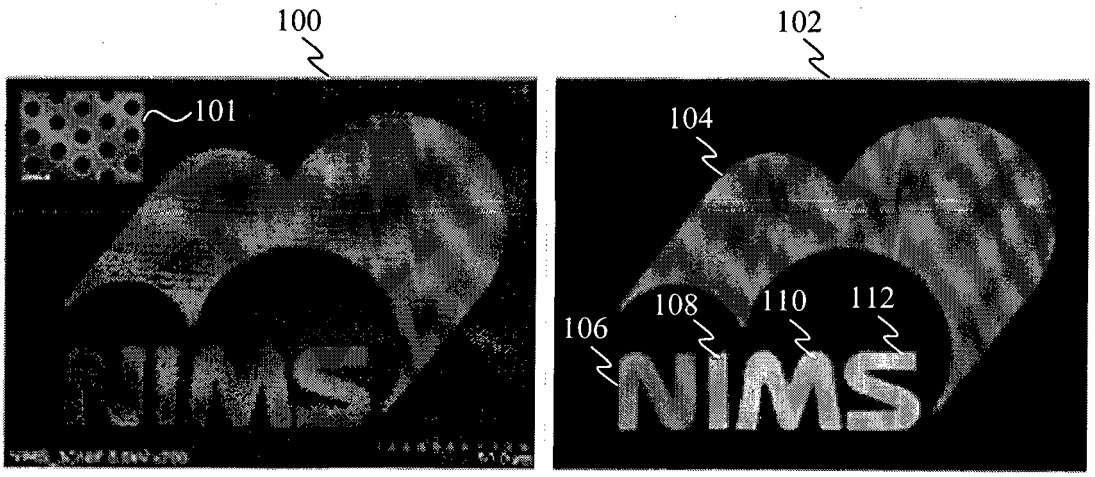


FIG. 1A (PRIOR ART)

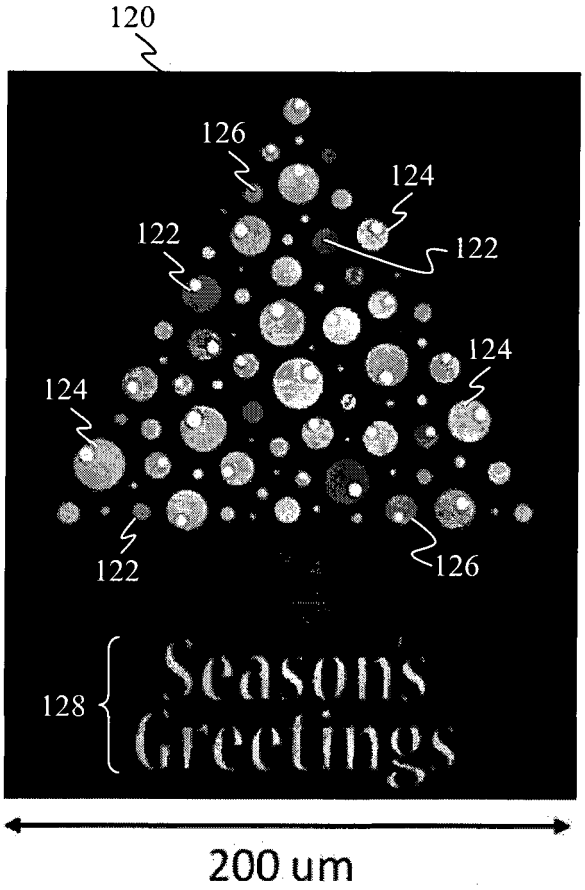


FIG. 1B (PRIOR ART)

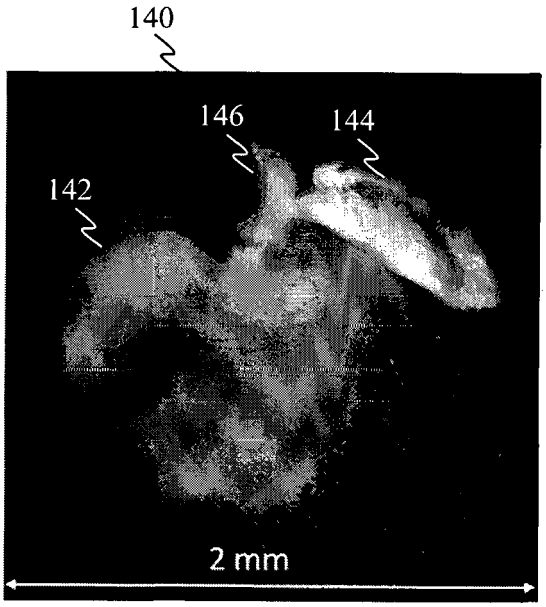


FIG. 1C (PRIOR ART)

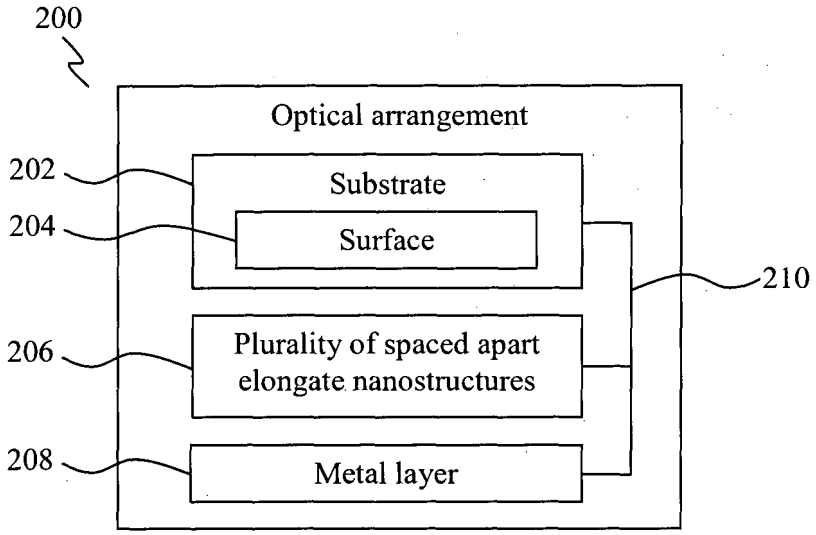

200
Optical arrangement
202
Substrate
204
Surface
210
206
Plurality of spaced apart elongate nanostructures
208
Metal layer

