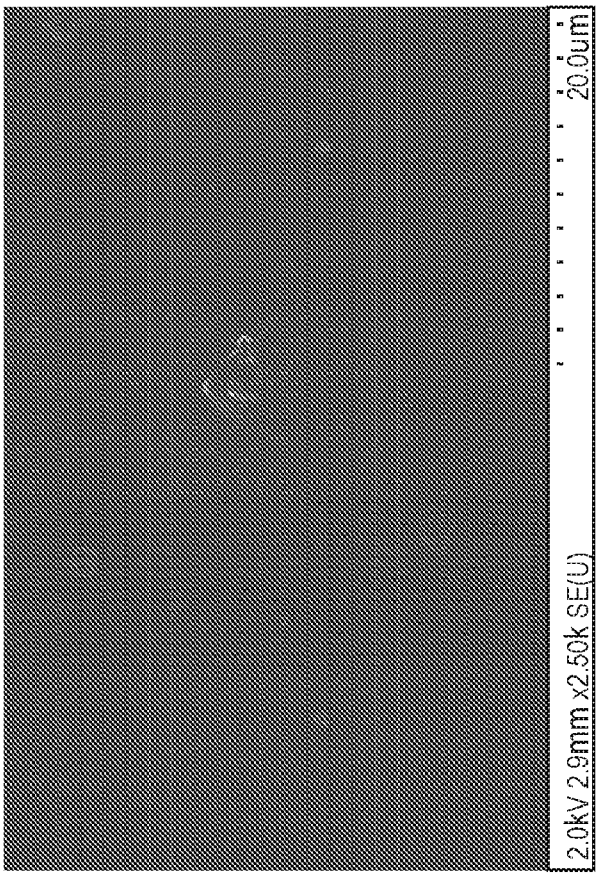

FIG. 220



FIG. 221

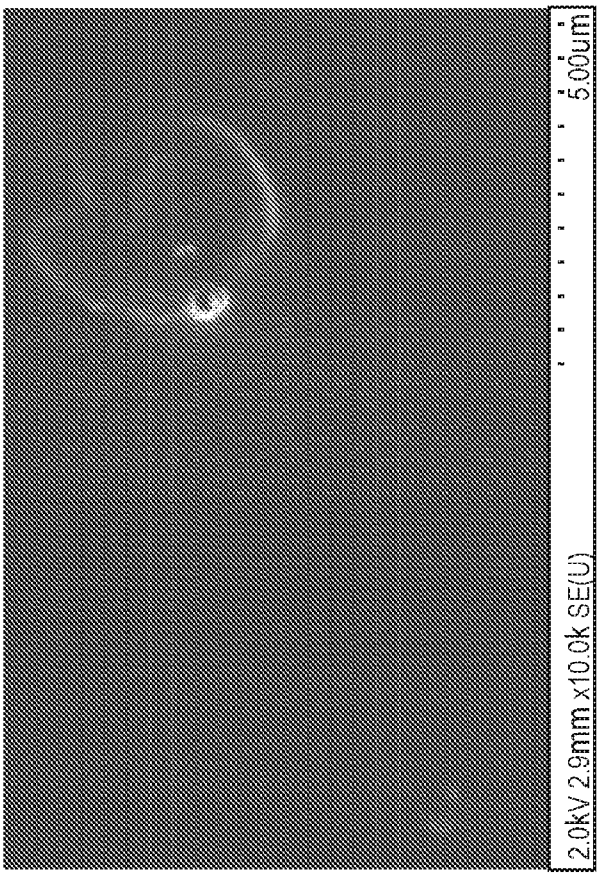

FIG. 222

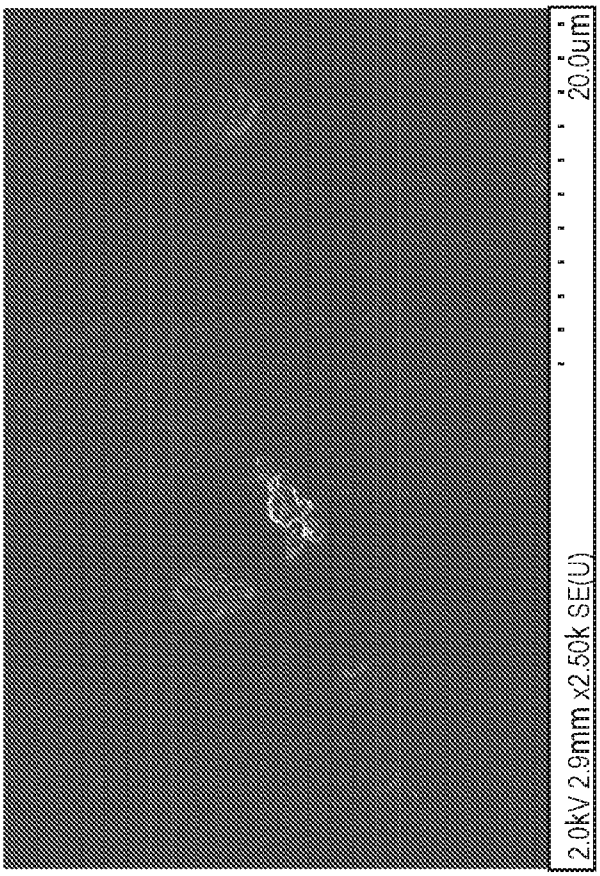

FIG. 223

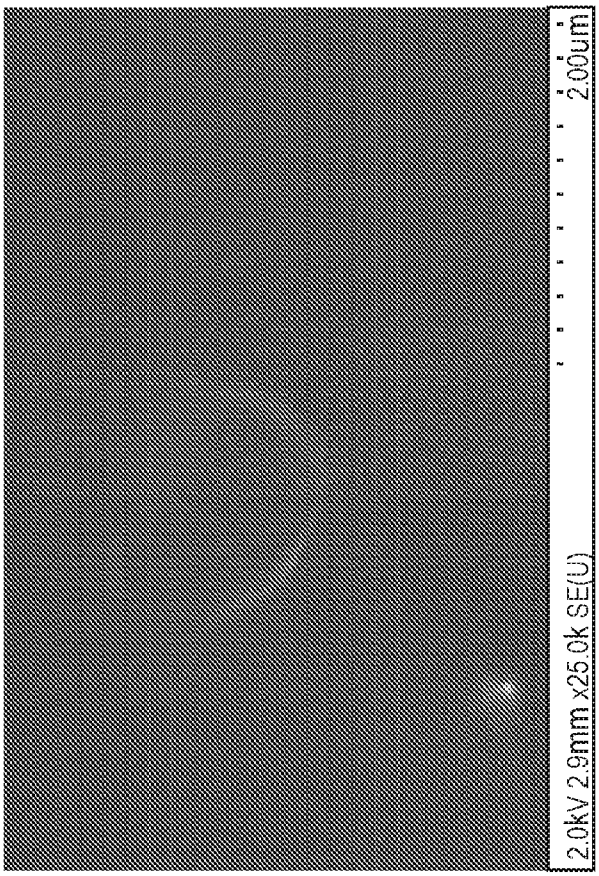

FIG. 224

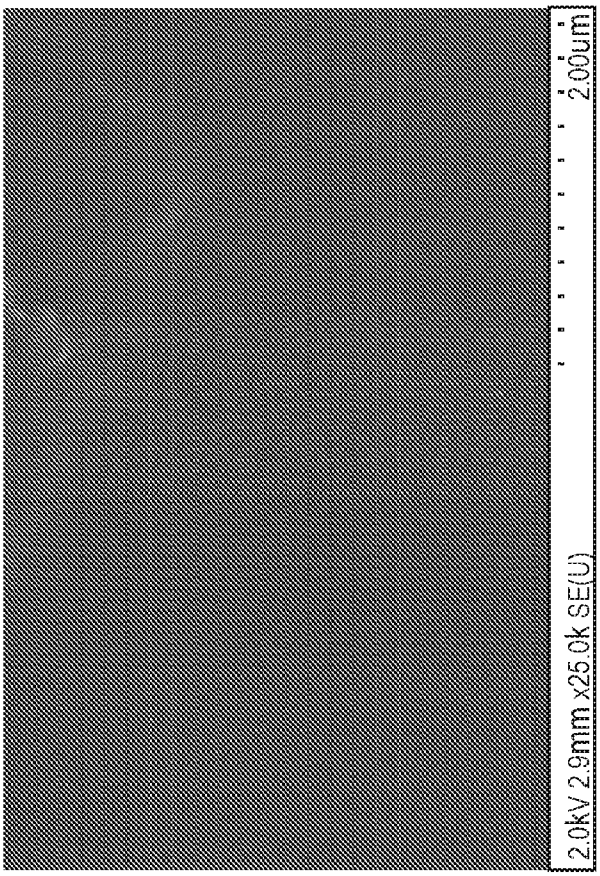

FIG. 225

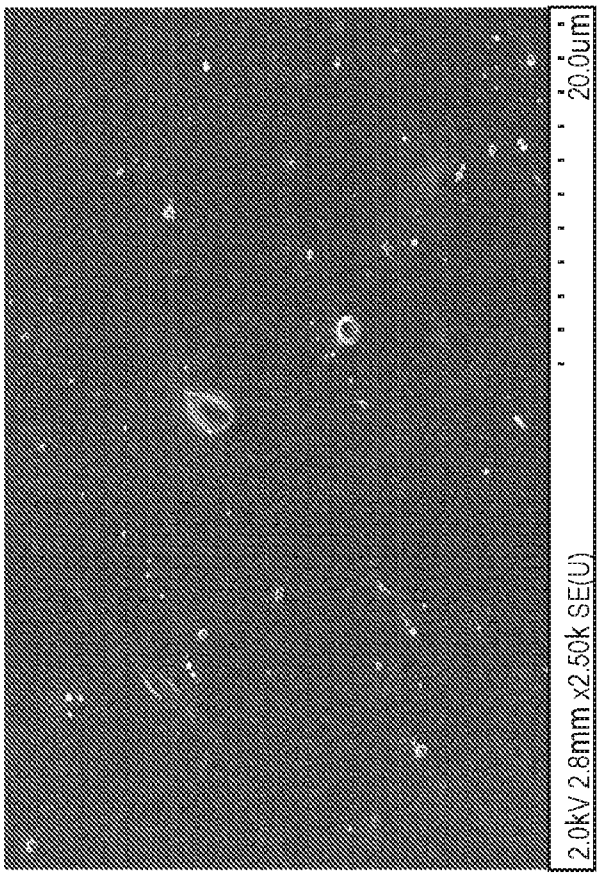

FIG. 226

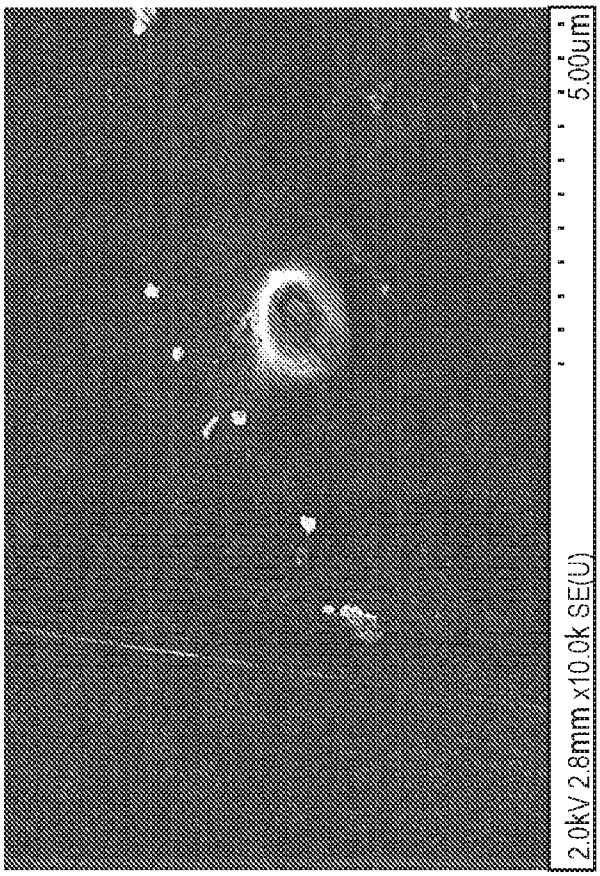

FIG. 227



FIG. 228

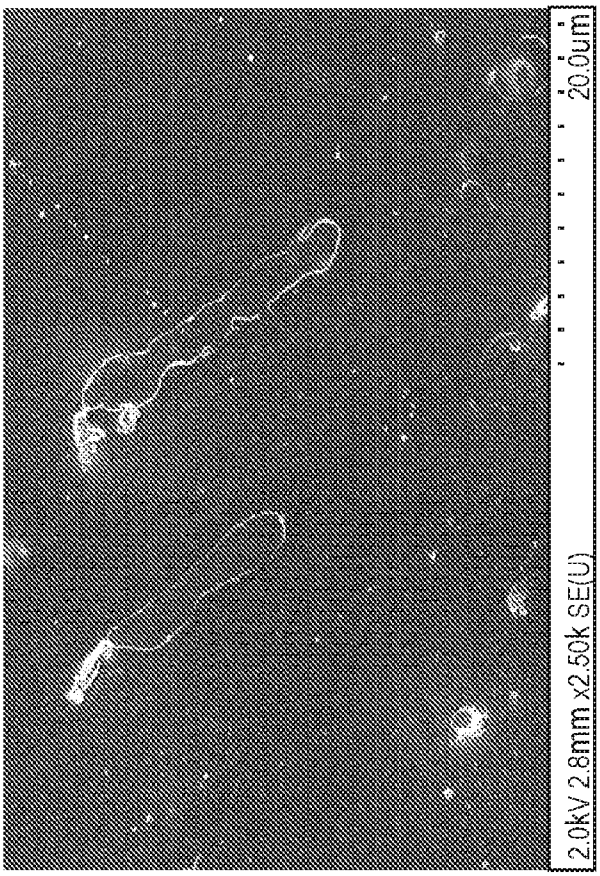

FIG. 229

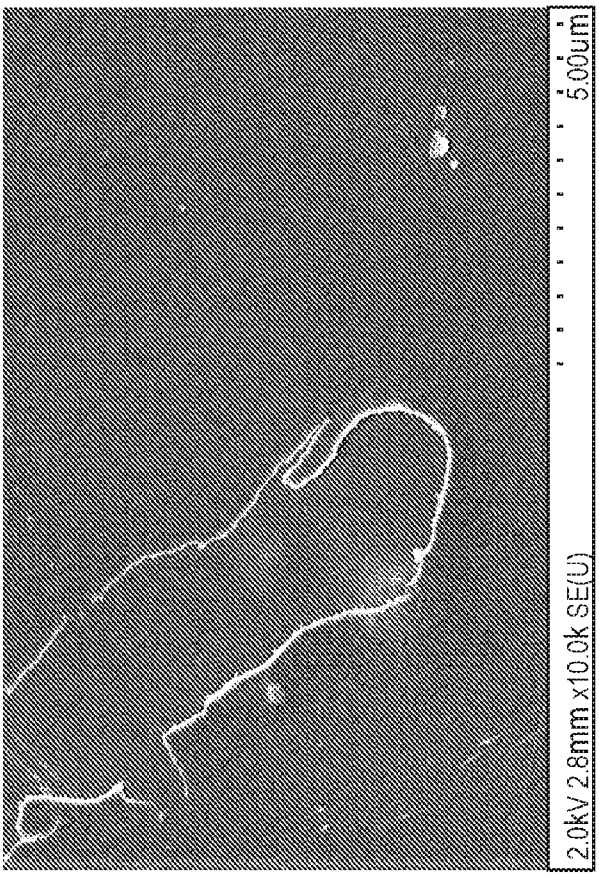

FIG. 230

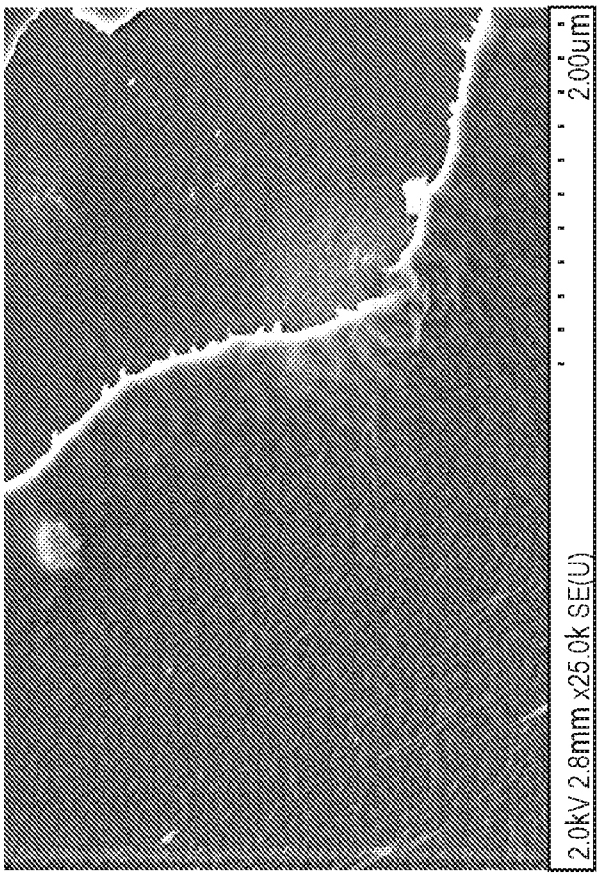

FIG. 231

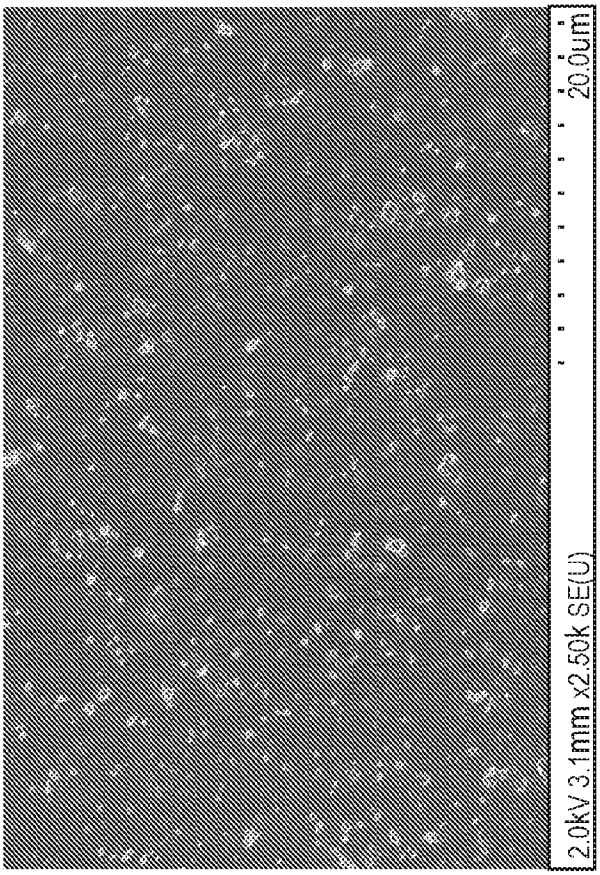

FIG. 232

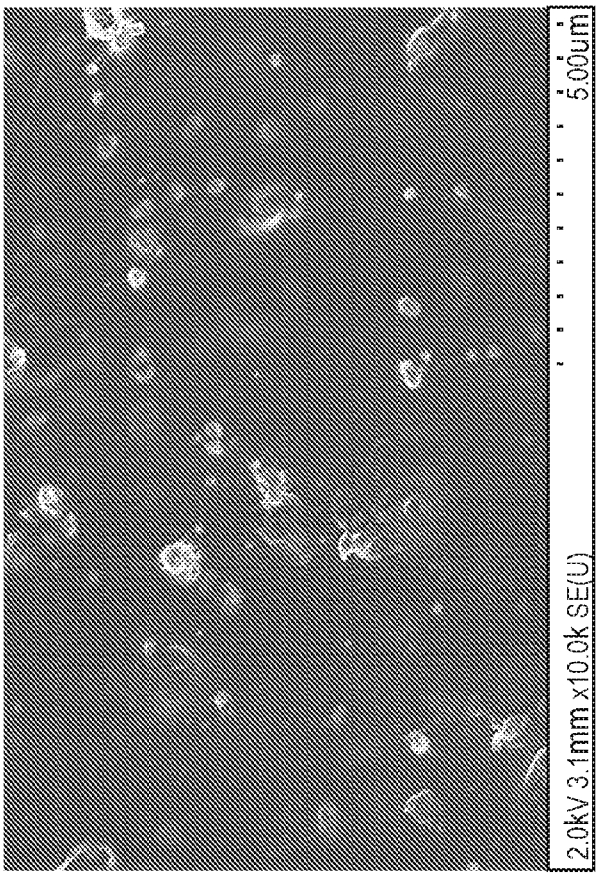

FIG. 233

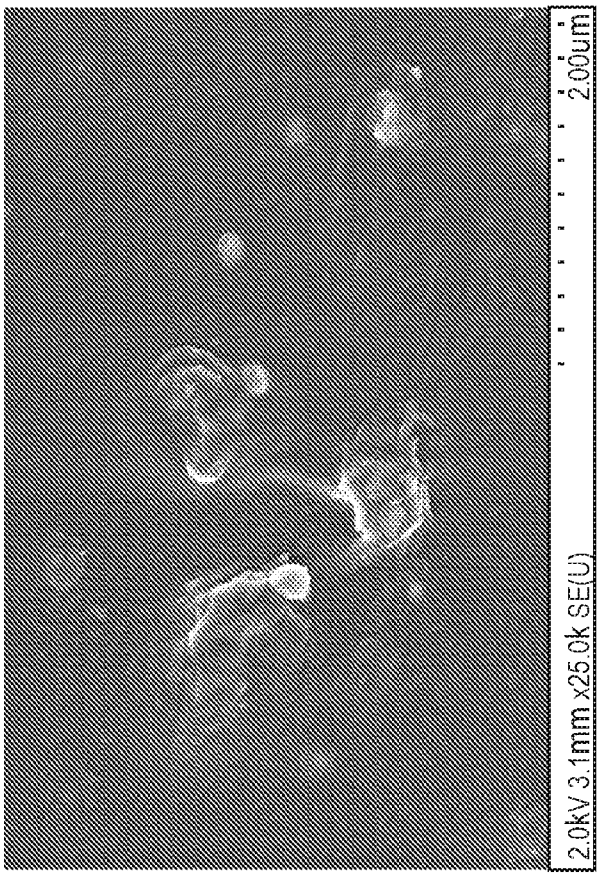

FIG. 234

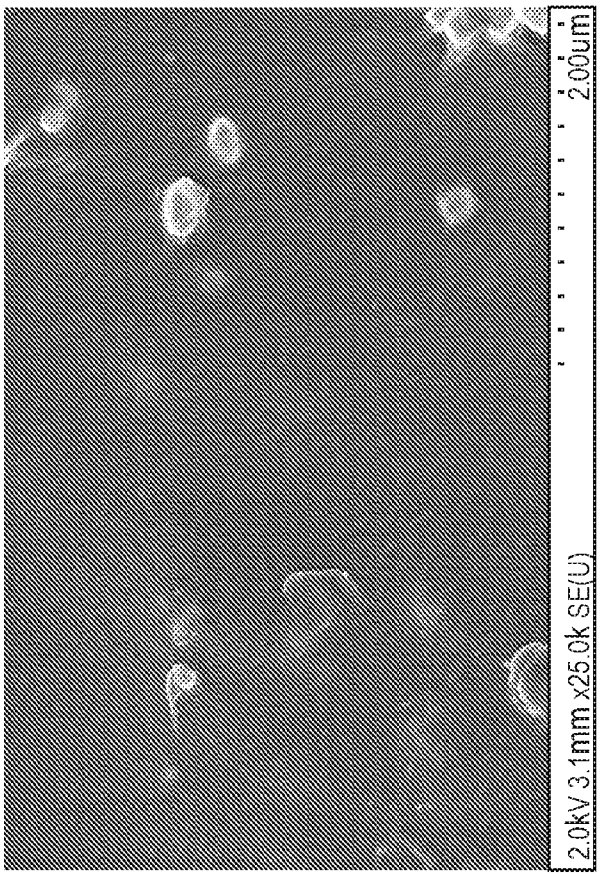

FIG. 235

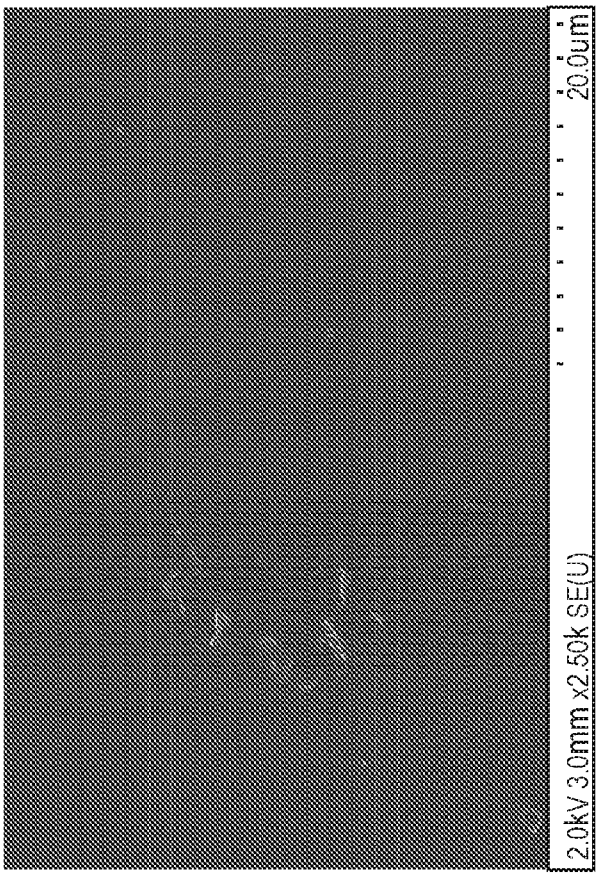

FIG. 236

