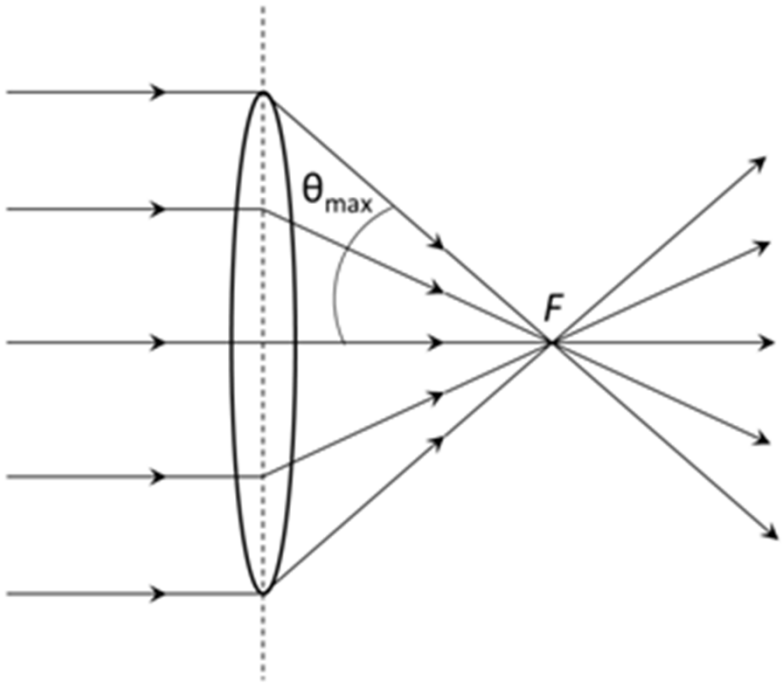


FIG. 1A

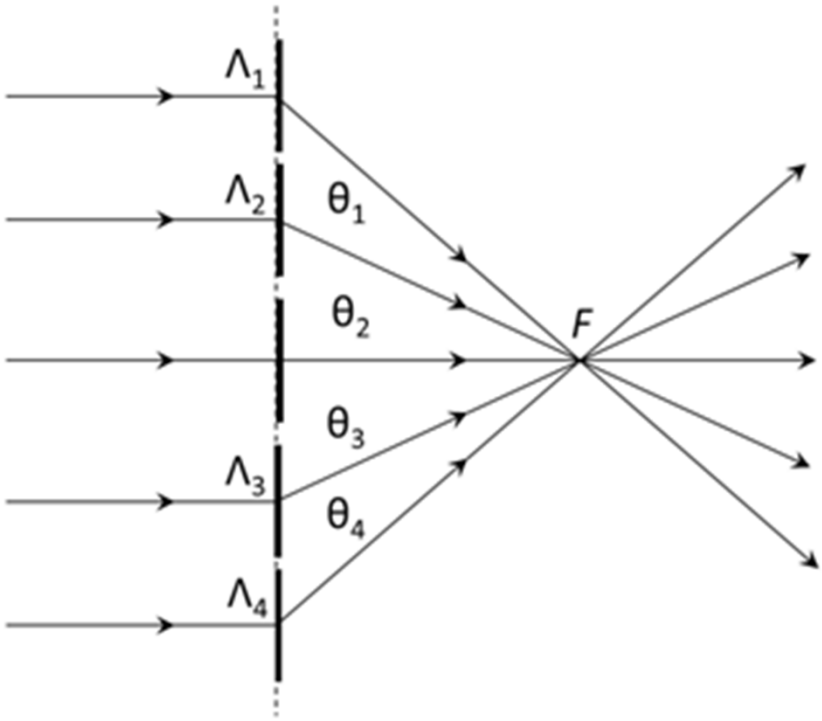


FIG. 1B

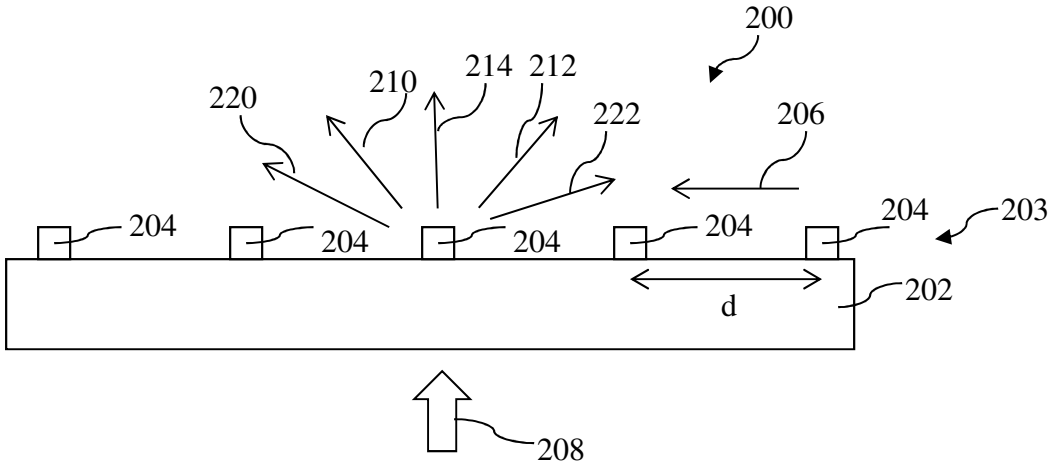
200
210
214
212
220
222
206
204
204
204
204
204
203
d
202
208