FIG. 2A

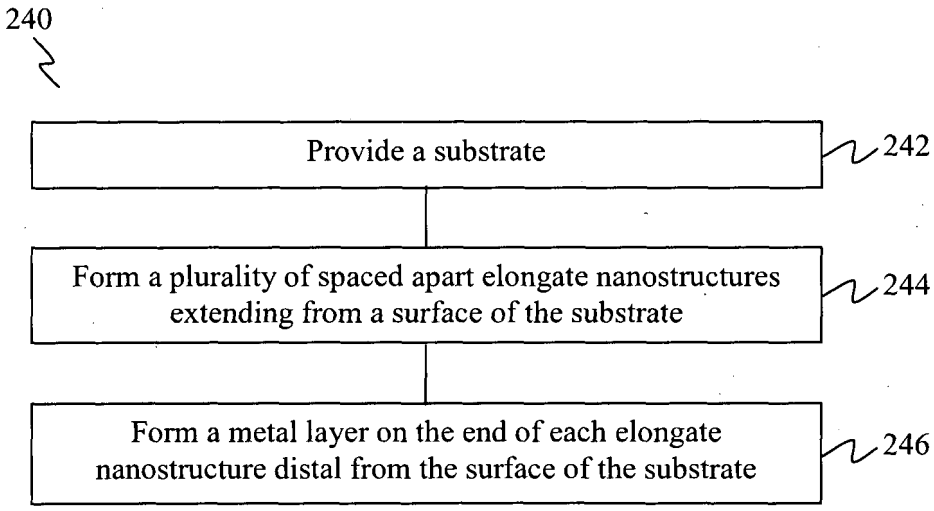

240
Provide a substrate
242
Form a plurality of spaced apart elongate nanostructures extending from a surface of the substrate
244
Form a metal layer on the end of each elongate nanostructure distal from the surface of the substrate
246