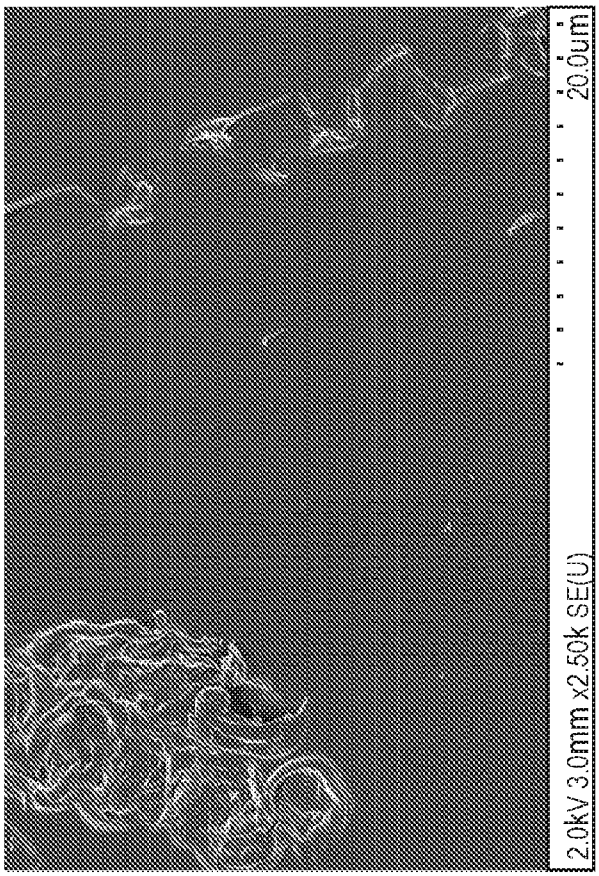

FIG. 237

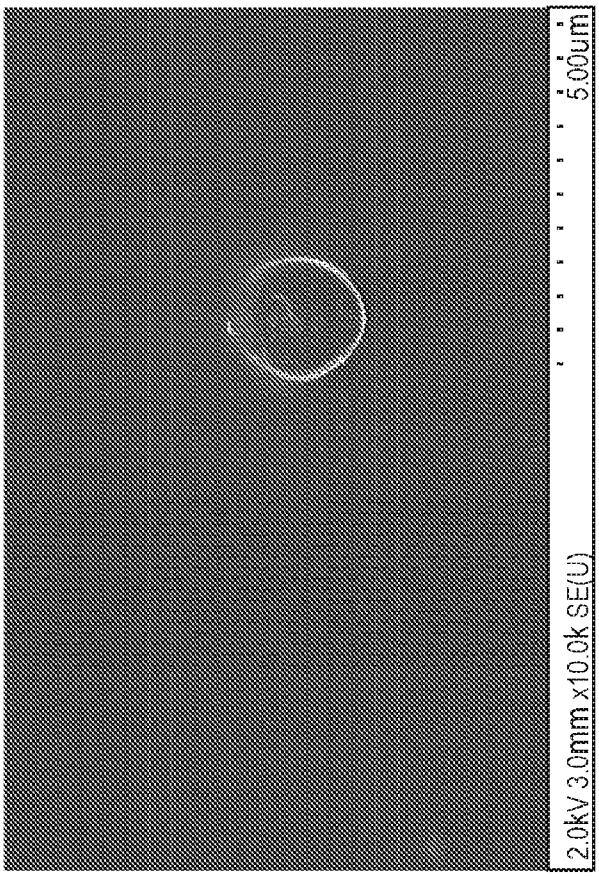

FIG. 238

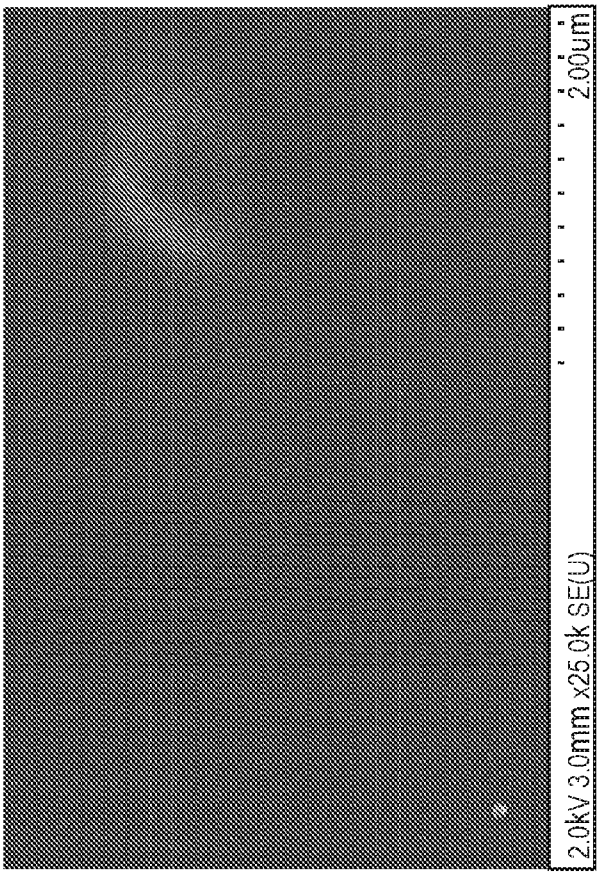

FIG. 239

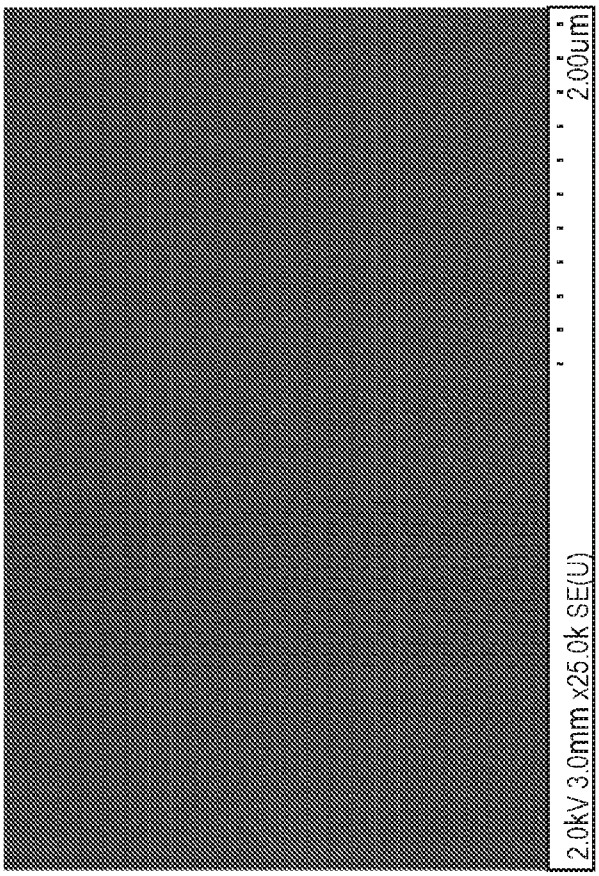

FIG. 240

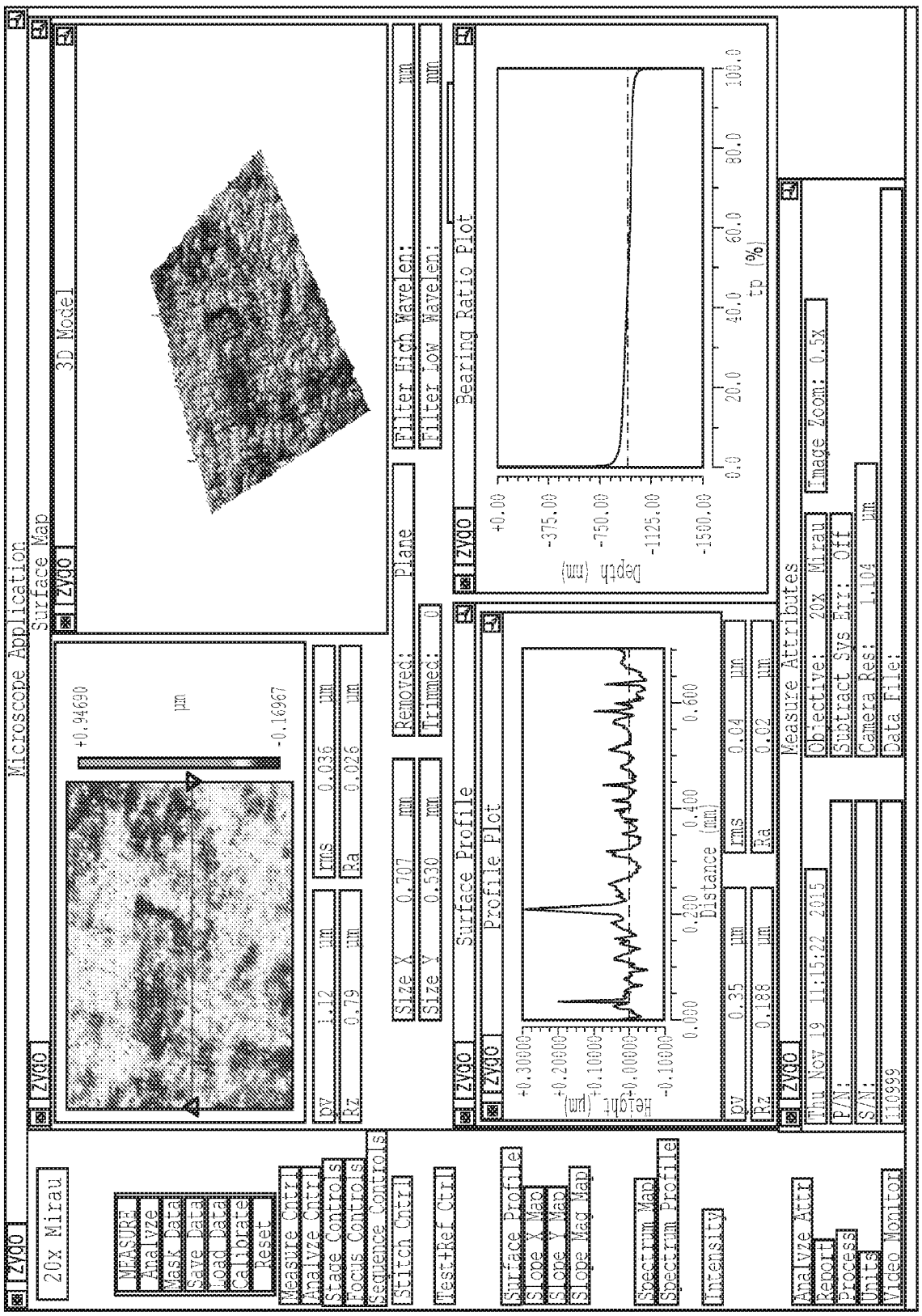
Microscope Application
ZYGO
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Ctrl
Analyze Ctrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Ctrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Surface Map
3D Model
+0.94690
µm
-0.16967
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen:
Filter Low Wavelen:
mm
Surface Profile
Profile Plot
Height (µm)
Distance (mm)
Bearing Ratio Plot
Depth (µm)
tp (%)
Measure Attributes
Thu Nov 19 11:19:22 2015
P/N:
S/N:
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 µm
Data File:
Image Zoom: 0.5x