FIG. 2

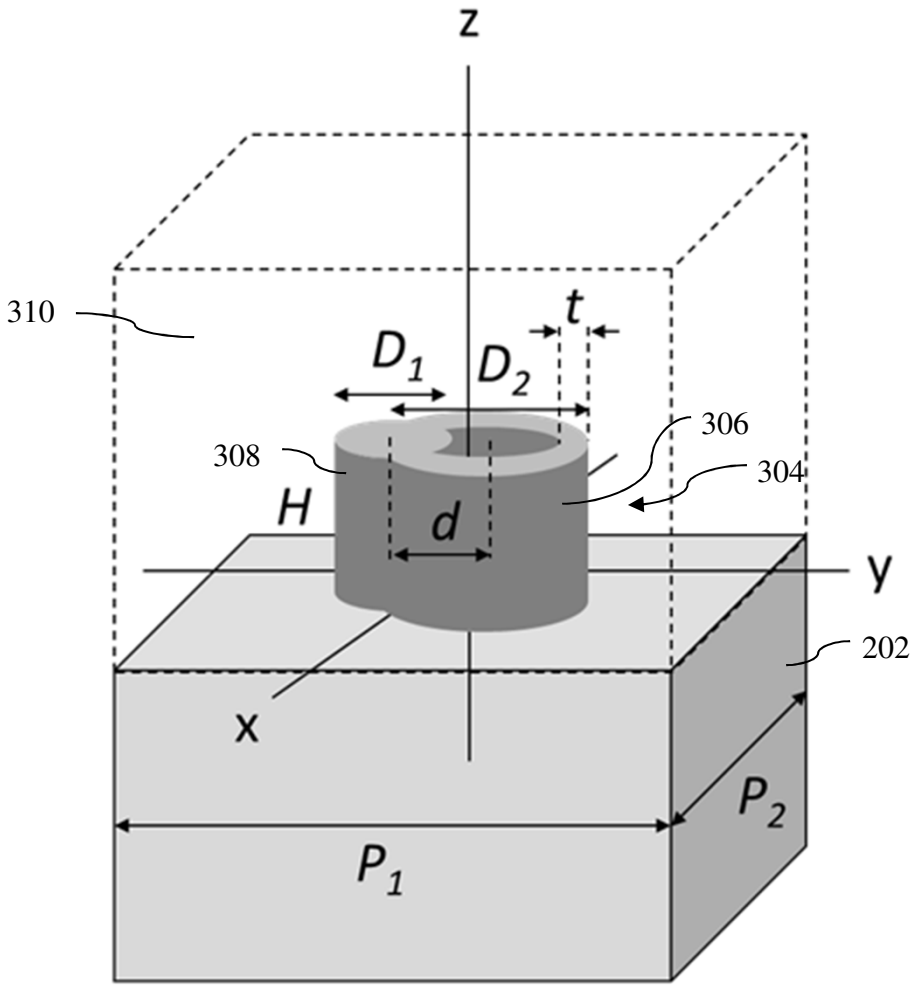
z
310
t
$D_1$
$D_2$
306
308
304
H
d
y
202
x
$P_2$
$P_1$