FIG. 2B

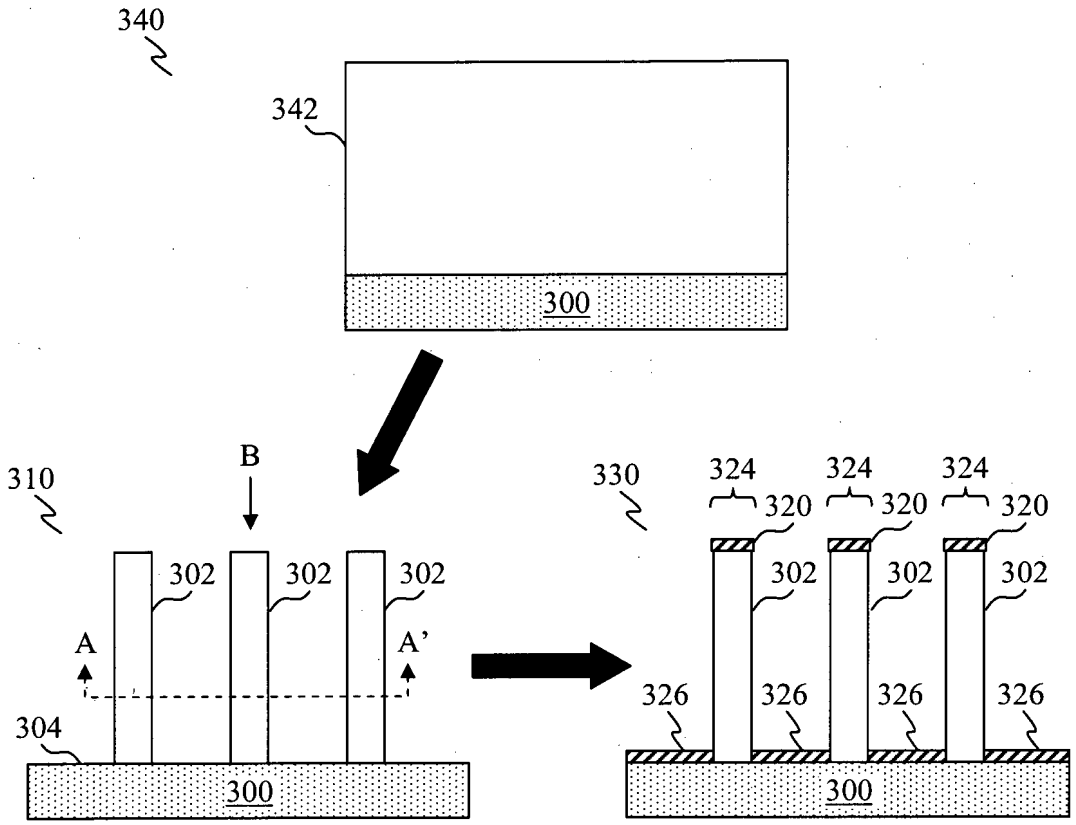

340
342
300
310
B
302
302
302
A
A'
304
300
330
324
324
324
320
320
320
302
302
302
326
326
326
326
300

FIG. 3A

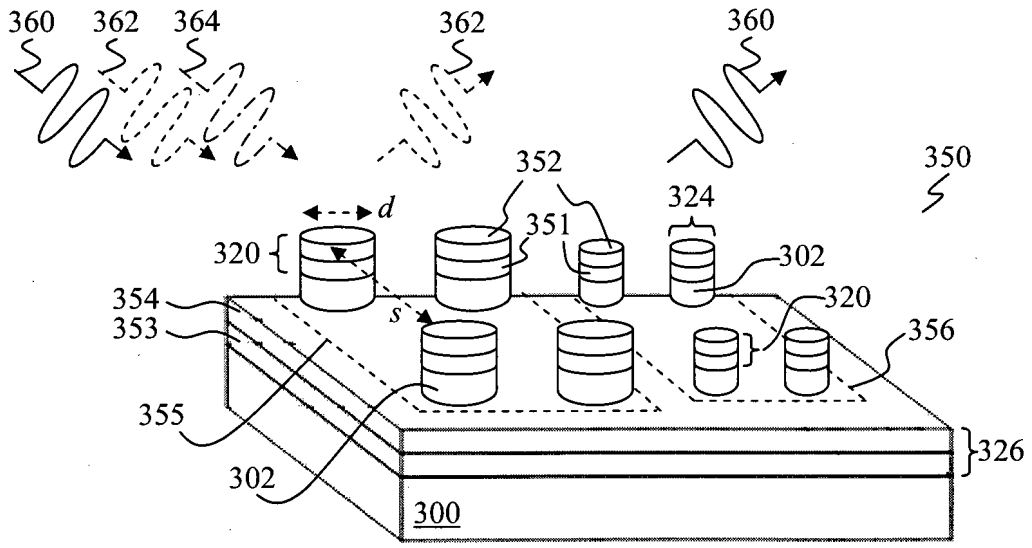

360
362
364
362
360
350
352
324
d
320
351
302
354
353
s
320
356
355
326
302
300

FIG. 3B

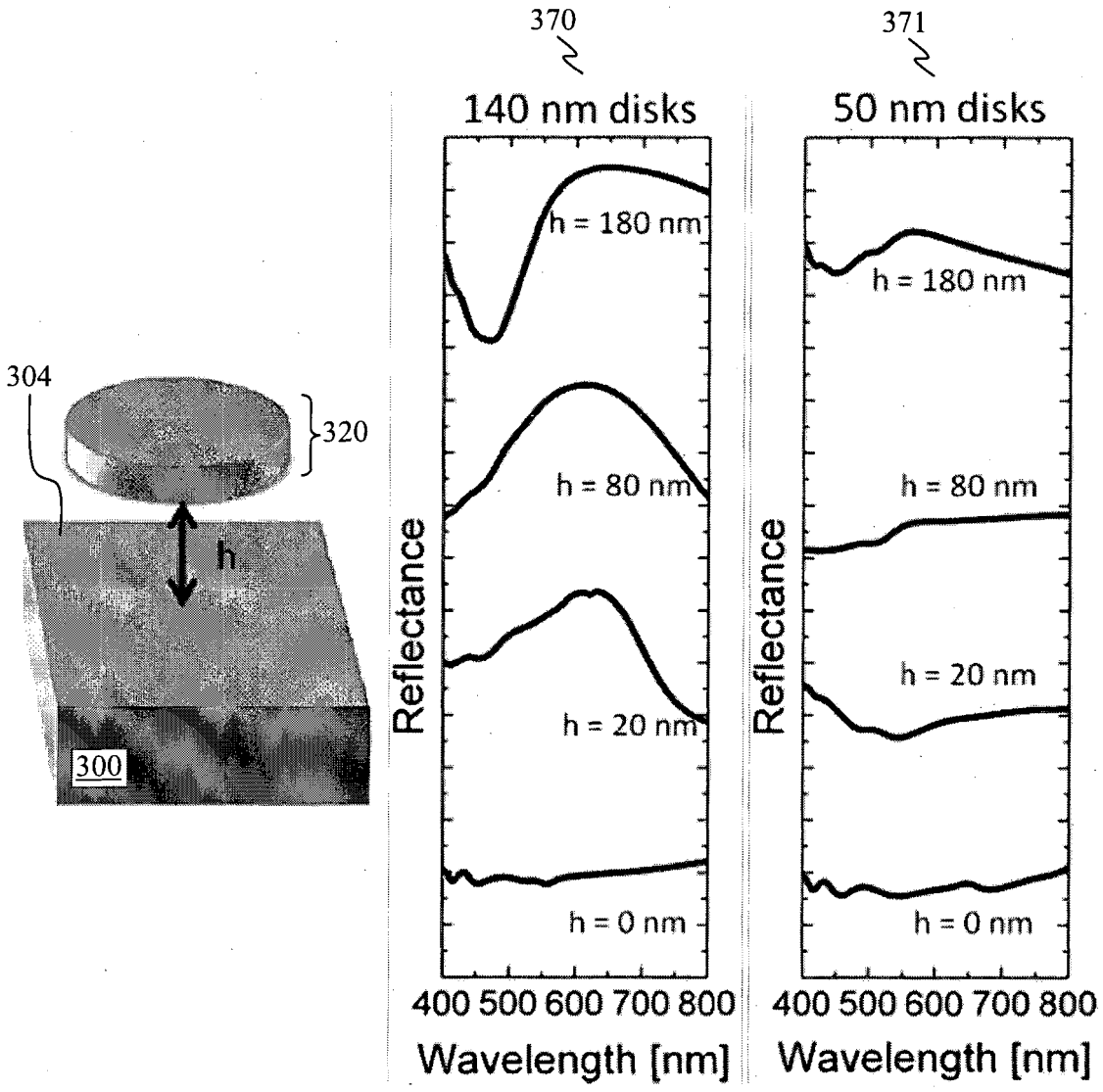

370
371
140 nm disks
50 nm disks
304
320
h
300
h = 180 nm
h = 80 nm
h = 20 nm
h = 0 nm
Reflectance
400 500 600 700 800
Wavelength [nm]