FIG. 241

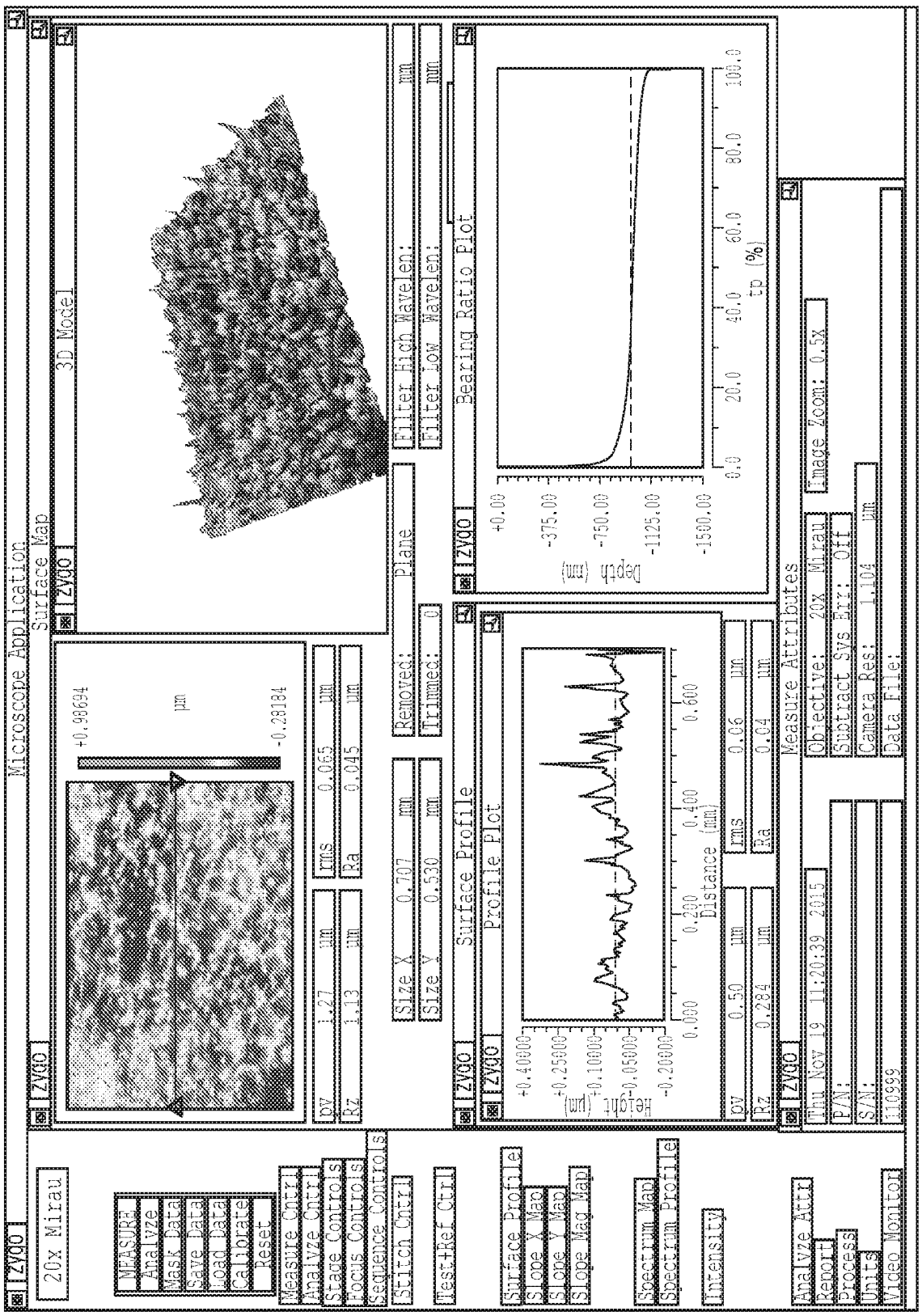
Microscope Application
Surface Map
3D Model
Surface Profile
Profile Plot
Bearing Ratio Plot
Measure Attributes
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Cntrl
Analyze Cntrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Cntrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen: mm
Filter Low Wavelen: mm
Height (µm)
Distance (mm)
Depth (mm)
tp (%)
Thu Nov 19 11:20:39 2015
P/N:
S/N:
110999
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 µm
Data File:
Image Zoom: 0.5x

FIG. 242

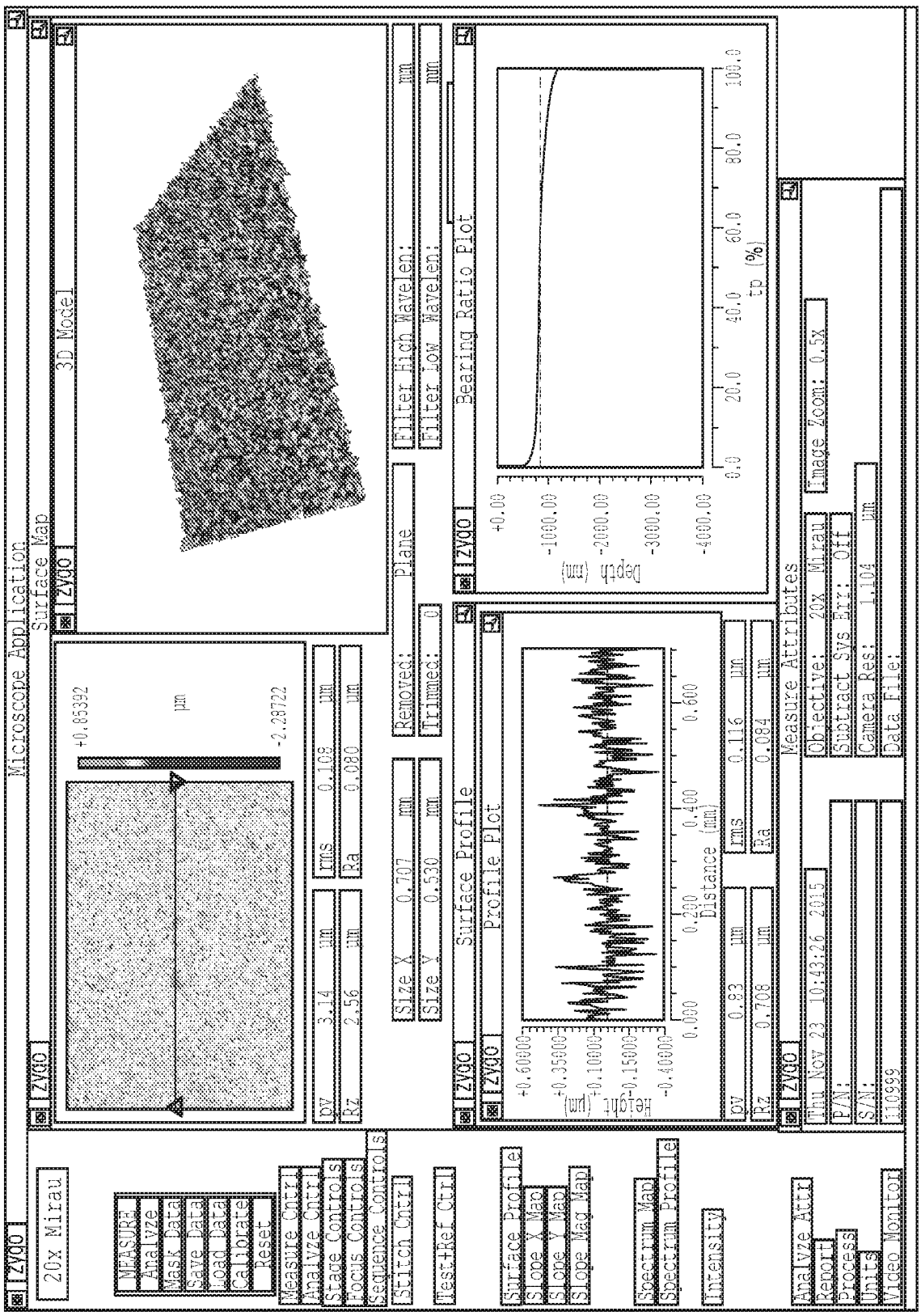
Microscope Application
ZYGO
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Ctrl
Analyze Ctrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Ctrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Surface Map
3D Model
+0.85392
µm
-2.28722
Sz 3.14 µm
Rz 2.56 µm
rms 0.108 µm
Ra 0.080 µm
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen: mm
Filter Low Wavelen: mm
Surface Profile
Profile Plot
Height (µm)
Distance (mm)
Sz 0.83 µm
Rz 0.708 µm
rms 0.116 µm
Ra 0.084 µm
Bearing Ratio Plot
Depth (µm)
tp (%)
Measure Attributes
Thu Nov 23 10:43:26 2015
P/N:
S/N:
110999
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 µm
Data File:
Image Zoom: 0.5x

FIG. 243

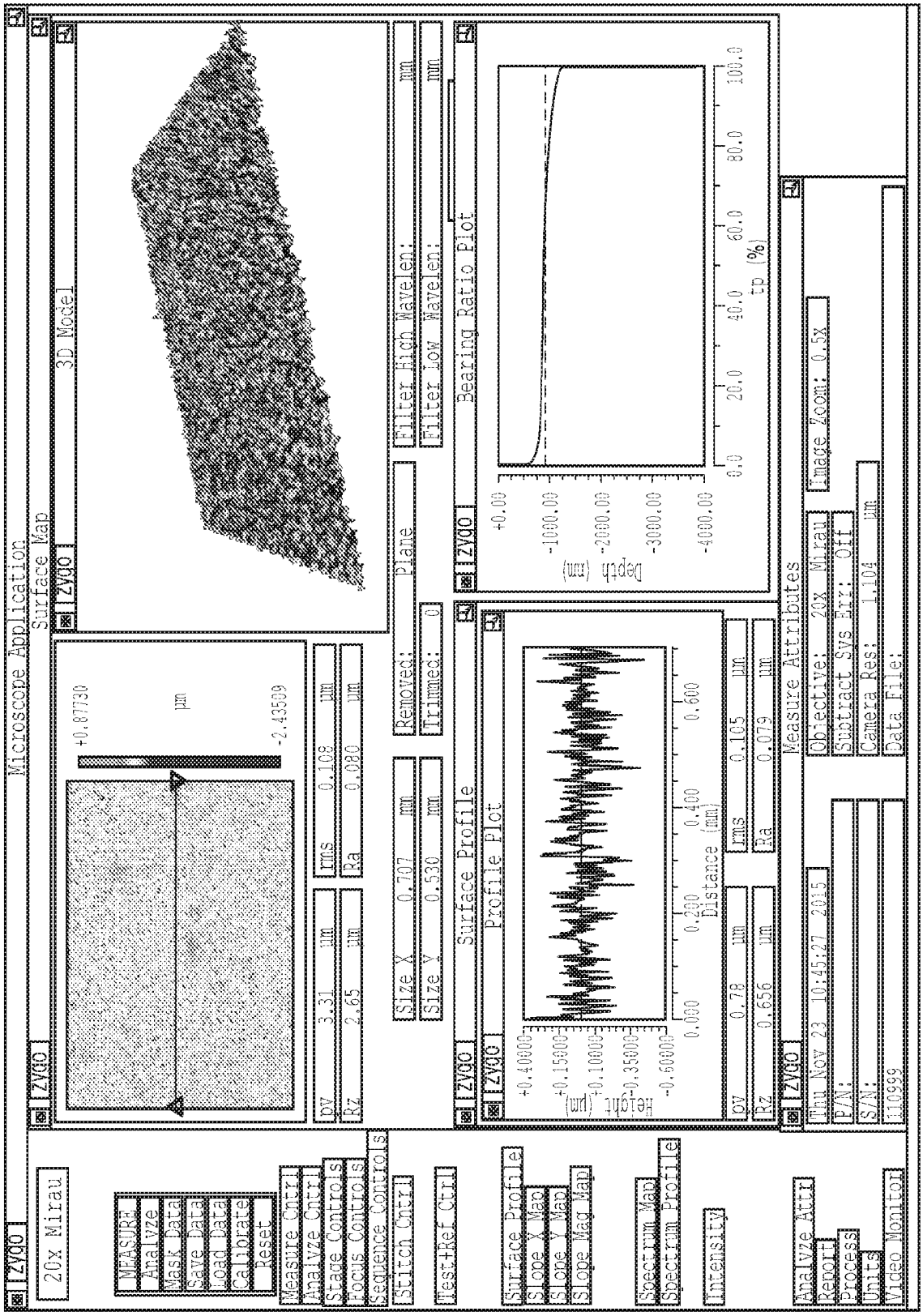
Microscope Application
ZYGO
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Ctrl
Analyze Ctrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Ctrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Surface Map
3D Model
+0.87730
-2.43509
µm
Sz 3.31 µm
Rz 2.65 µm
rms 0.108 µm
Ra 0.080 µm
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen: mm
Filter Low Wavelen: mm
Surface Profile
Profile Plot
Height (µm)
Distance (mm)
Sz 0.78 µm
Rz 0.656 µm
rms 0.105 µm
Ra 0.079 µm
Bearing Ratio Plot
Depth (µm)
tp (%)
Measure Attributes
Thu Nov 23 10:49:27 2015
PAN:
S/N:
110999
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 µm
Data File:
Image Zoom: 0.5x

FIG. 244

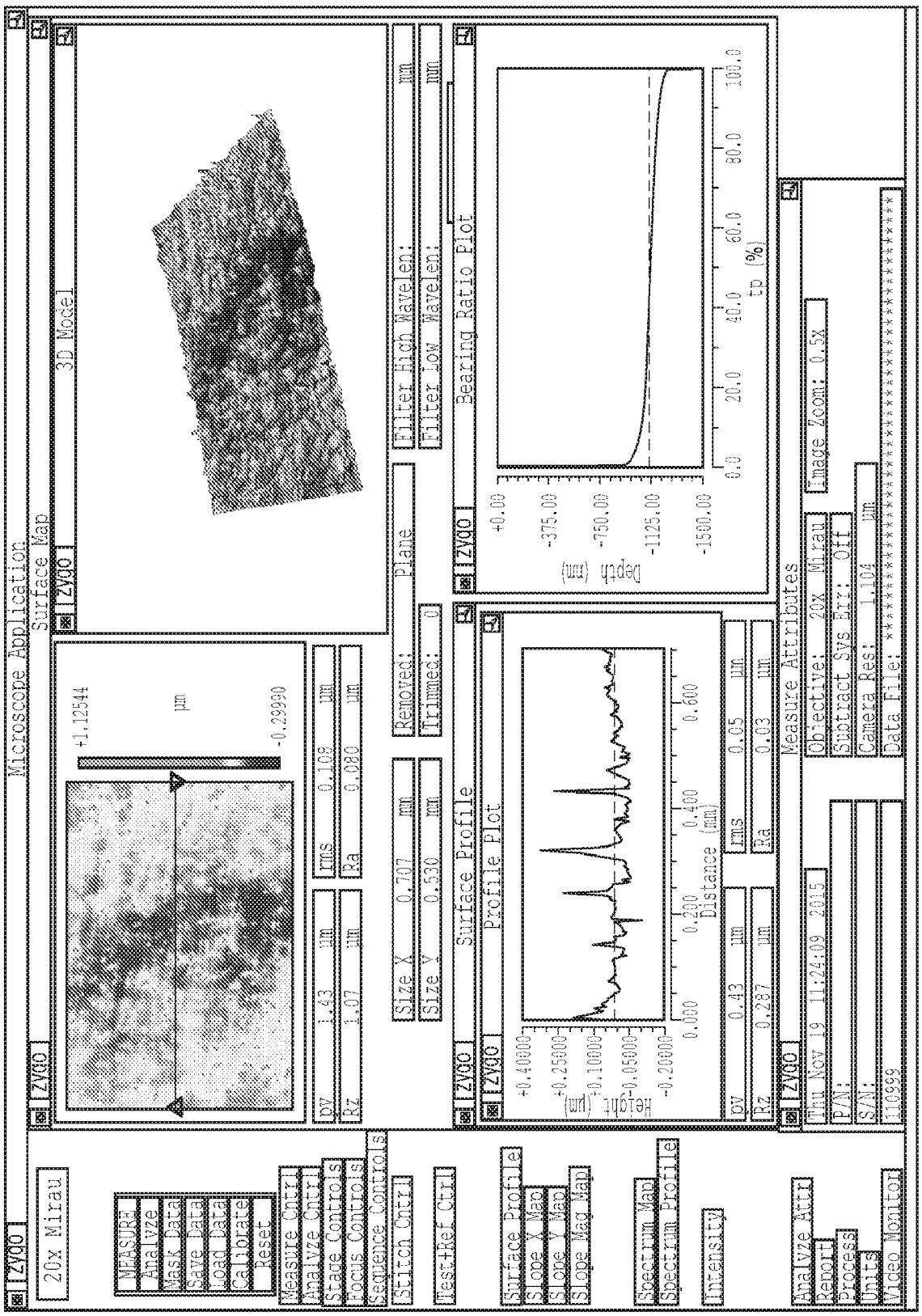
Microscope Application
Surface Map
3D Model
Surface Profile
Profile Plot
Bearing Ratio Plot
Measure Attributes
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Ctrl
Analyze Ctrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Ctrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen:
Filter Low Wavelen:
Sv 1.43 um
Rz 1.07 um
rms 0.108 um
Ra 0.080 um
Sv 0.43 um
Rz 0.287 um
rms 0.05 um
Ra 0.03 um
Thu Nov 19 11:24:09 2015
P/N:
S/N:
110999
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 um
Image Zoom: 0.5x
Height (um)
Distance (mm)
Depth (um)
tp (%)

FIG. 245

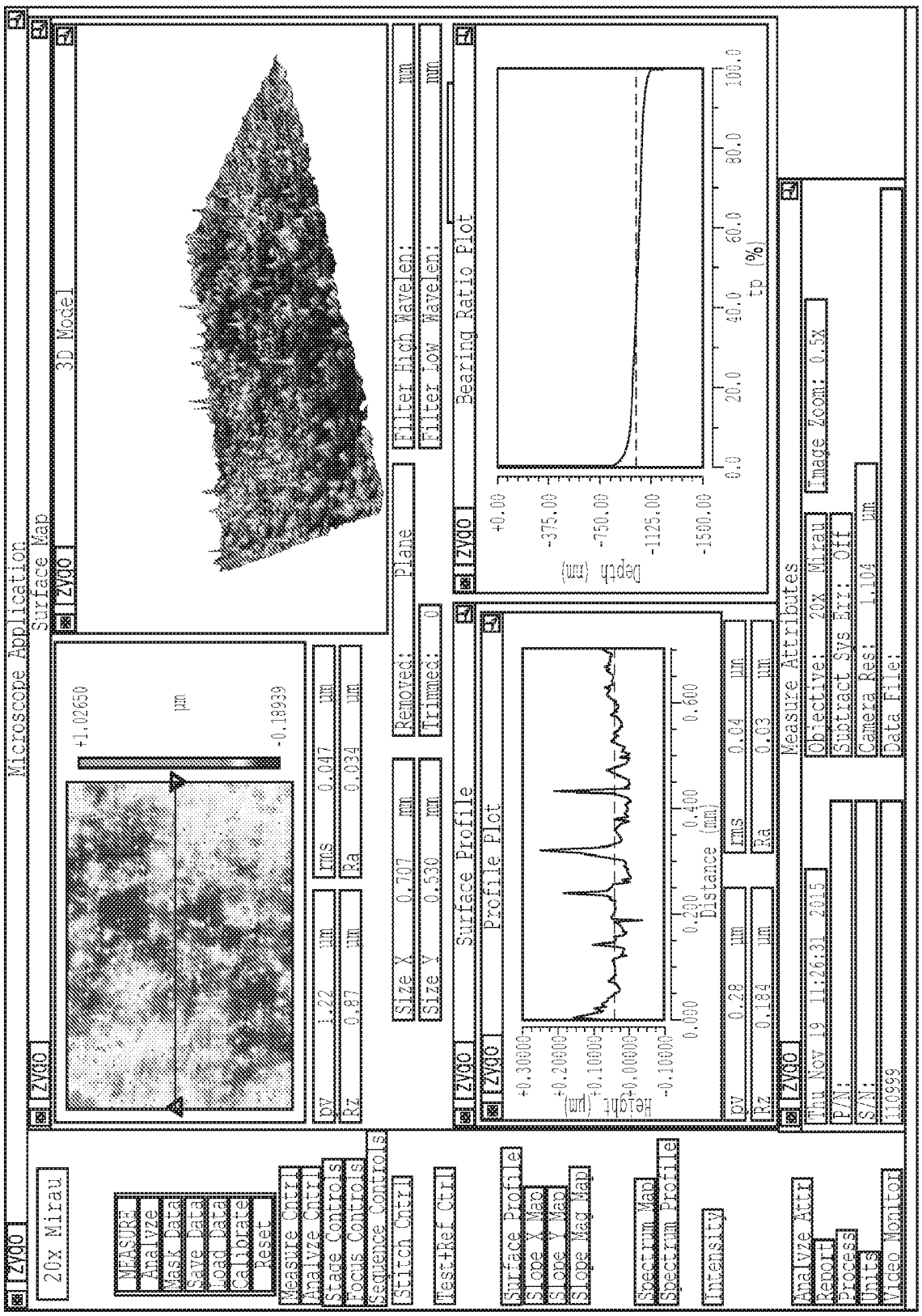
Microscope Application
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Ctrl
Analyze Ctrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Ctrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Surface Map
3D Model
Plane
Removed:
Trimmed:
Filter High Wavelen:
Filter Low Wavelen:
Bearing Ratio Plot
Measure Attributes
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 um
Data File:
Image Zoom: 0.5x
Surface Profile
Profile Plot
Distance (mm)
Height (um)
Thu Nov 19 11:26:31 2015
P/N:
S/N:
110999

FIG. 246

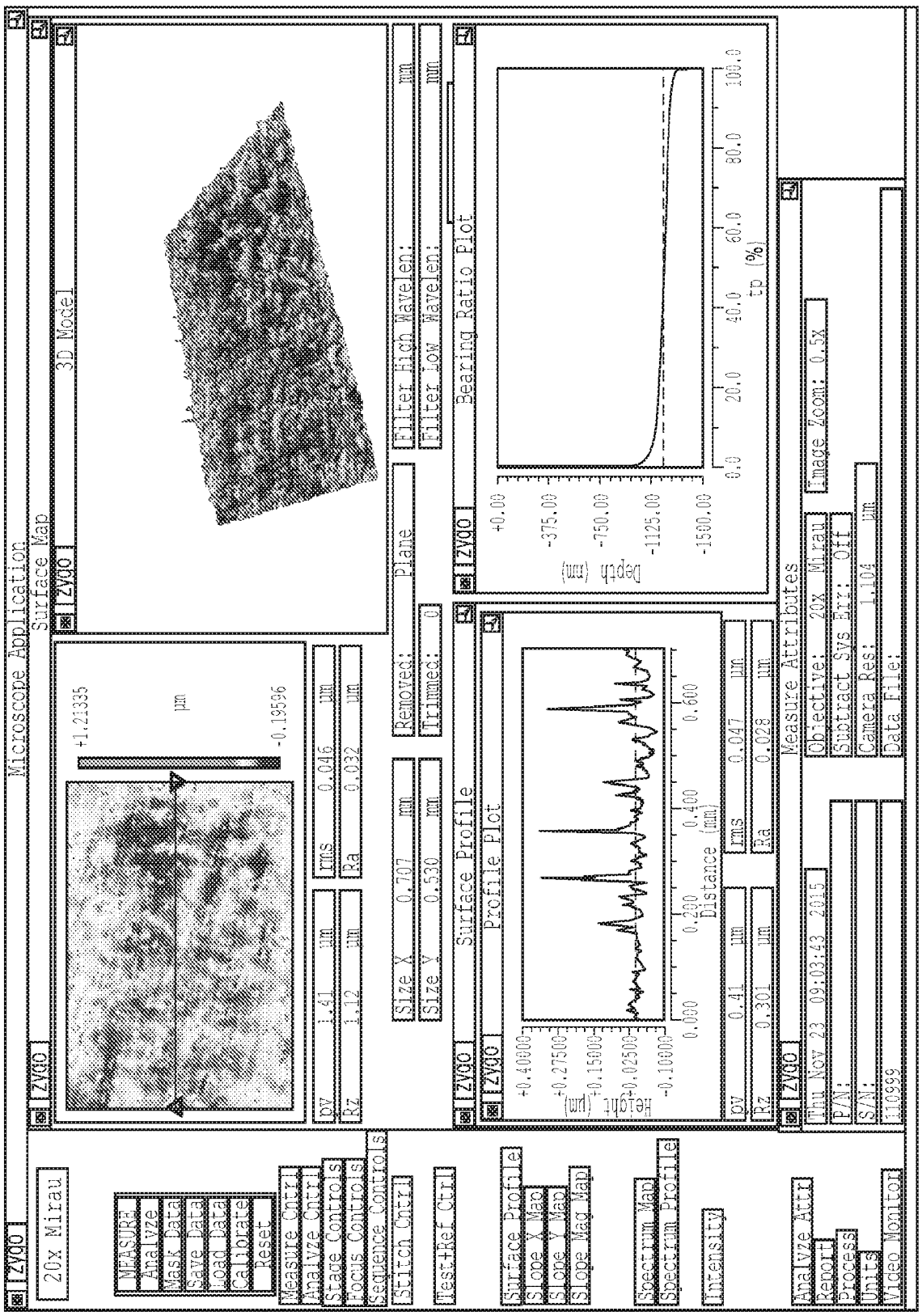
Microscope Application
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Ctrl
Analyze Ctrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Ctrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Surface Map
3D Model
+1.21335
-0.19596
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen:
Filter Low Wavelen:
Surface Profile
Profile Plot
Distance (mm)
Height
Bearing Ratio Plot
Depth
tp (%)
Measure Attributes
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 um
Data File:
Image Zoom: 0.5x
Thu Nov 23 09:03:43 2015
P/N:
S/N:
110999

FIG. 247

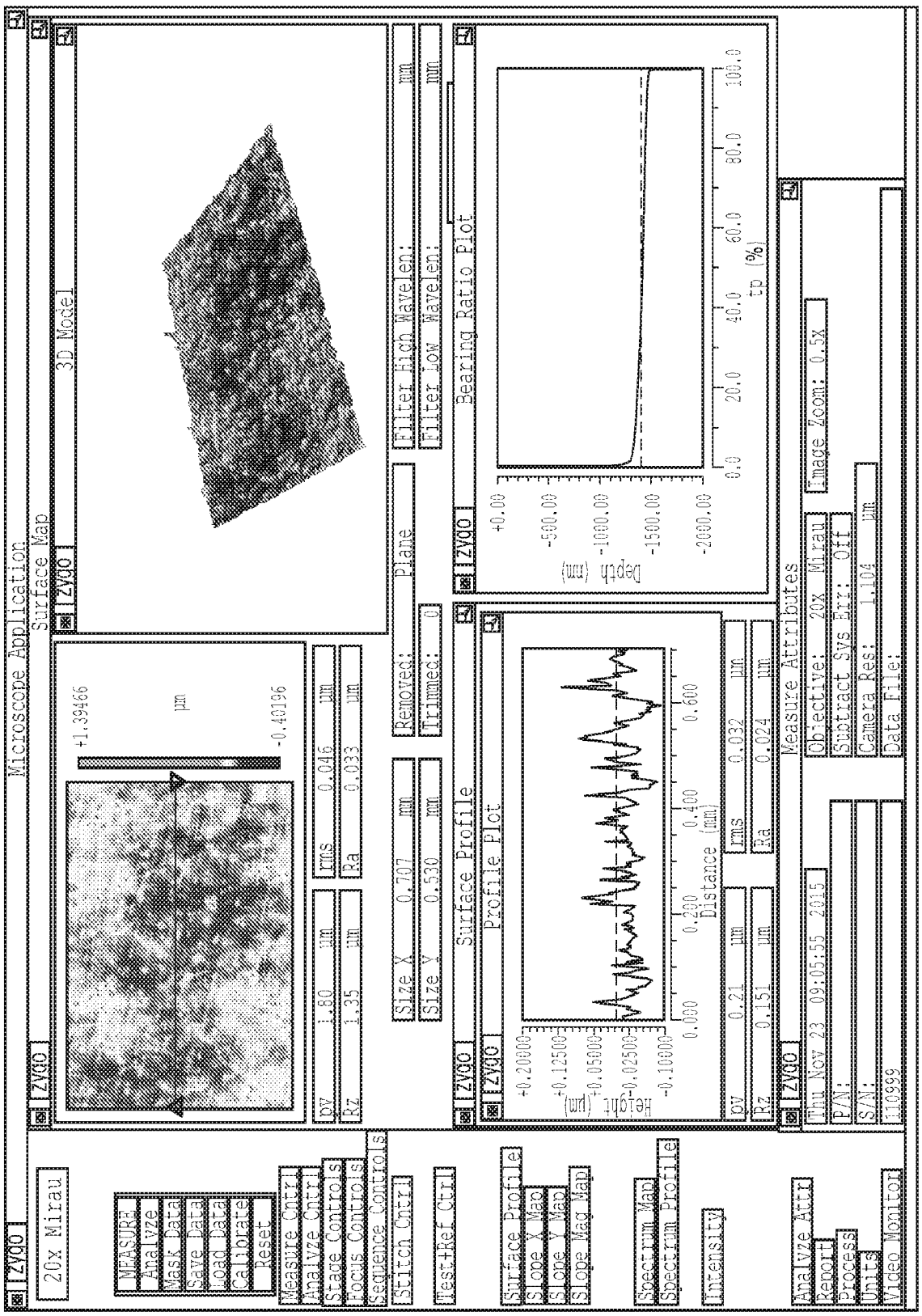
Microscope Application
Surface Map
3D Model
Surface Profile
Profile Plot
Bearing Ratio Plot
Measure Attributes
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Ctrl
Analyze Ctrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Ctrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
+1.39466
-0.40196
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen:
Filter Low Wavelen:
Depth (µm)
tp (%)
Distance (mm)
Height (µm)
Thu Nov 23 09:09:55 2015
P/N:
S/N:
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 µm
Data File:
Image Zoom: 0.5x

FIG. 248

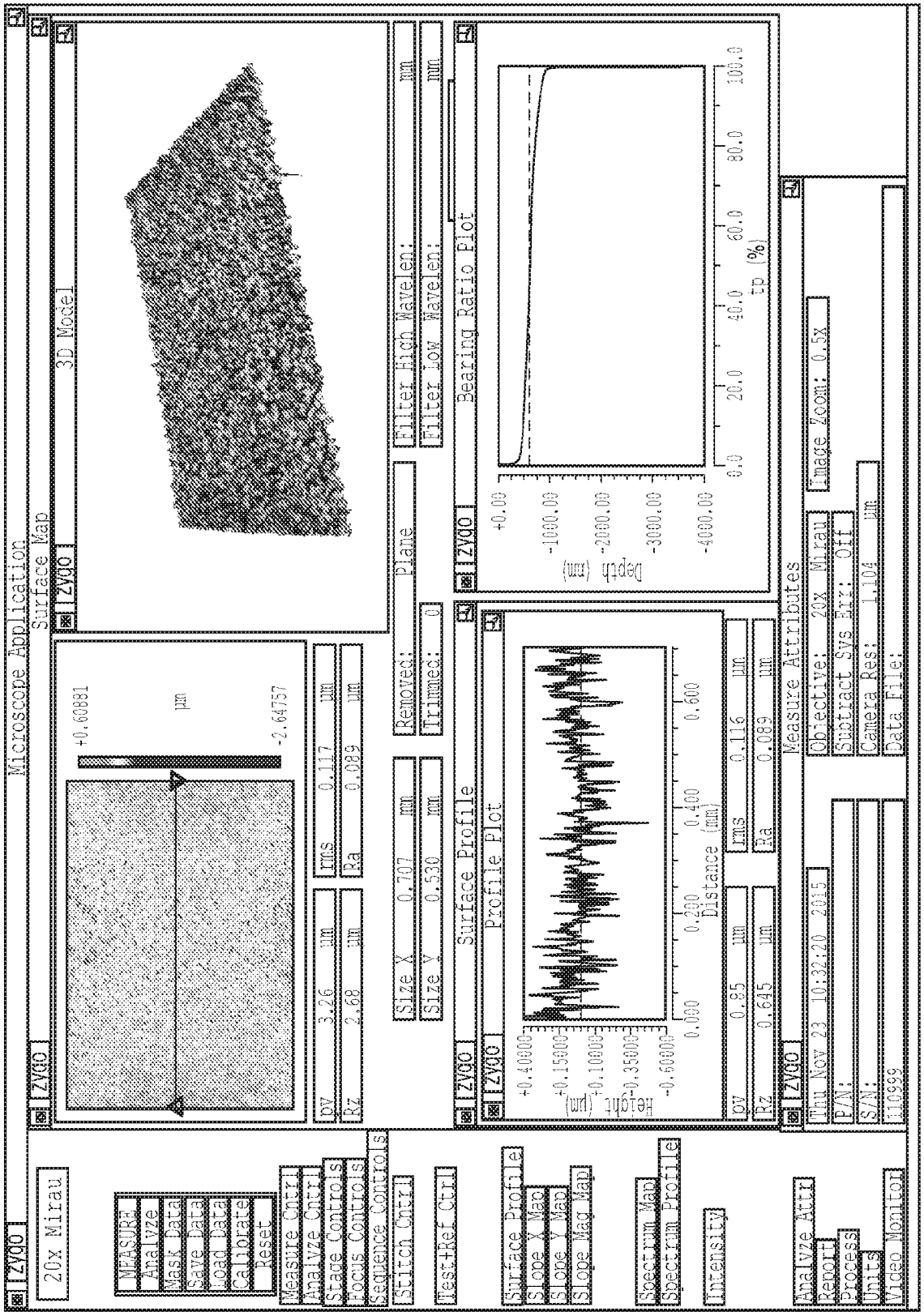
Microscope Application
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Ctrl
Analyze Ctrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Ctrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Surface Map
3D Model
+0.60881
-2.64757
Sz 3.26 um
Rz 2.68 um
Rms 0.117 um
Ra 0.089 um
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen: mm
Filter Low Wavelen: mm
Surface Profile
Profile Plot
Height (um)
Distance (mm)
Sz 0.85 um
Rz 0.645 um
Rms 0.116 um
Ra 0.089 um
Bearing Ratio Plot
Depth (um)
tp (%)
Measure Attributes
Thu Nov 23 10:32:20 2015
P/N:
S/N:
110999
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 um
Data File:
Image Zoom: 0.5x

FIG. 249

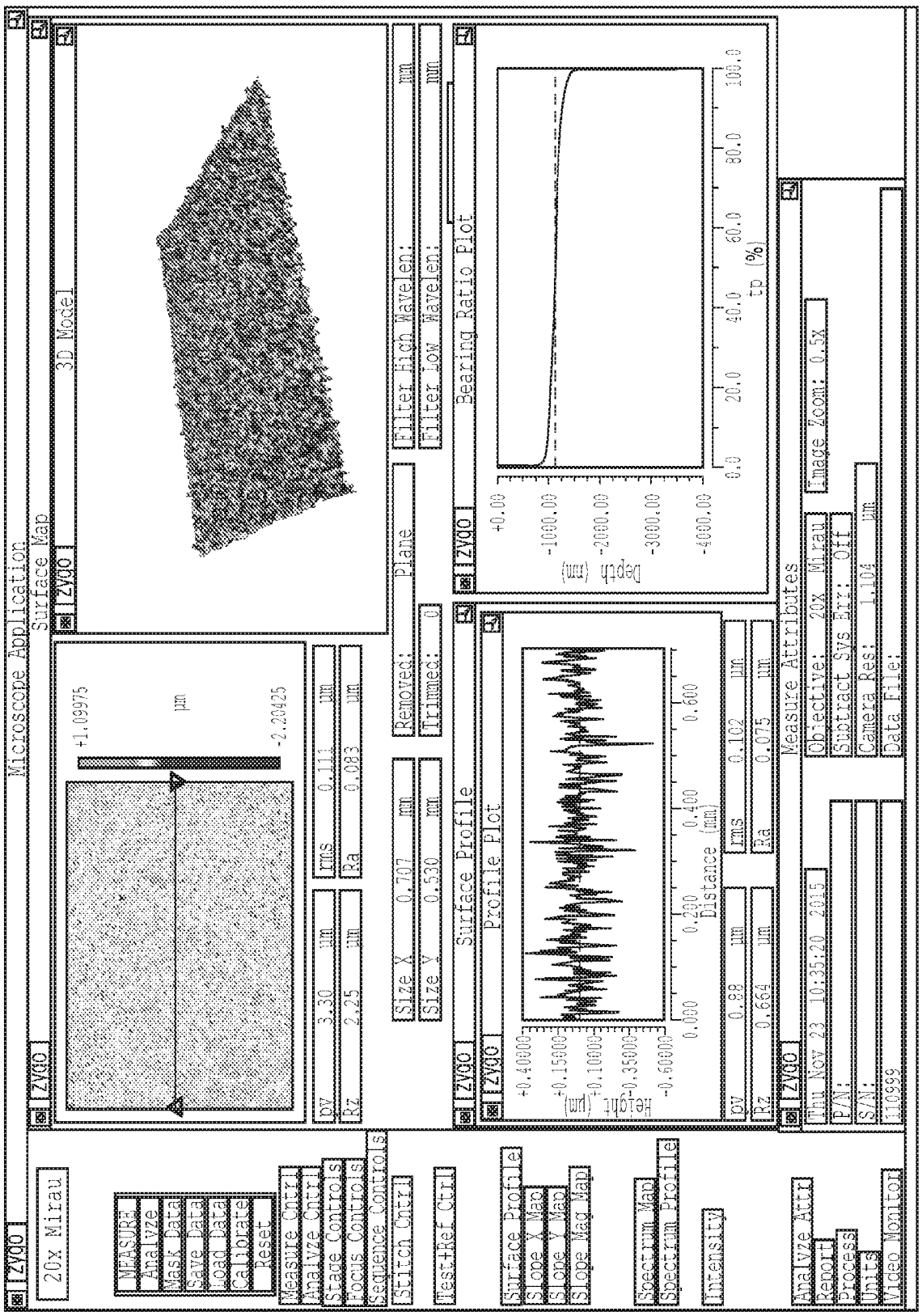
Microscope Application
ZYGO
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Ctrl
Analyze Ctrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Ctrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Surface Map
3D Model
+1.09975
µm
-2.20425
Sz 3.30 µm
Rz 2.25 µm
rms 0.111 µm
Ra 0.083 µm
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen: mm
Filter Low Wavelen: mm
Surface Profile
Profile Plot
Height (µm)
Distance (mm)
Sz 0.88 µm
Rz 0.664 µm
rms 0.102 µm
Ra 0.075 µm
Bearing Ratio Plot
Depth (µm)
tp (%)
Measure Attributes
Thu Nov 23 10:39:20 2015
P/N:
S/N:
110999
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 µm
Data File:
Image Zoom: 0.5x