FIG. 3C

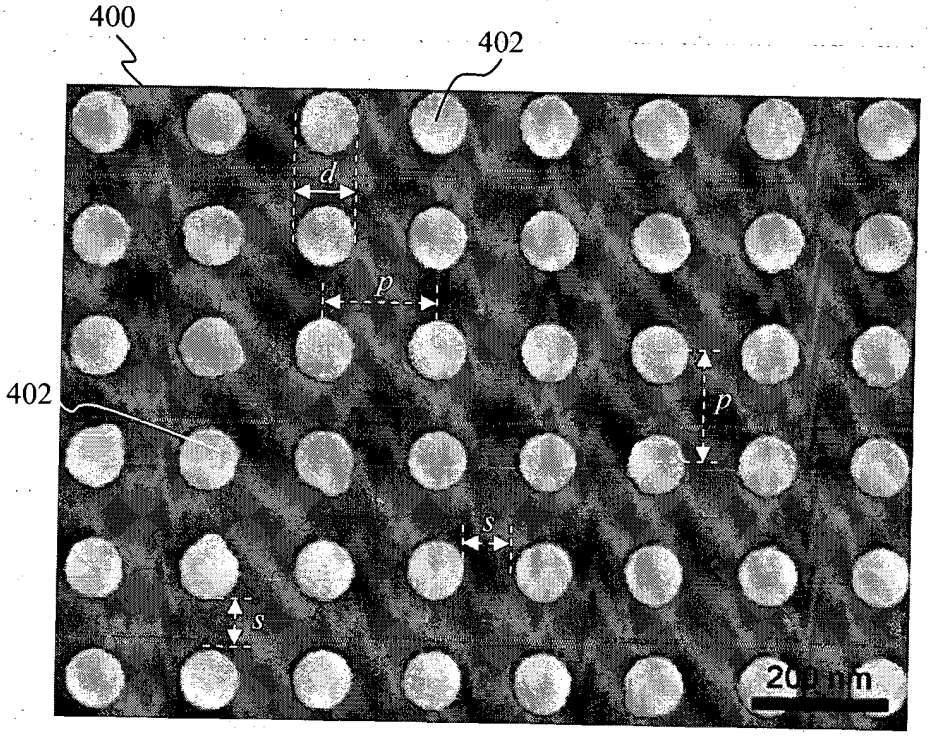

400
402
402
d
p
p
s
s
200 nm

FIG. 4A

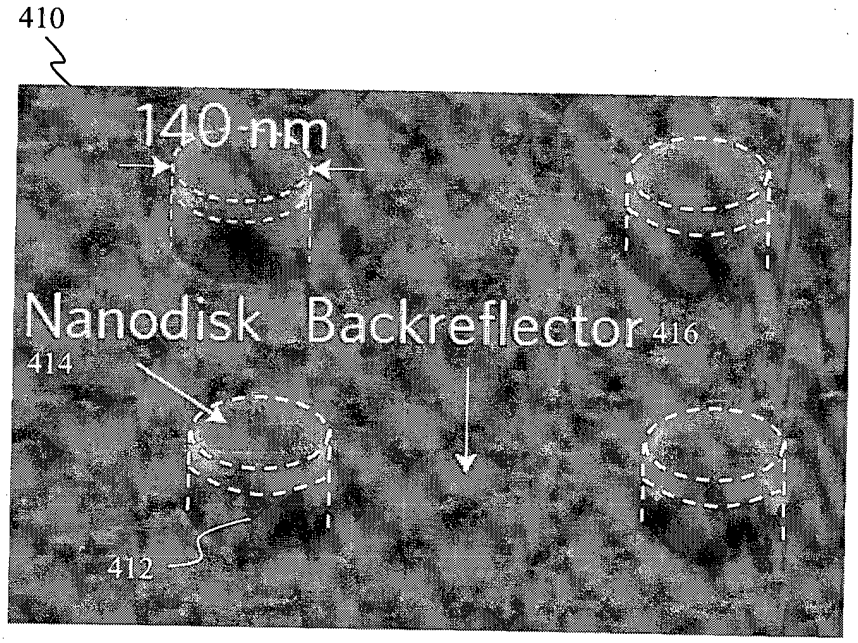

410
140-nm
Nanodisk
Backreflector
416
414
412

FIG. 4B

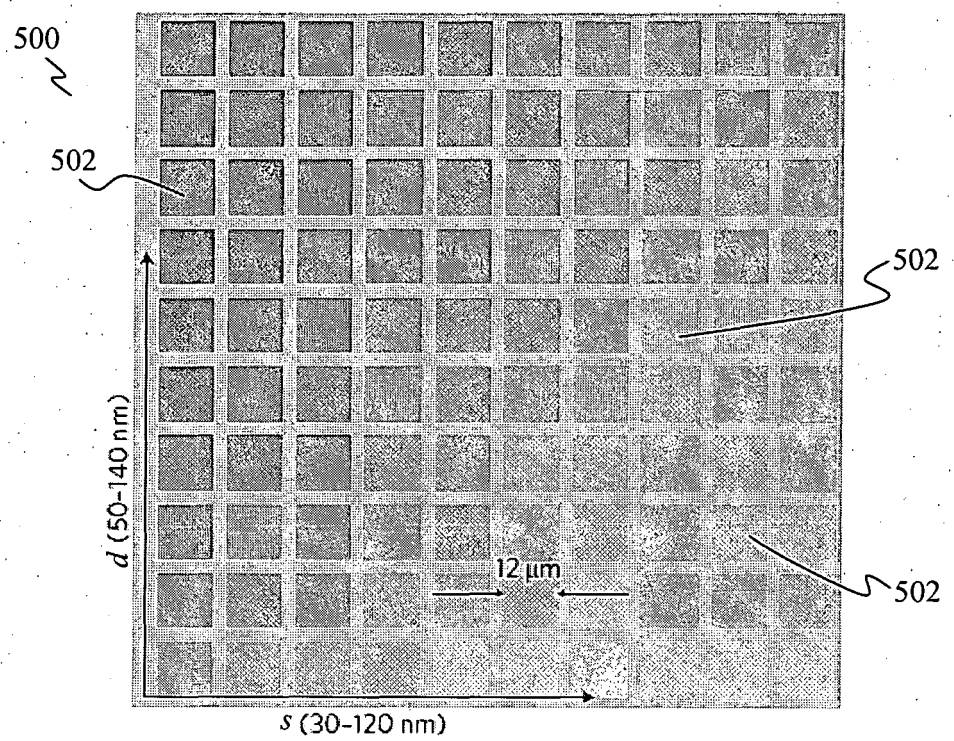

500
502
502
502
d (50-140 nm)
12 µm
s (30-120 nm)

FIG. 5A

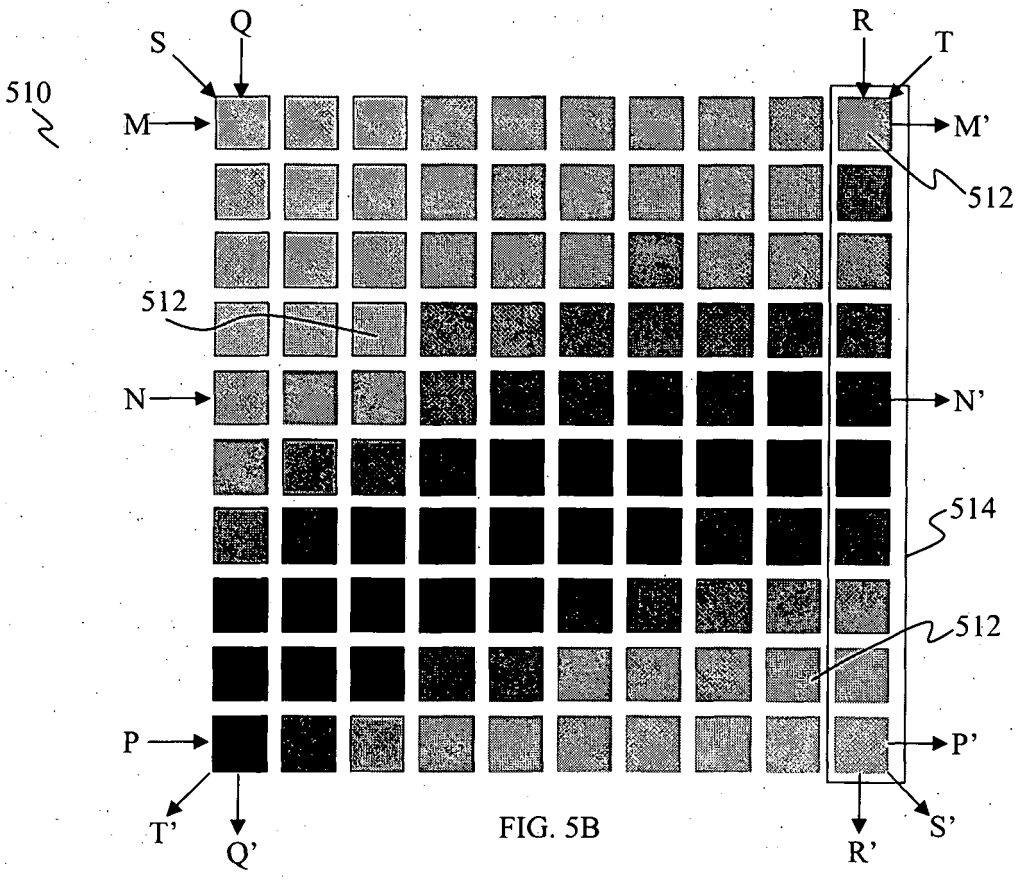

510
S
Q
R
T
M
M'
512
512
N
N'
514
512
P
P'
T'
Q'
R'
S'

FIG. 5B

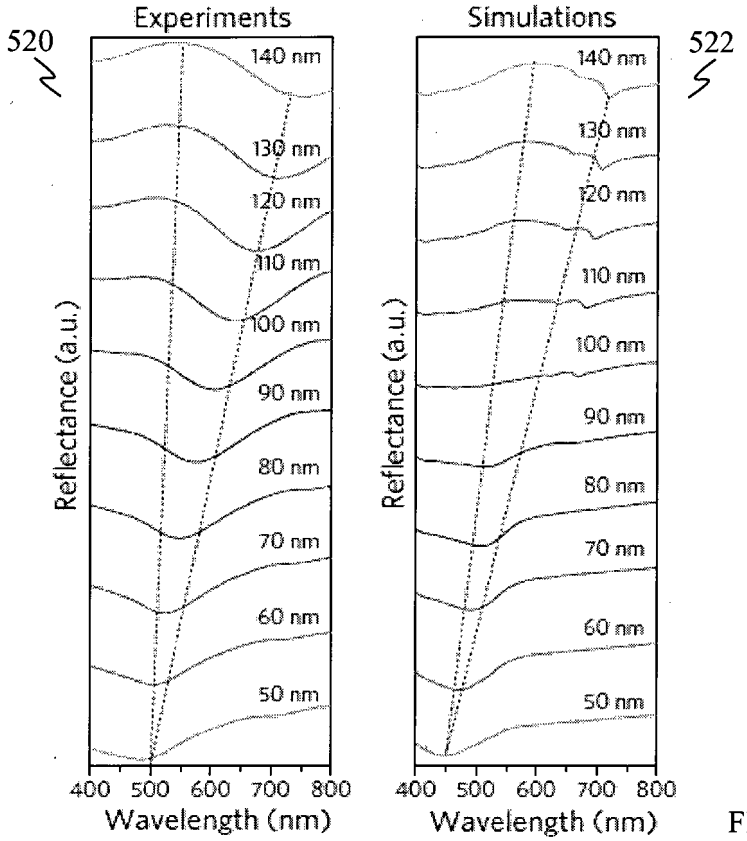

Experiments
Simulations
520
522
140 nm
130 nm
120 nm
110 nm
100 nm
90 nm
80 nm
70 nm
60 nm
50 nm
Reflectance (a.u.)
400 500 600 700 800
Wavelength (nm)