FIG. 250

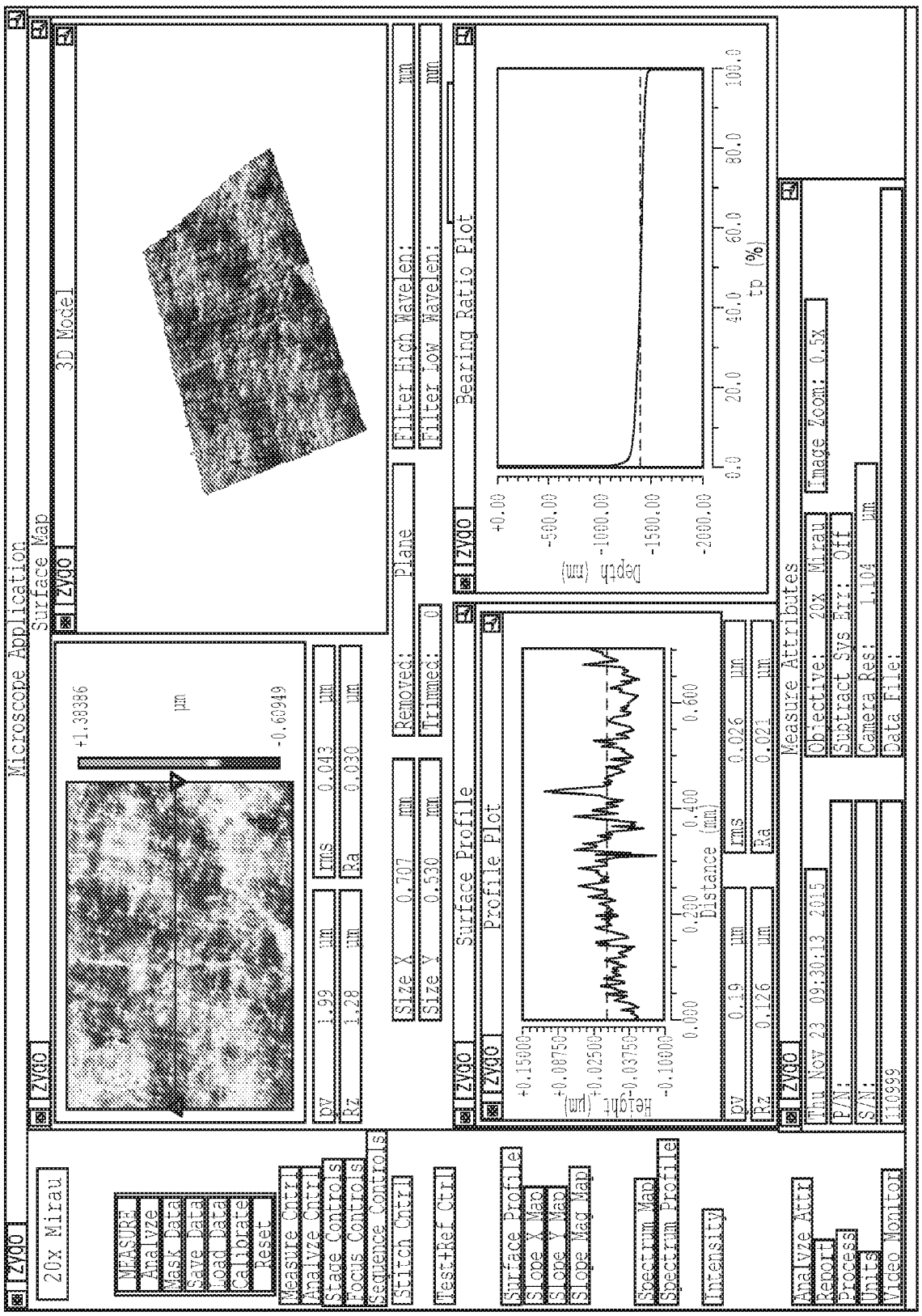
Microscope Application
ZYGO
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Ctrl
Analyze Ctrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Ctrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Surface Map
3D Model
+1.38386
µm
-0.60949
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen:
Filter Low Wavelen:
Surface Profile
Profile Plot
Height (µm)
Distance (mm)
Bearing Ratio Plot
Depth (µm)
tp (%)
Measure Attributes
Objective: 20x Mirau
Image Zoom: 0.5x
Subtract Sys Err: Off
Camera Res: 1.104 µm
Data File:
Thu Nov 23 09:30:13 2015
P/N:
S/N:
110999

FIG. 251

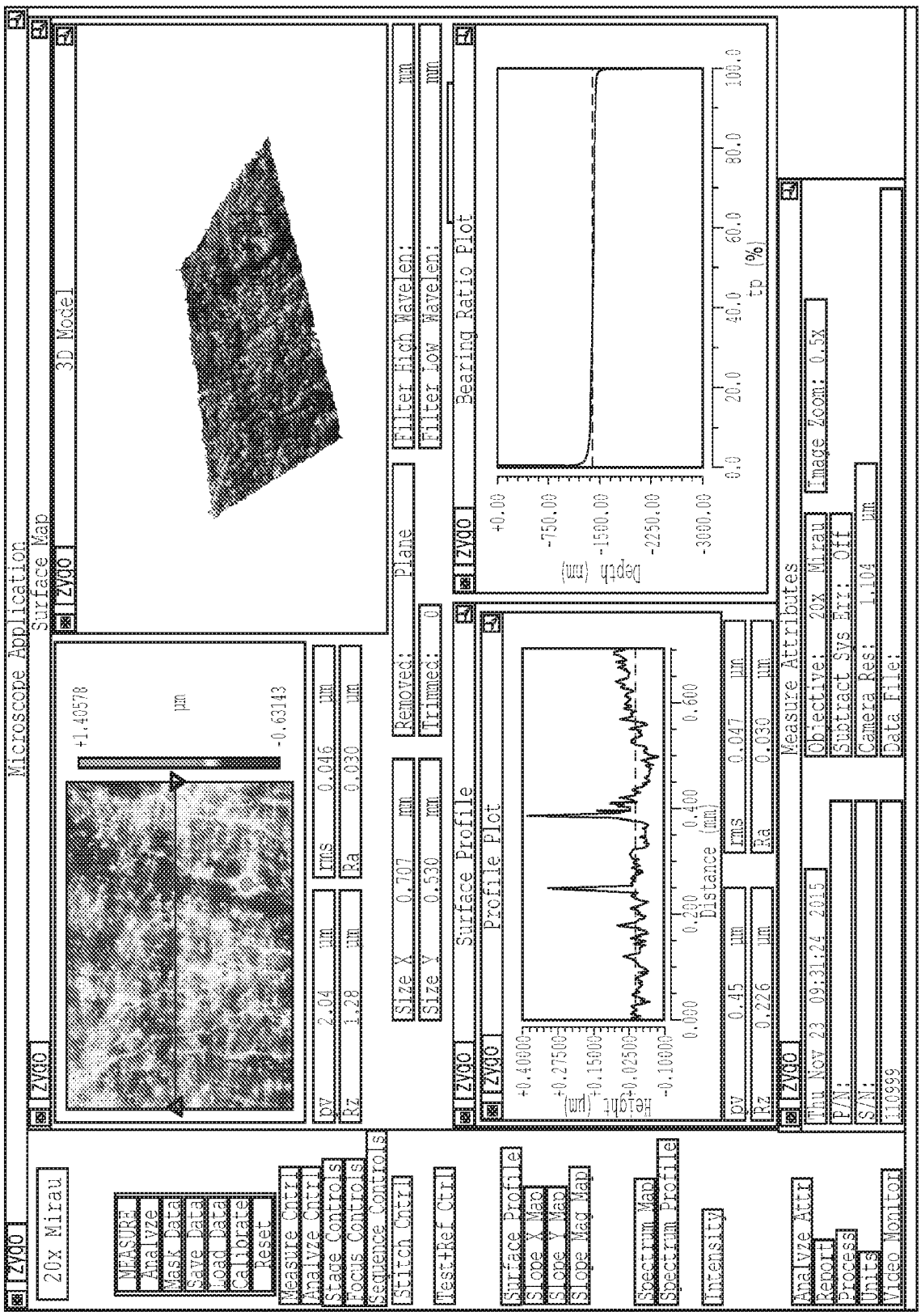
Microscope Application
Surface Map
3D Model
Bearing Ratio Plot
Surface Profile
Profile Plot
Measure Attributes
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Ctrl
Analyze Ctrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Ctrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Filter High Wavelen:
Filter Low Wavelen:
Removed: Plane
Trimmed: 0
Size X 0.707 mm
Size Y 0.530 mm
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 um
Data File:
Image Zoom: 0.5x
Thu Nov 23 09:31:24 2015
P/N:
S/N:
110999
Distance (mm)
Height (um)
Depth (um)
tp (%)

FIG. 252

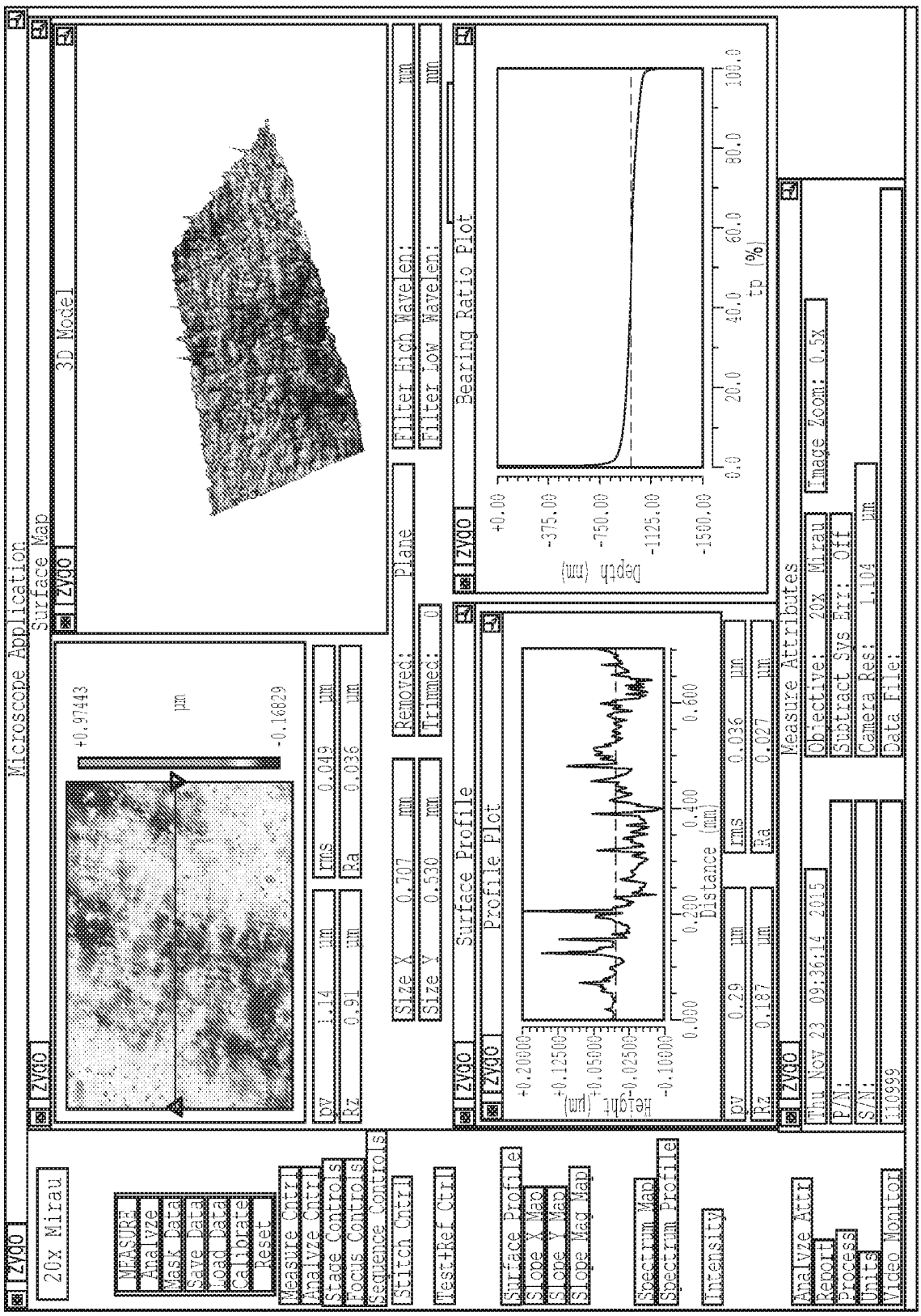
Microscope Application
Surface Map
3D Model
Surface Profile
Profile Plot
Bearing Ratio Plot
Measure Attributes
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Cntrl
Analyze Cntrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Cntrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen: mm
Filter Low Wavelen: mm
Distance (mm)
Height (µm)
Depth (mm)
tp (%)
Thu Nov 23 09:36:14 2015
P/N:
S/N:
110999
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 µm
Data File:
Image Zoom: 0.5x

FIG. 253

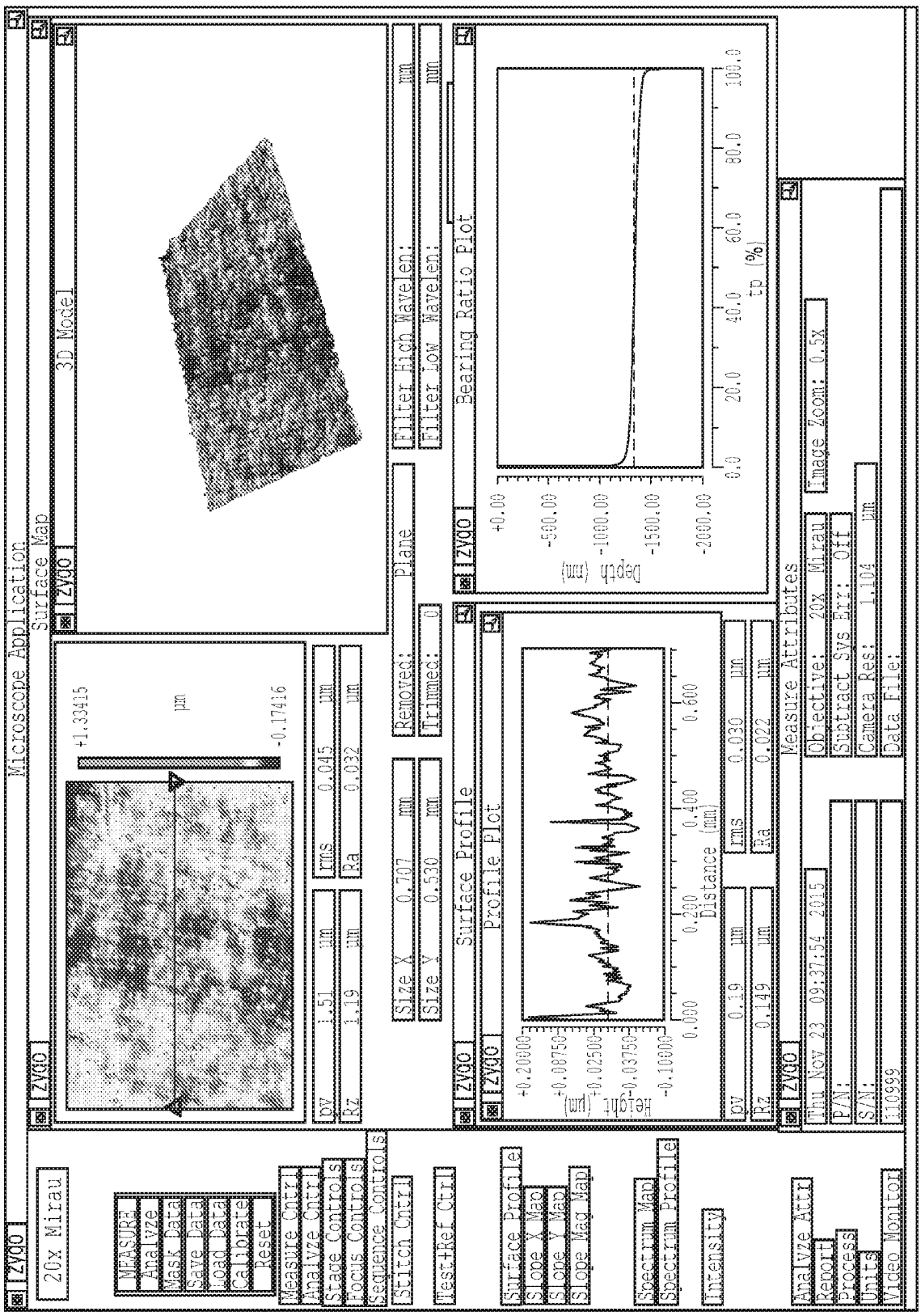
Microscope Application
Surface Map
3D Model
Surface Profile
Profile Plot
Bearing Ratio Plot
Measure Attributes
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Cntrl
Analyze Cntrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Cntrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen: mm
Filter Low Wavelen: mm
Distance (mm)
Height (µm)
Depth (mm)
tp (%)
Thu Nov 23 09:37:54 2015
P/N:
S/N:
110999
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 µm
Data File:
Image Zoom: 0.5x

FIG. 254

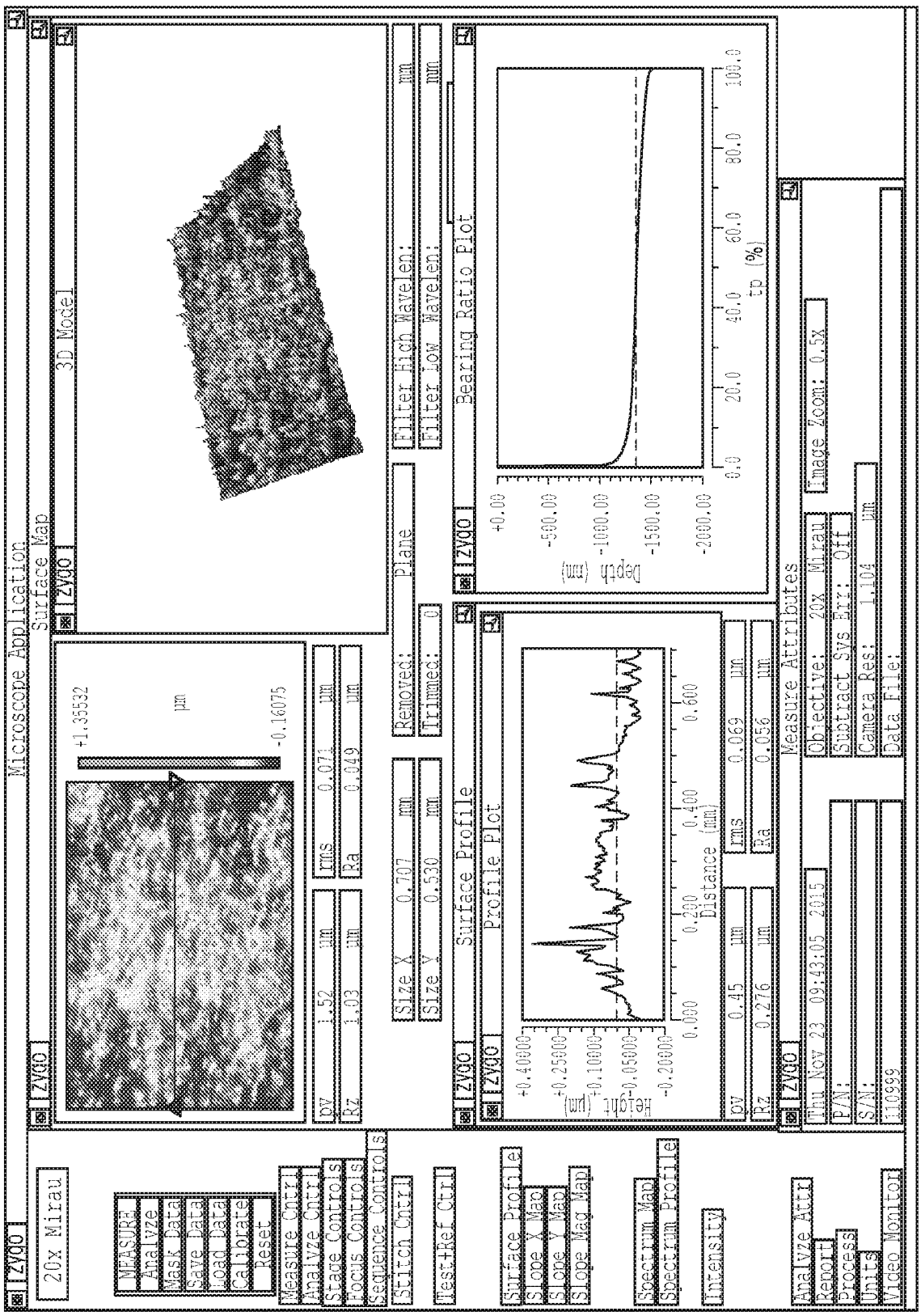
Microscope Application
Surface Map
3D Model
Surface Profile
Profile Plot
Bearing Ratio Plot
Measure Attributes
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Cntrl
Analyze Cntrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Cntrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen: mm
Filter Low Wavelen: mm
Distance (mm)
Height (µm)
Depth (mm)
tp (%)
Thu Nov 23 09:43:05 2015
P/N:
S/N:
110999
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 µm
Data File:
Image Zoom: 0.5x

FIG. 255

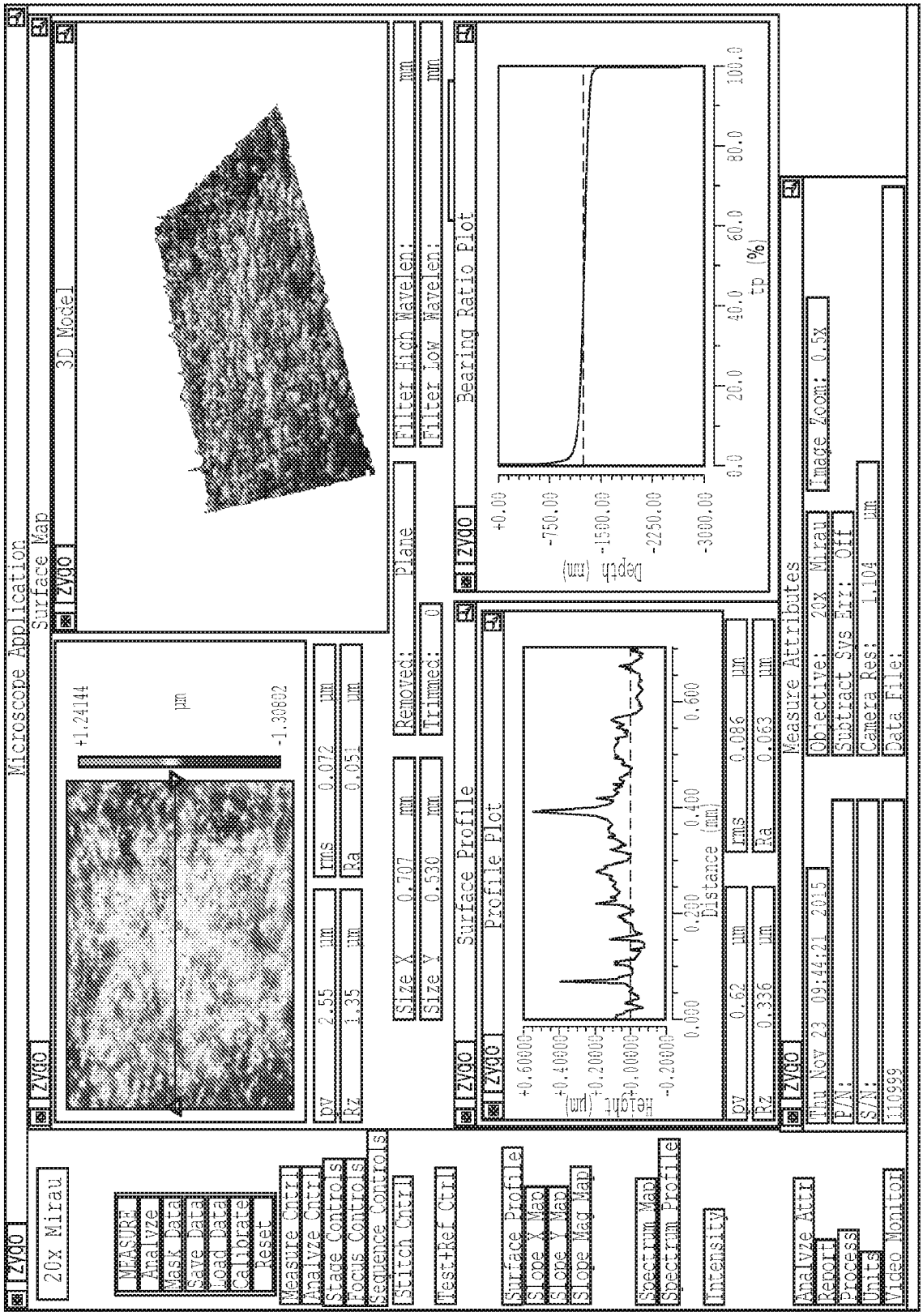
Microscope Application
ZYGO
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Ctrl
Analyze Ctrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Ctrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Surface Map
3D Model
+1.24144
-1.30802
µm
Sz 2.55 µm
Rz 1.35 µm
rms 0.072 µm
Ra 0.051 µm
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen: mm
Filter Low Wavelen: mm
Surface Profile
Profile Plot
Height (µm)
Distance (mm)
Sz 0.62 µm
Rz 0.336 µm
rms 0.086 µm
Ra 0.063 µm
Bearing Ratio Plot
Depth (µm)
tp (%)
Measure Attributes
Thu Nov 23 09:44:21 2015
P/N:
S/N:
110999
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 µm
Data File:
Image Zoom: 0.5x

FIG. 256

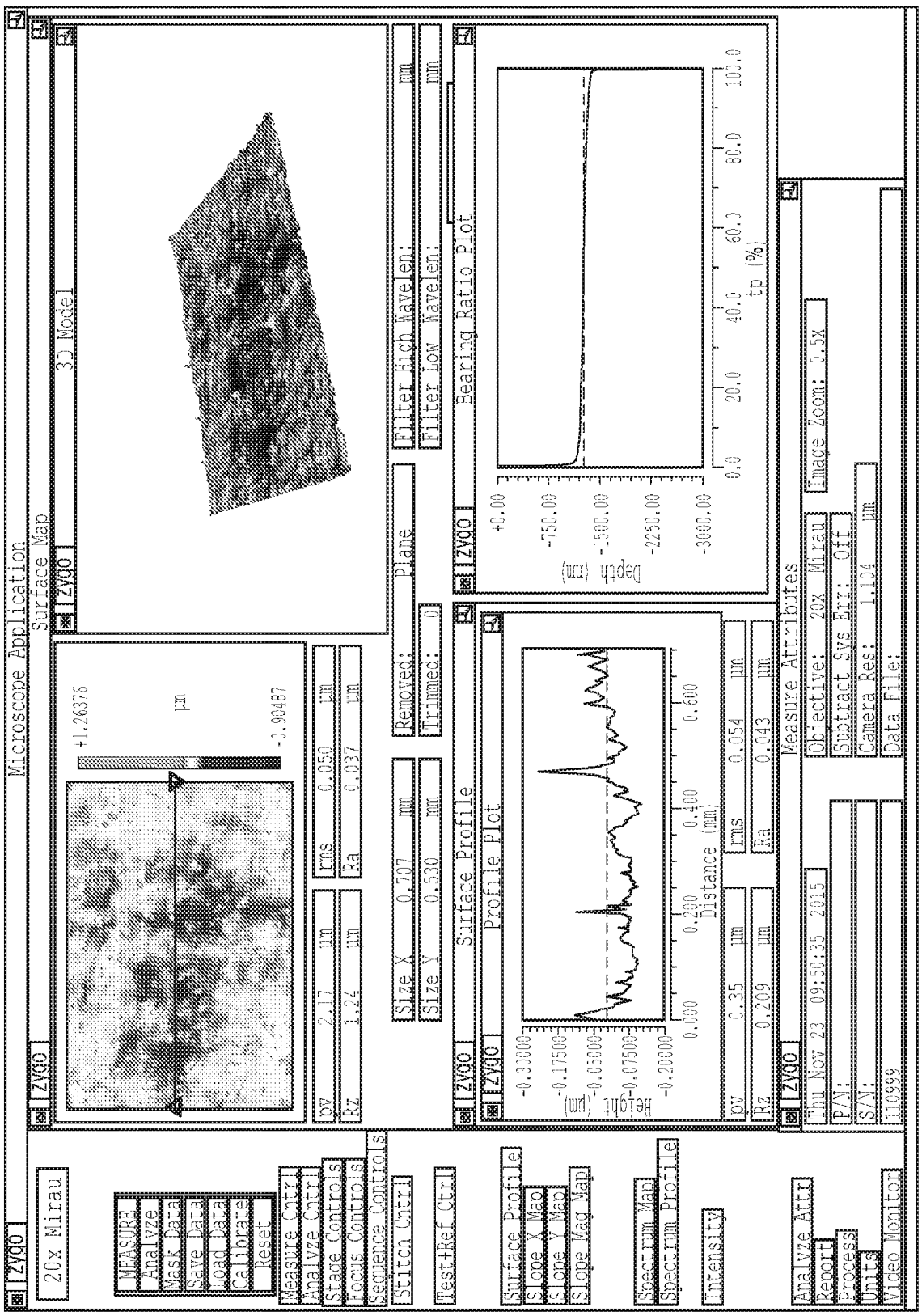
Microscope Application
Surface Map
3D Model
Surface Profile
Profile Plot
Bearing Ratio Plot
Measure Attributes
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Ctrl
Analyze Ctrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Ctrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen:
Filter Low Wavelen:
Sv 2.17 um
Rz 1.24 um
rms 0.050 um
Ra 0.037 um
Sv 0.35 um
Rz 0.209 um
rms 0.054 um
Ra 0.043 um
Thu Nov 23 09:50:35 2015
P/N:
S/N:
110999
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 um
Data File:
Image Zoom: 0.5x
Depth (um)
tp (%)
Height (um)
Distance (mm)

FIG. 257

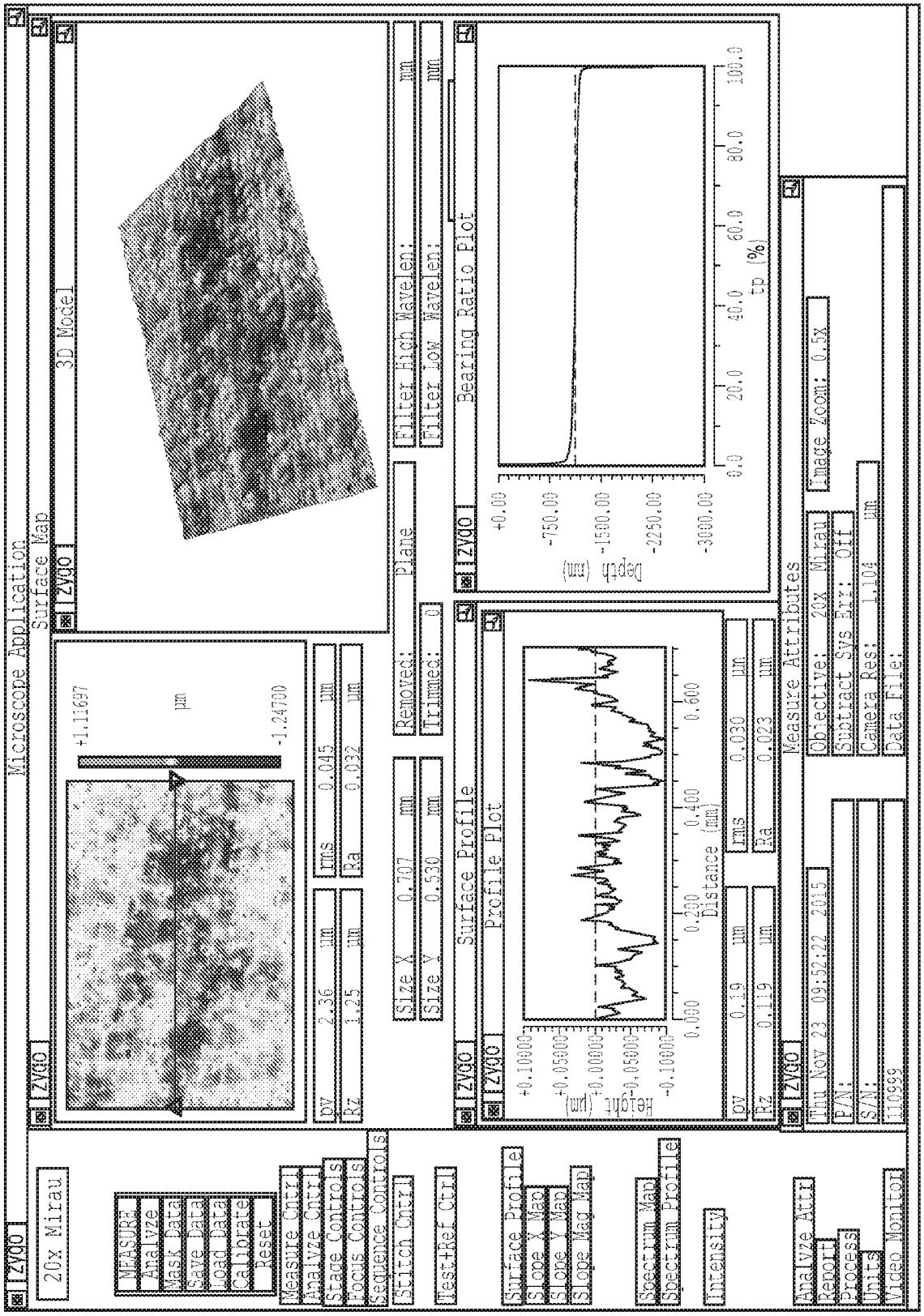
Microscope Application
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Ctrl
Analyze Ctrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Ctrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Surface Map
3D Model
+1.11697
-1.24700
µm
Sz 2.36 µm
Rz 1.25 µm
rms 0.045 µm
Ra 0.032 µm
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen: mm
Filter Low Wavelen: mm
Surface Profile
Profile Plot
Height (µm)
Distance (mm)
Sz 0.19 µm
Rz 0.119 µm
rms 0.030 µm
Ra 0.023 µm
Bearing Ratio Plot
Depth (µm)
tp (%)
Measure Attributes
Thu Nov 23 09:52:22 2015
P/N:
S/N:
110999
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 µm
Data File:
Image Zoom: 0.5x