FIG. 5C

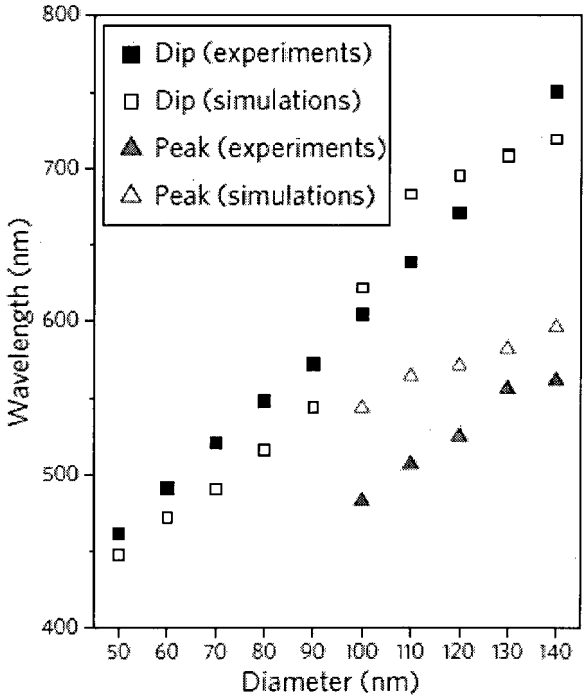

Dip (experiments)
Dip (simulations)
Peak (experiments)
Peak (simulations)
Wavelength (nm)
800
700
600
500
400
50 60 70 80 90 100 110 120 130 140
Diameter (nm)

FIG. 5D

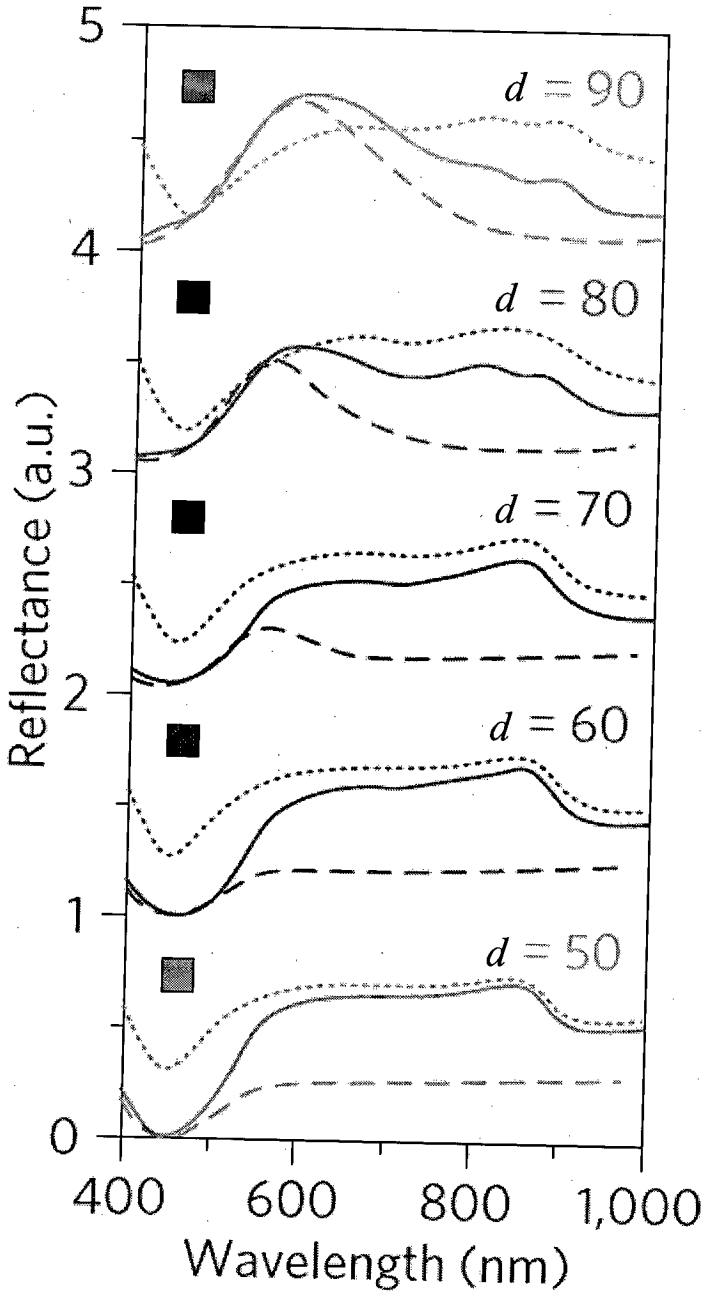

5
4
3
2
1
0
Reflectance (a.u.)
d = 90
d = 80
d = 70
d = 60
d = 50
400
600
800
1,000
Wavelength (nm)