FIG. 258

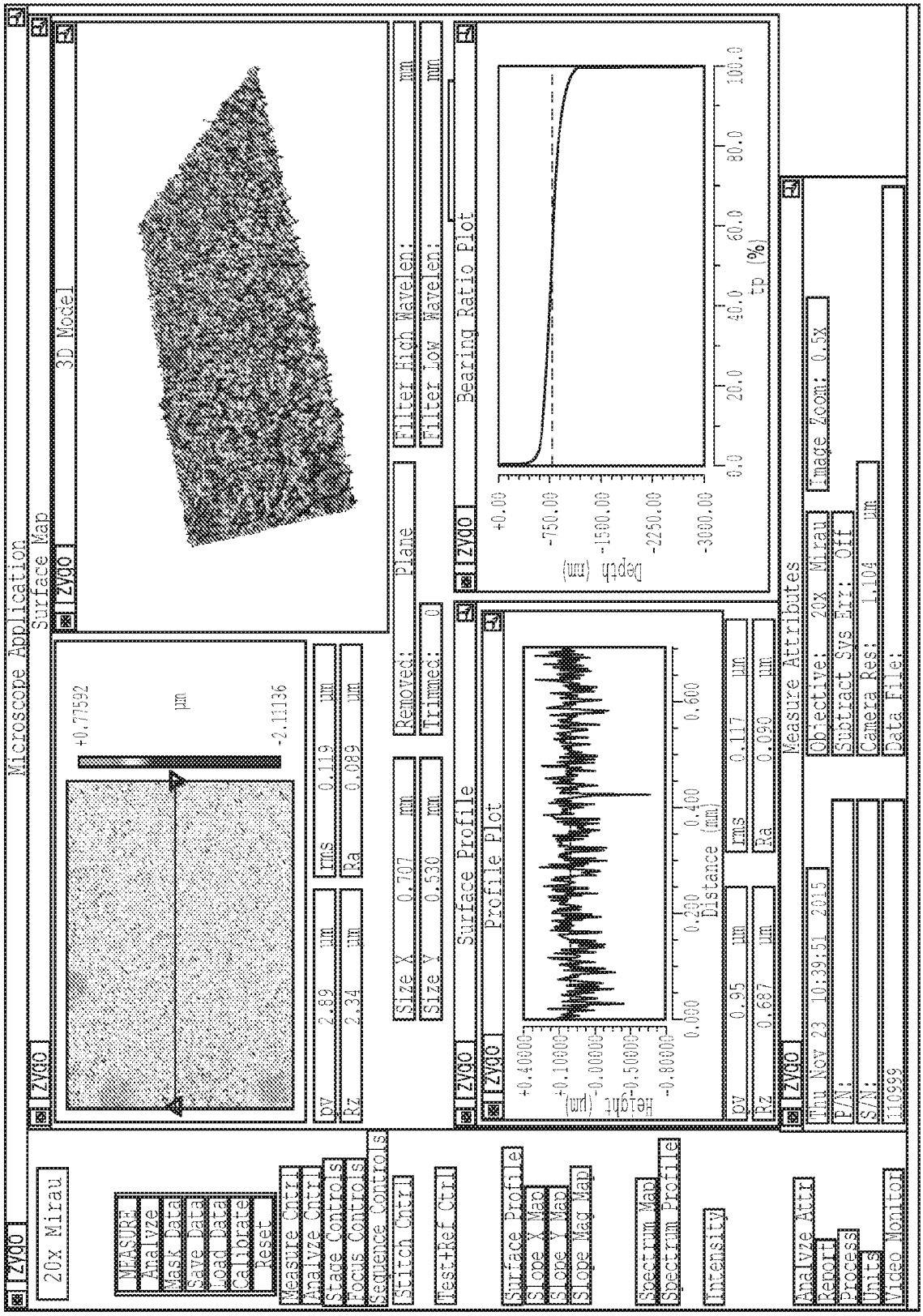
Microscope Application
ZYGO
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Ctrl
Analyze Ctrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Ctrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Surface Map
3D Model
+0.77592
-2.11136
µm
Sz 2.89 µm
Rz 2.34 µm
rms 0.119 µm
Ra 0.089 µm
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen: mm
Filter Low Wavelen: mm
Surface Profile
Profile Plot
Height (µm)
Distance (mm)
Sz 0.95 µm
Rz 0.687 µm
rms 0.117 µm
Ra 0.090 µm
Measure Attributes
Thu Nov 23 10:39:51 2015
P/N:
S/N:
110999
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 µm
Data File:
Image Zoom: 0.5x
Bearing Ratio Plot
Depth (µm)
tp (%)

FIG. 259

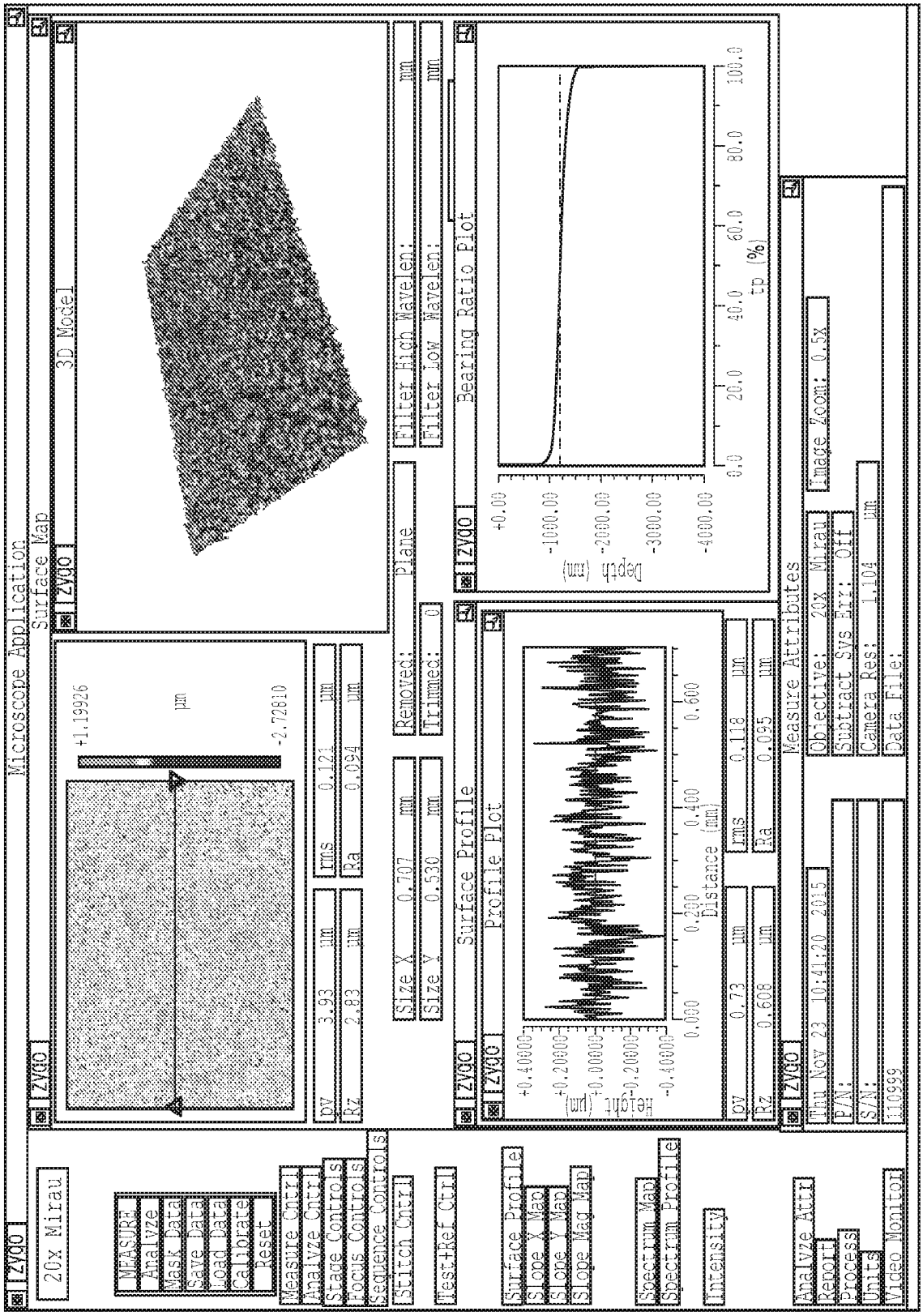
Microscope Application
Surface Map
3D Model
Surface Profile
Profile Plot
Bearing Ratio Plot
Measure Attributes
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Cntrl
Analyze Cntrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Cntrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen: mm
Filter Low Wavelen: mm
Distance (mm)
Height (µm)
Depth (mm)
tp (%)
Thu Nov 23 10:41:20 2015
P/N:
S/N:
110999
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 µm
Data File:
Image Zoom: 0.5x

FIG. 260

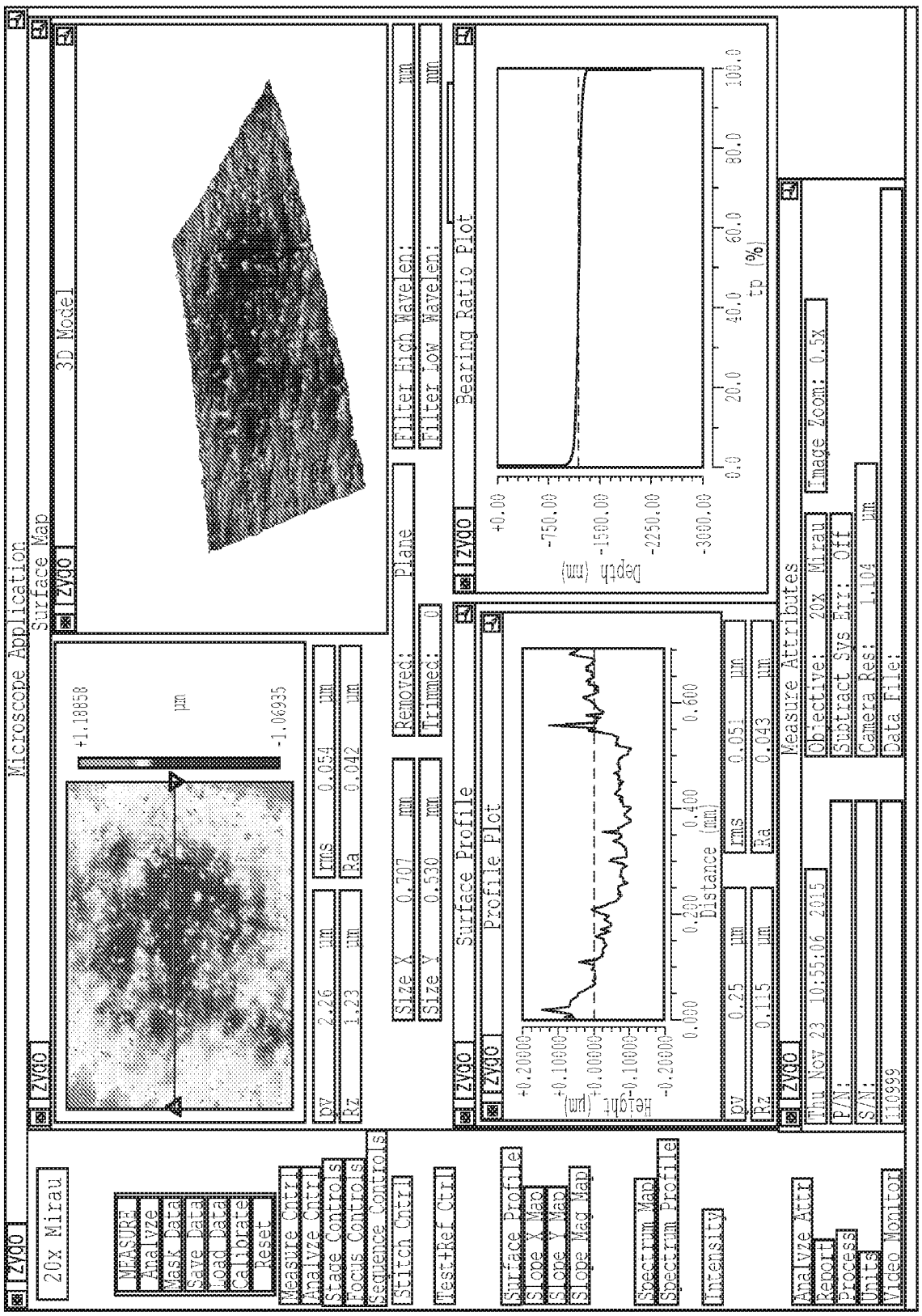
Microscope Application
Surface Map
3D Model
Bearing Ratio Plot
Surface Profile
Profile Plot
Measure Attributes
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Ctrl
Analyze Ctrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Ctrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Filter High Wavelen:
Filter Low Wavelen:
Plane
Removed:
Trimmed:
Size X 0.707 mm
Size Y 0.530 mm
Depth (um)
tp (%)
Distance (mm)
Height (um)
Objective: 20x Mirau
Image Zoom: 0.5x
Subtract Sys Err: Off
Camera Res: 1.104 um
Data File:
S/N:
P/N:
Thu Nov 23 10:59:06 2015

FIG. 261

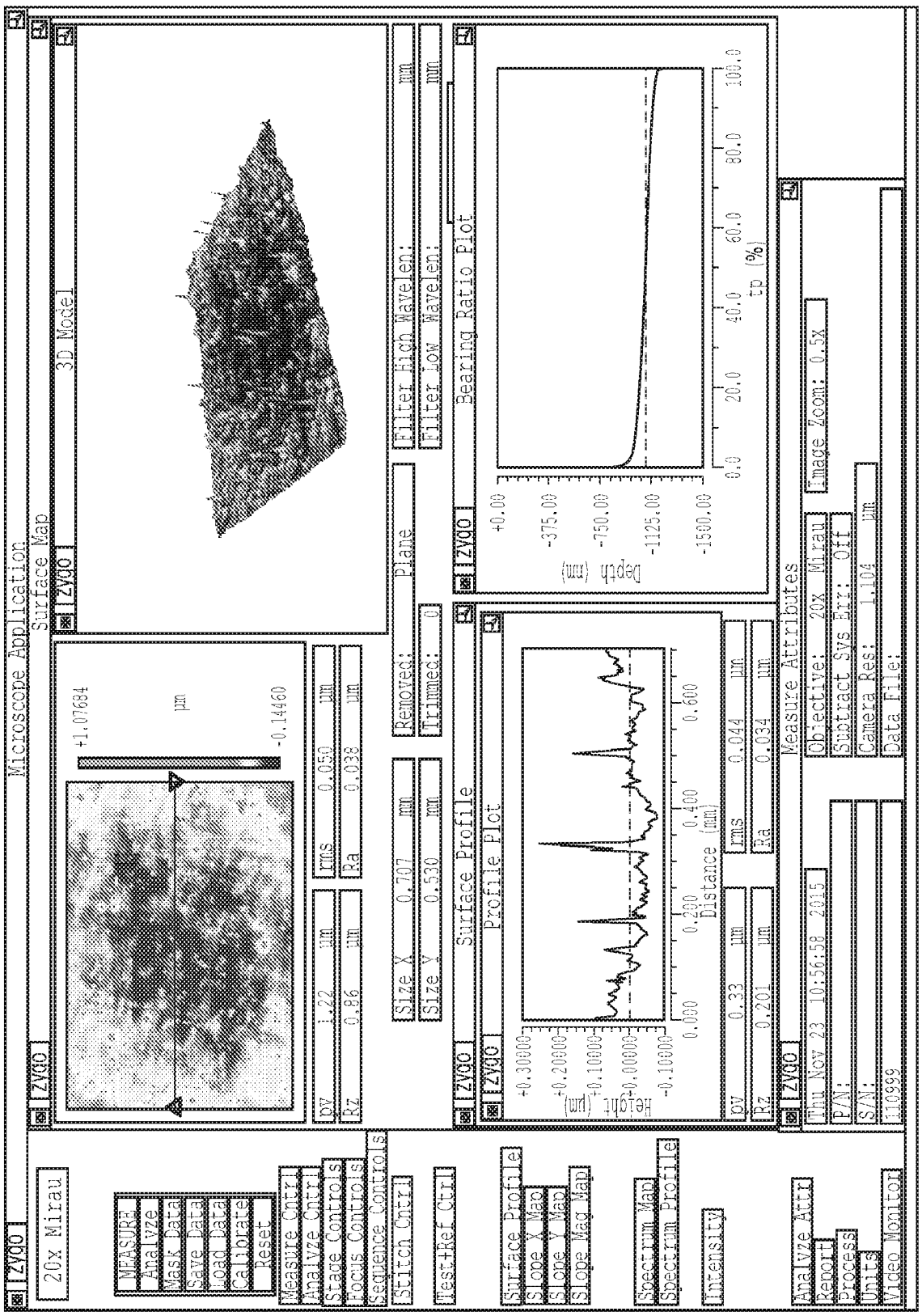
Microscope Application
ZYGO
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Ctrl
Analyze Ctrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Ctrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Surface Map
3D Model
+1.07684
µm
-0.14460
Sz 1.22 µm
Rz 0.86 µm
rms 0.050 µm
Ra 0.038 µm
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen: mm
Filter Low Wavelen: mm
Surface Profile
Profile Plot
Height (µm)
Distance (mm)
Sz 0.33 µm
Rz 0.201 µm
rms 0.044 µm
Ra 0.034 µm
Bearing Ratio Plot
Depth (µm)
tp (%)
Measure Attributes
Thu Nov 23 10:56:58 2015
P/N:
S/N:
110999
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 µm
Data File:
Image Zoom: 0.5x

FIG. 262

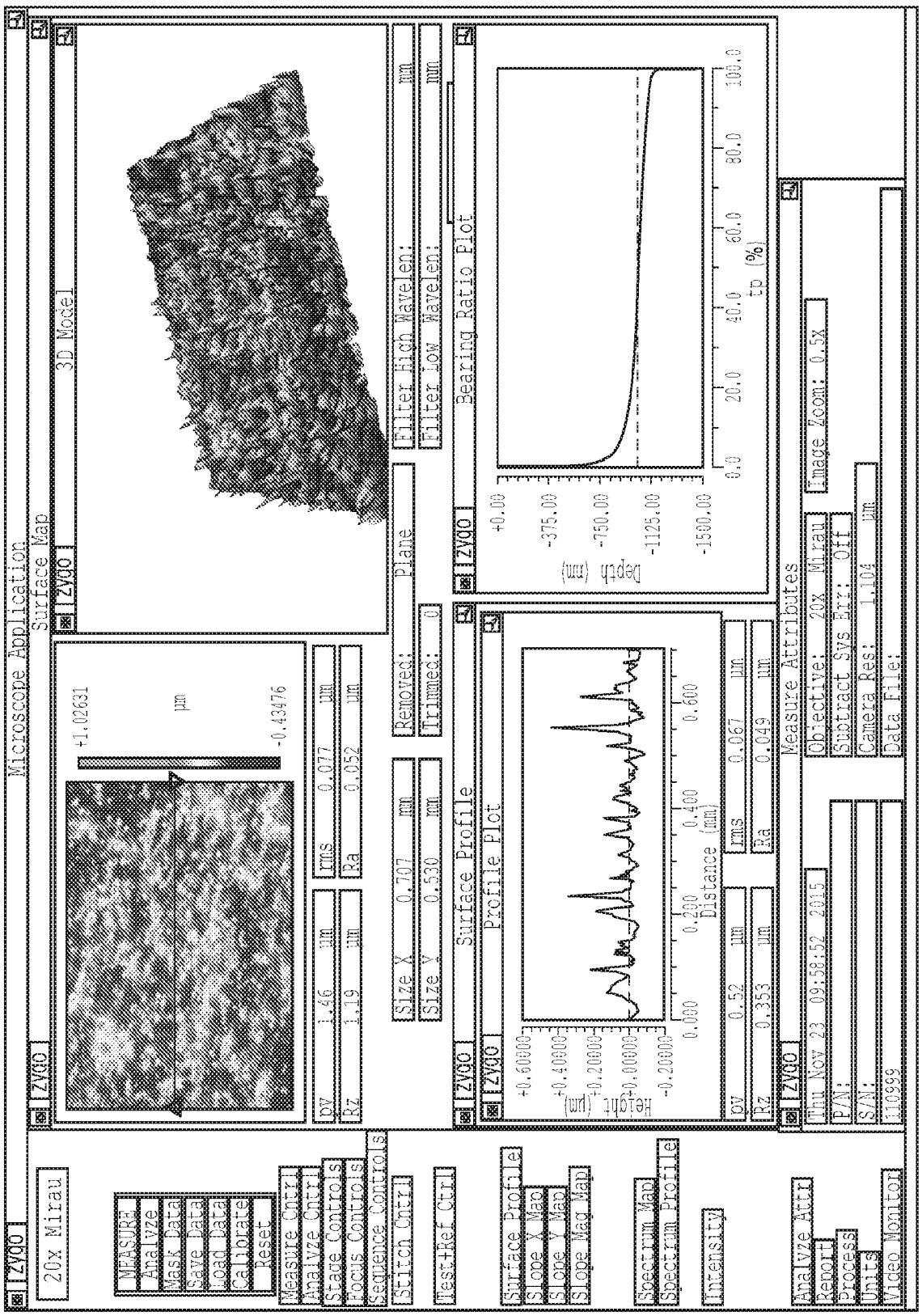
Microscope Application
ZYGO
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Ctrl
Analyze Ctrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Ctrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Surface Map
3D Model
+1.02631
-0.43476
µm
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen:
Filter Low Wavelen:
mm
Surface Profile
Profile Plot
Distance (mm)
Height (µm)
Bearing Ratio Plot
Depth (µm)
tp (%)
Measure Attributes
Objective: 20x Mirau
Image Zoom: 0.5x
Subtract Sys Err: Off
Camera Res: 1.104 µm
Data File:
Thu Nov 23 09:58:52 2015
P/N:
S/N:
110999