FIG. 6A

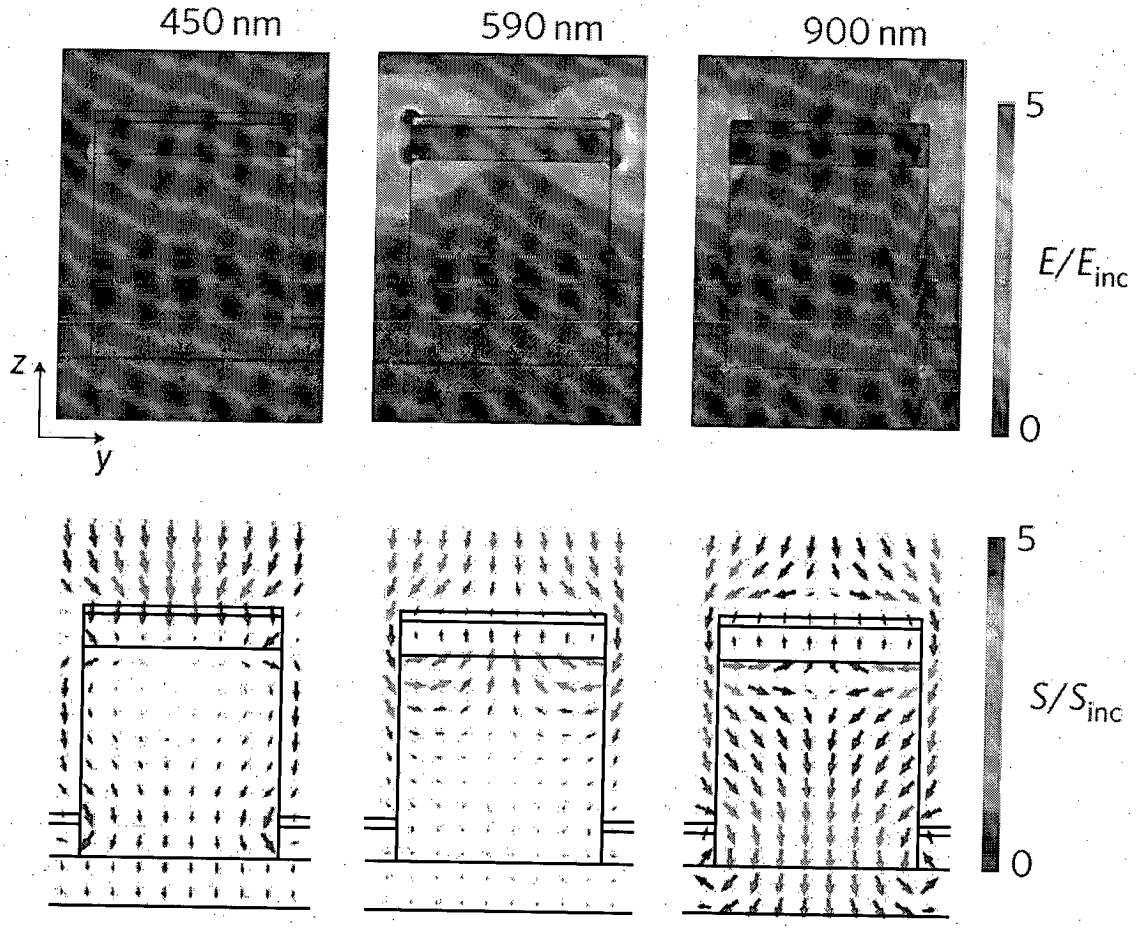


FIG. 6B

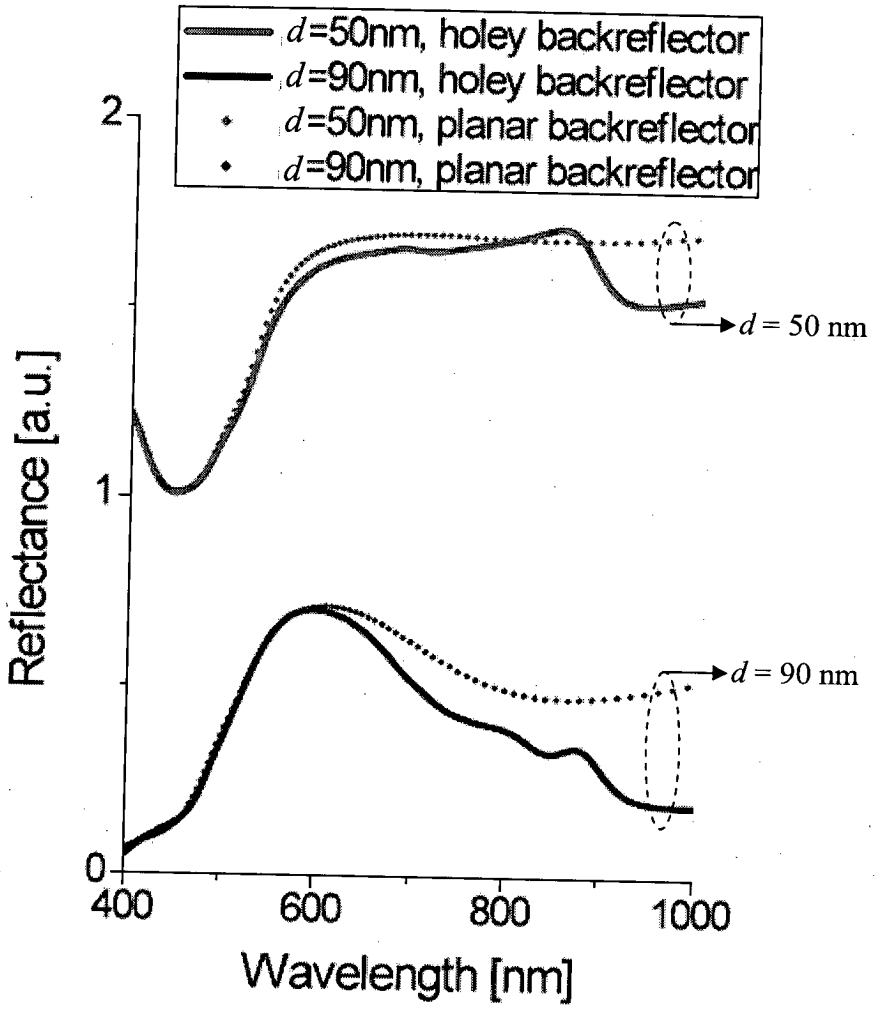

d=50nm, holey backreflector
d=90nm, holey backreflector
d=50nm, planar backreflector
d=90nm, planar backreflector
d = 50 nm
d = 90 nm
Reflectance [a.u.]
Wavelength [nm]
0
1
2
400
600
800
1000