FIG. 263

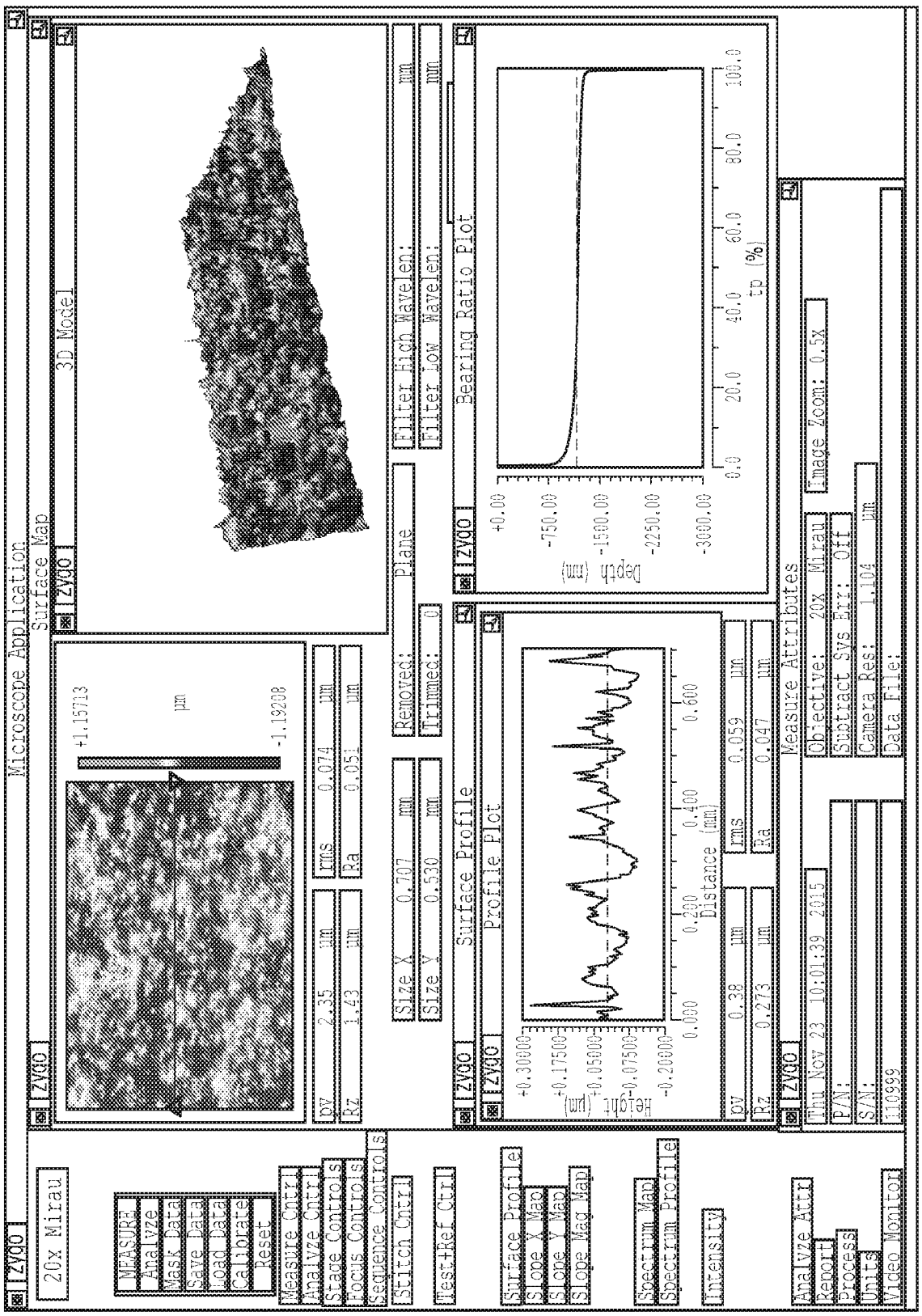
Microscope Application
ZYGO
20x Mirau
MEASURE
Analyze
Mask Data
Save Data
Load Data
Calibrate
Reset
Measure Ctrl
Analyze Ctrl
Stage Controls
Focus Controls
Sequence Controls
Stitch Ctrl
Test+Ref Ctrl
Surface Profile
Slope X Map
Slope Y Map
Slope Mag Map
Spectrum Map
Spectrum Profile
Intensity
Analyze Attr
Report
Process
Units
Video Monitor
Surface Map
3D Model
+1.15713
-1.19208
µm
Sz 2.35 µm
Rz 1.43 µm
rms 0.074 µm
Ra 0.051 µm
Size X 0.707 mm
Size Y 0.530 mm
Removed: Plane
Trimmed: 0
Filter High Wavelen: mm
Filter Low Wavelen: mm
Surface Profile
Profile Plot
Height (µm)
Distance (mm)
Sz 0.38 µm
Rz 0.273 µm
rms 0.059 µm
Ra 0.047 µm
Bearing Ratio Plot
Depth (µm)
tp (%)
Measure Attributes
Thu Nov 23 10:01:39 2015
PAN:
S/N:
110999
Objective: 20x Mirau
Subtract Sys Err: Off
Camera Res: 1.104 µm
Data File:
Image Zoom: 0.5x

FIG. 264

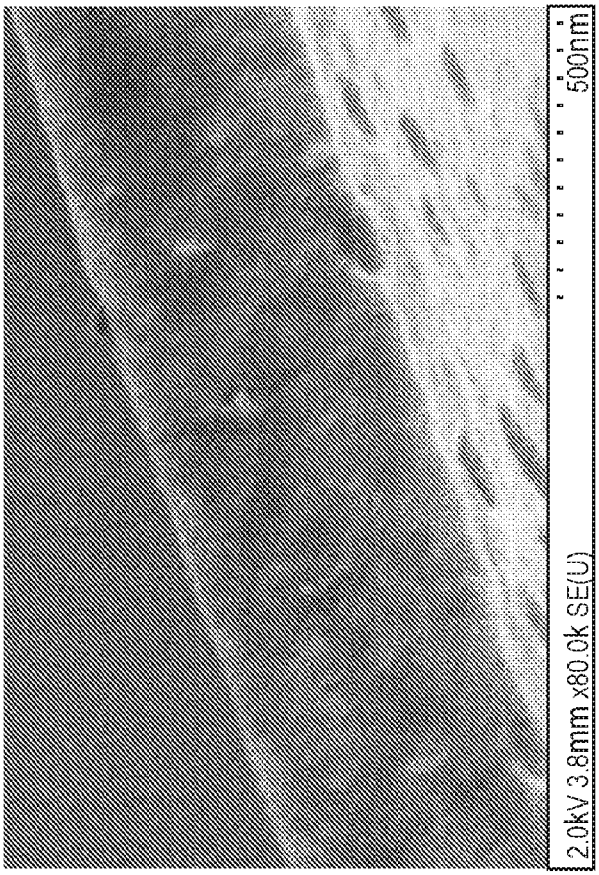

FIG. 265

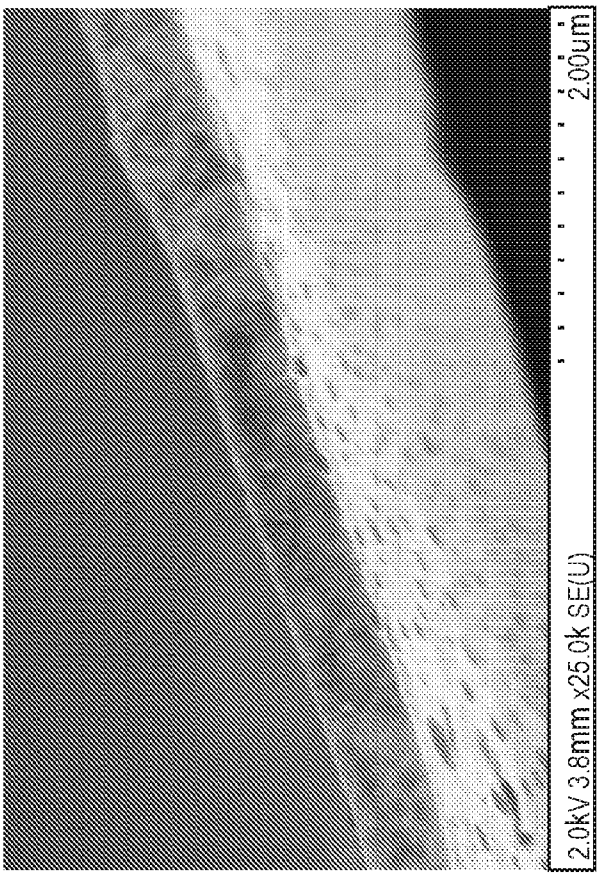

FIG. 266

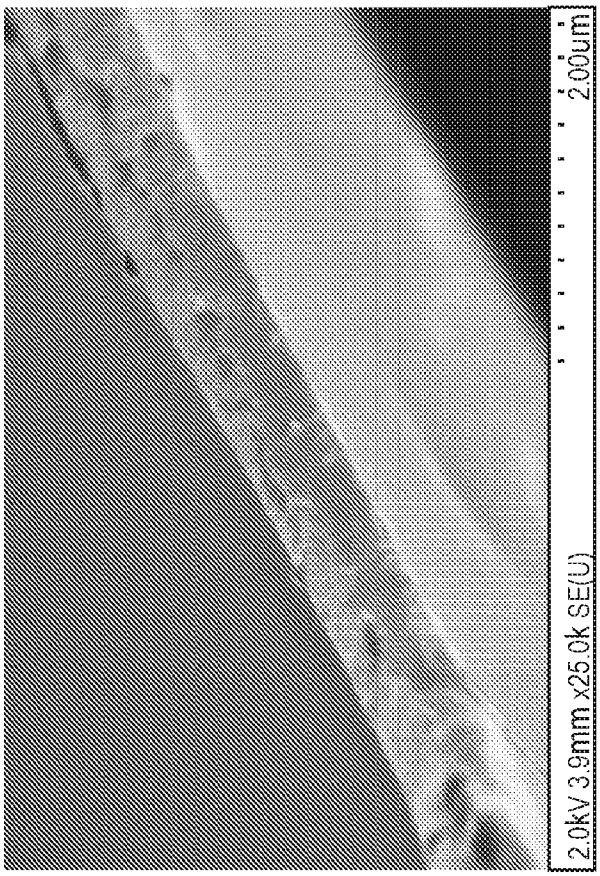

FIG. 267

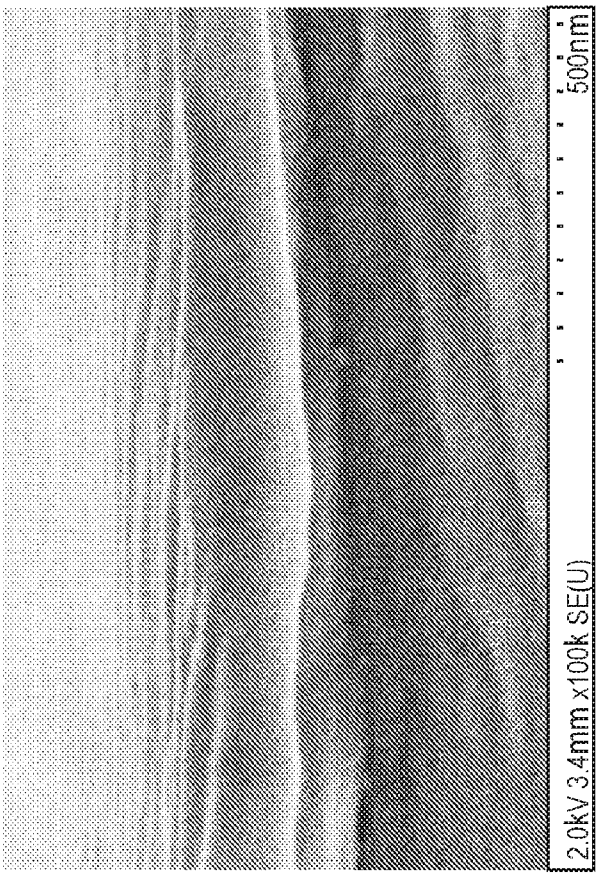

FIG. 268

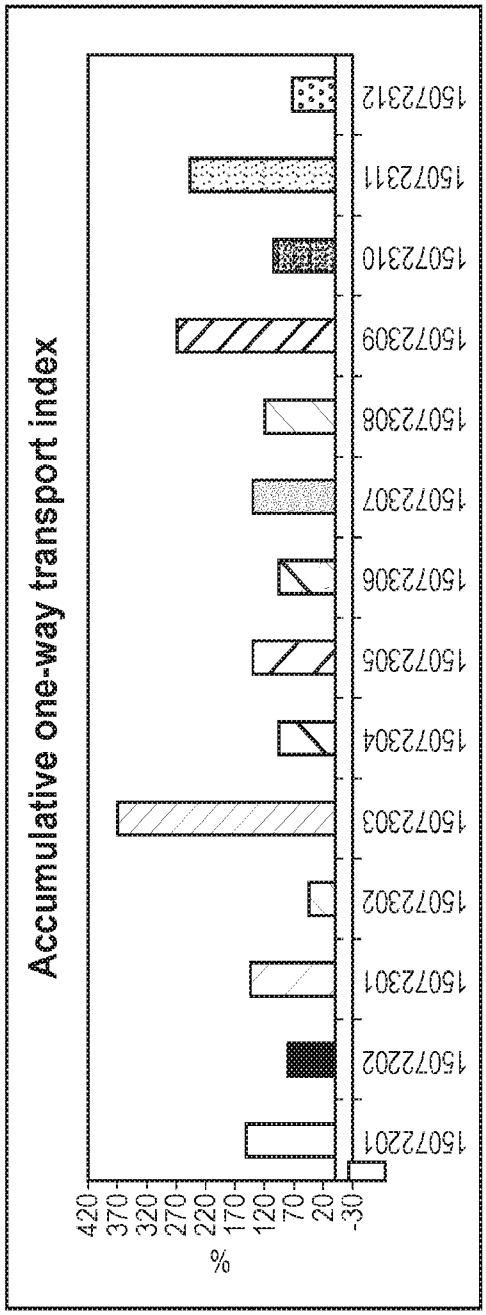
Accumulative one-way transport index
420
370
320
270
220
170
120
70
20
-30
%
15072201
15072202
15072301
15072302
15072303
15072304
15072305
15072306
15072307
15072308
15072309
15072310
15072311
15072312

FIG. 269

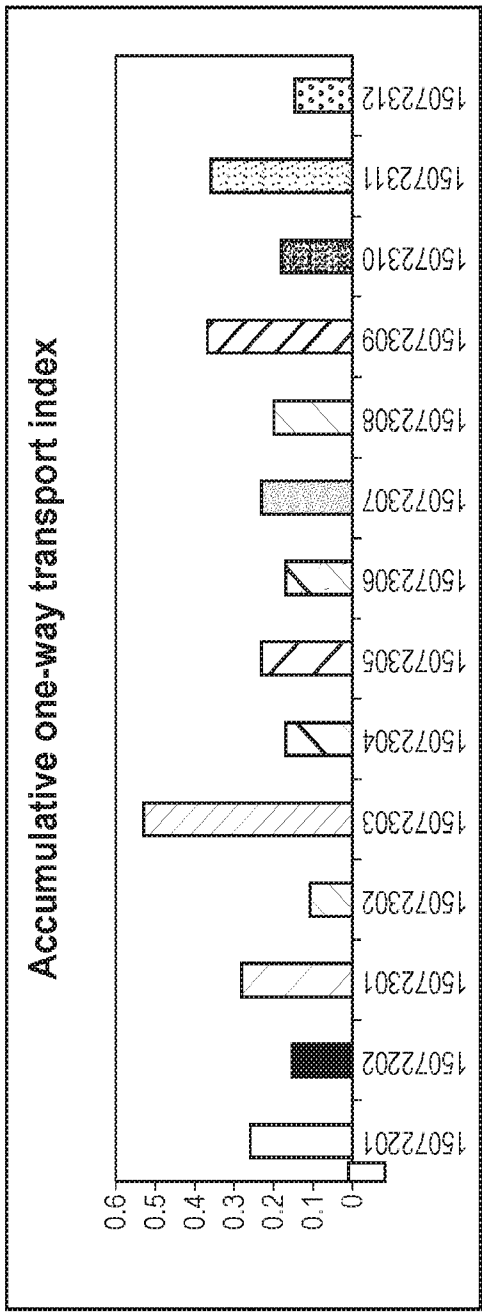
Accumulative one-way transport index
0.6
0.5
0.4
0.3
0.2
0.1
0
15072201
15072202
15072301
15072302
15072303
15072304
15072305
15072306
15072307
15072308
15072309
15072310
15072311
15072312

FIG. 270