FIG. 7

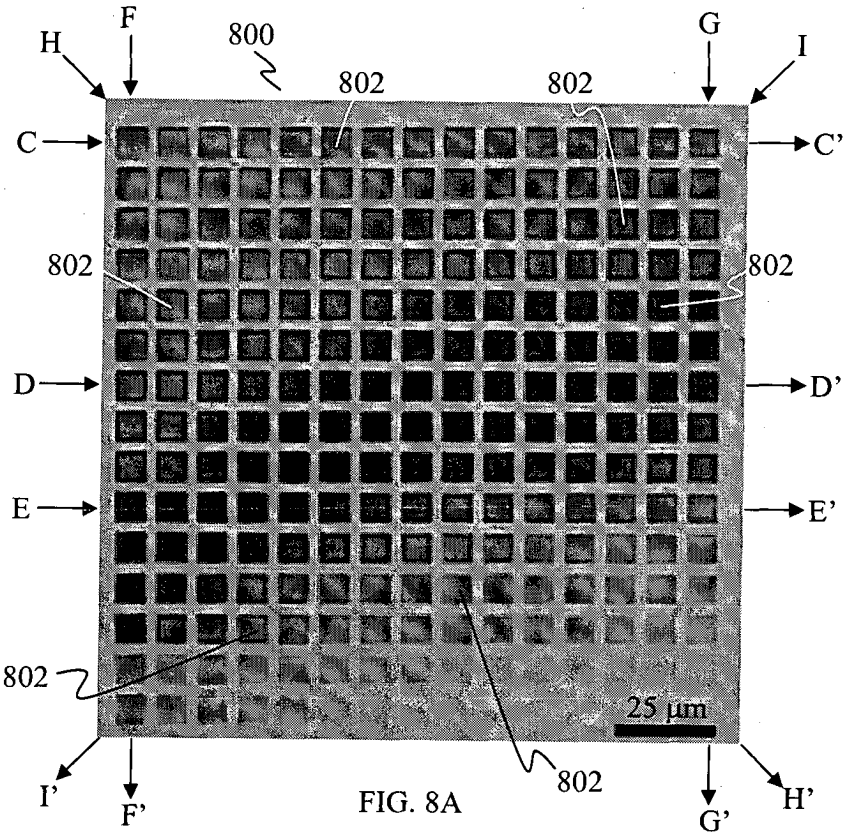


FIG. 8A

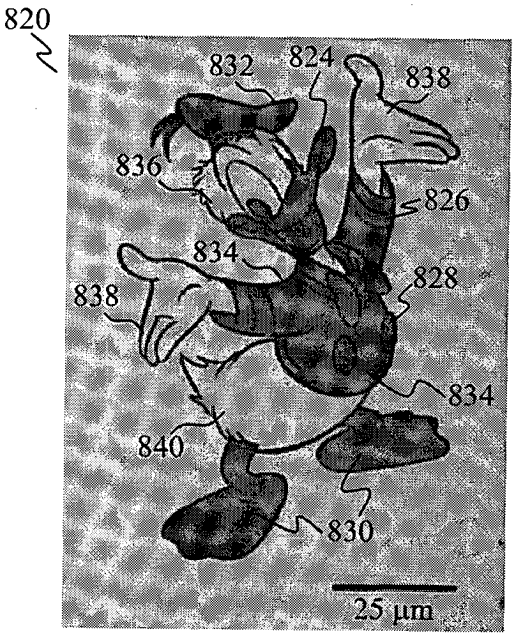


FIG. 8B

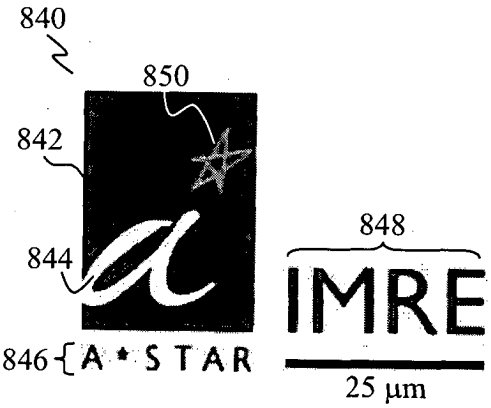


FIG. 8C

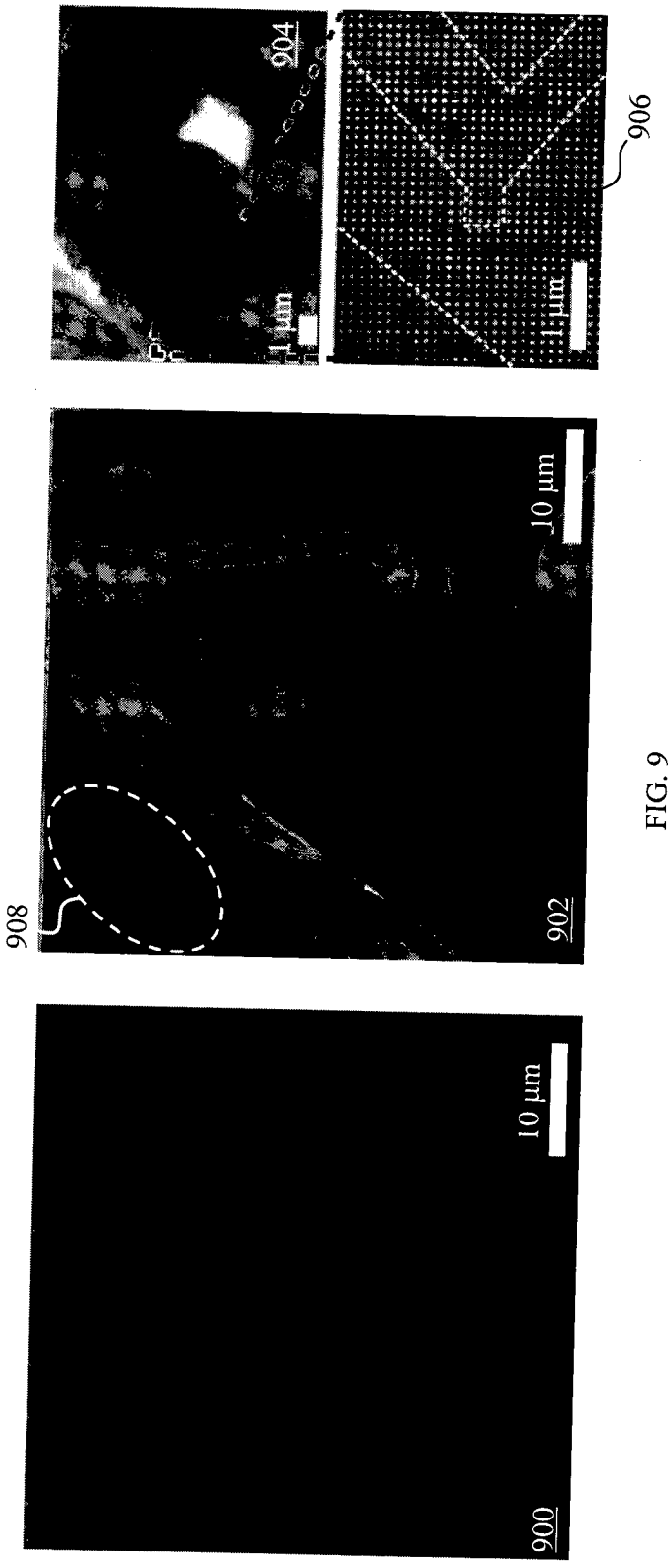


FIG. 9

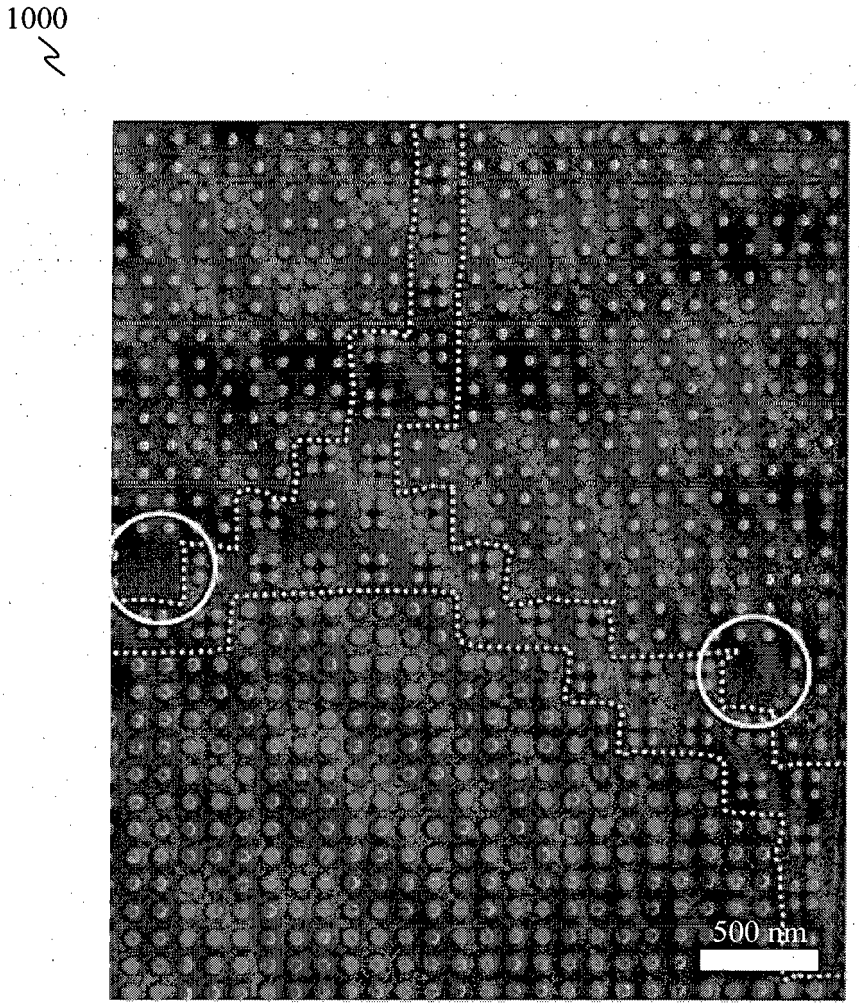


FIG. 10

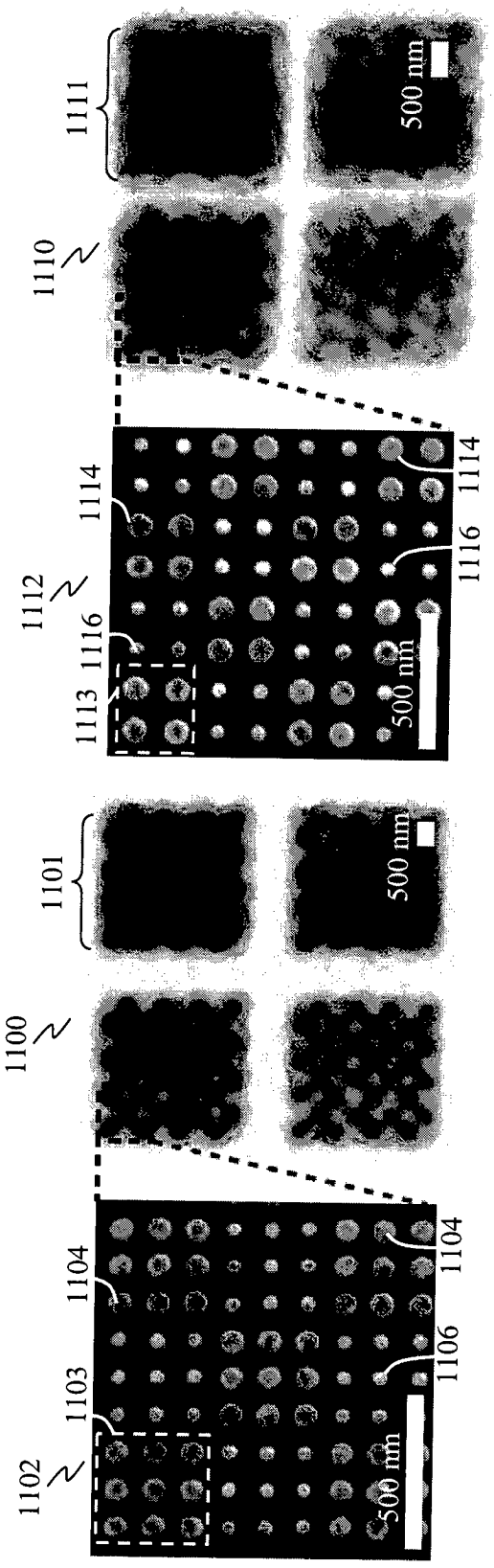

1111
500 nm
1110
1114
1116
1112
1116
1113
500 nm
1101
500 nm
1100
1104
1104
1106
1103
1102
500 nm

FIG. 11

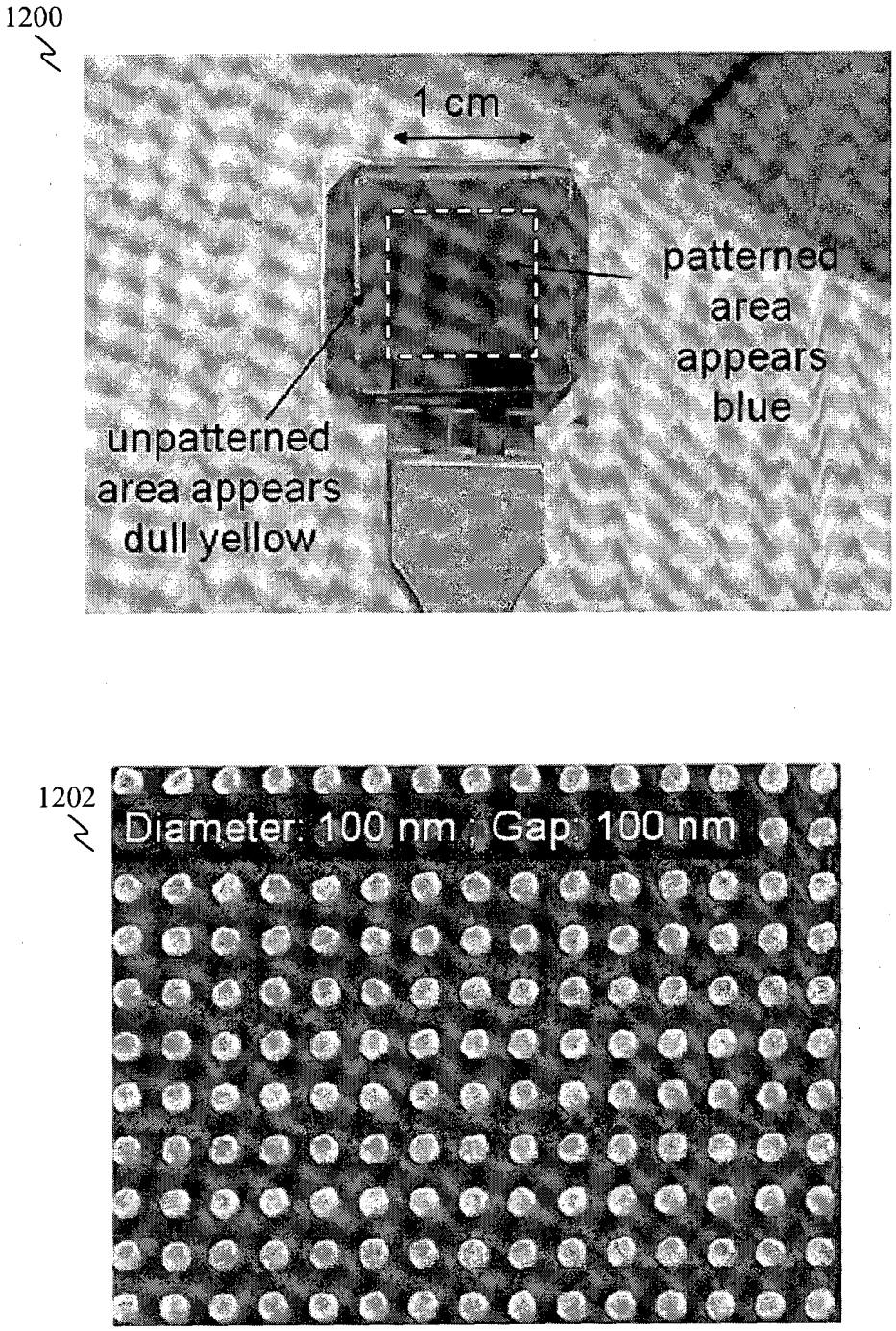

1200
1 cm
patterned area appears blue
unpatterned area appears dull yellow
1202
Diameter: 100 nm ; Gap: 100 nm

FIG. 12