FIG. 3

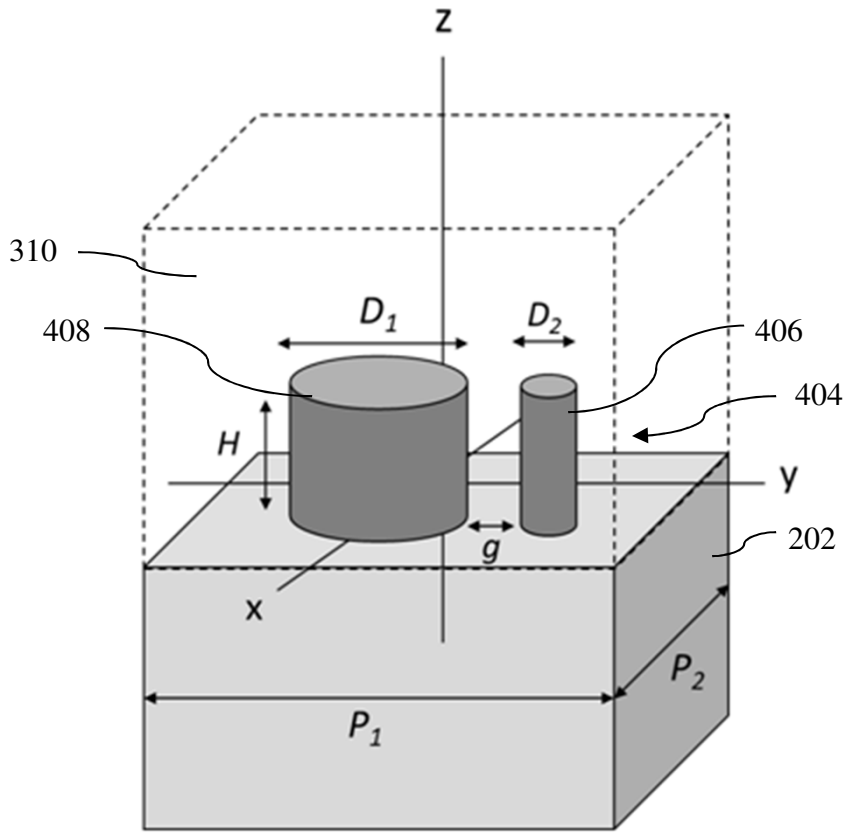


**FIG. 4**

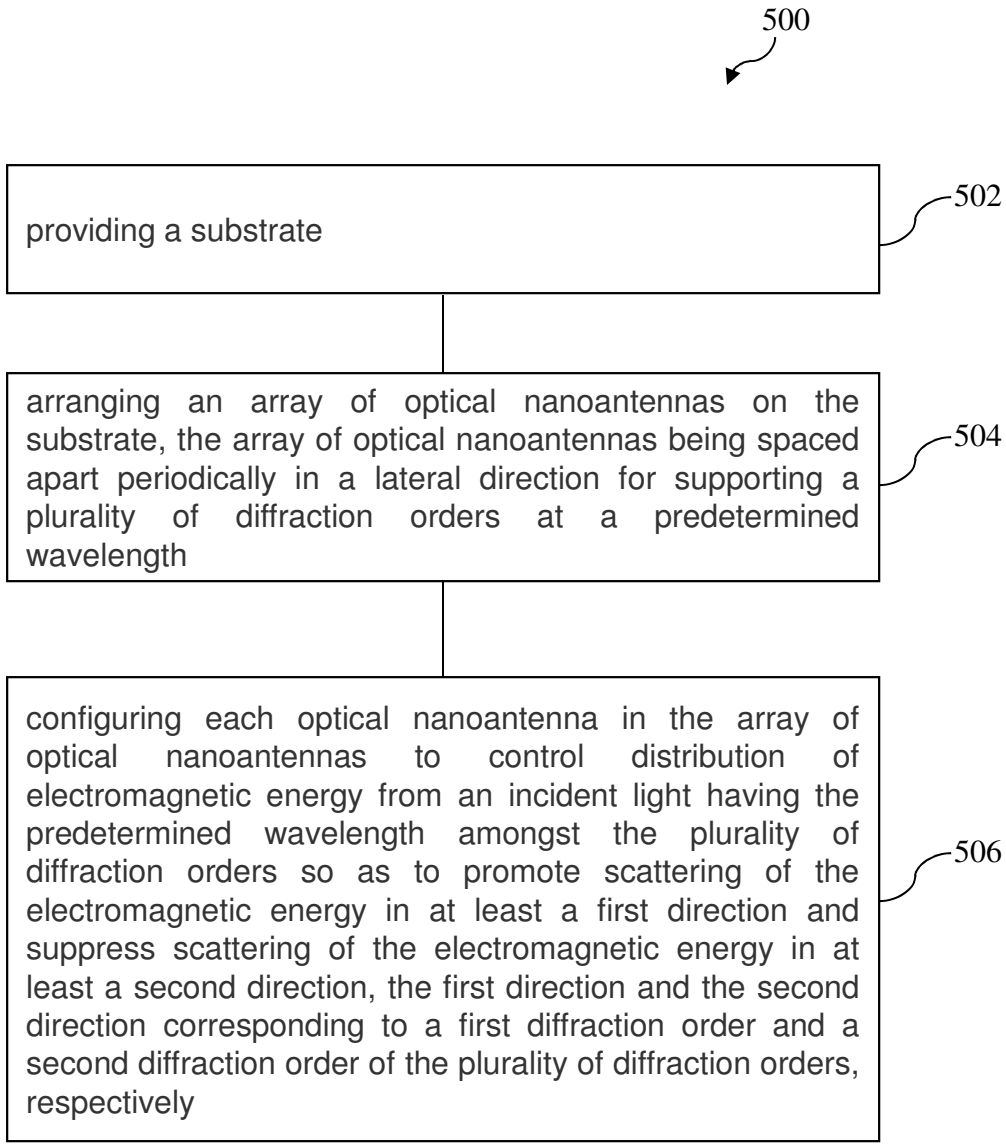
500
providing a substrate
502
arranging an array of optical nanoantennas on the substrate, the array of optical nanoantennas being spaced apart periodically in a lateral direction for supporting a plurality of diffraction orders at a predetermined wavelength
504
configuring each optical nanoantenna in the array of optical nanoantennas to control distribution of electromagnetic energy from an incident light having the predetermined wavelength amongst the plurality of diffraction orders so as to promote scattering of the electromagnetic energy in at least a first direction and suppress scattering of the electromagnetic energy in at least a second direction, the first direction and the second direction corresponding to a first diffraction order and a second diffraction order of the plurality of diffraction orders, respectively
506

**FIG. 5**

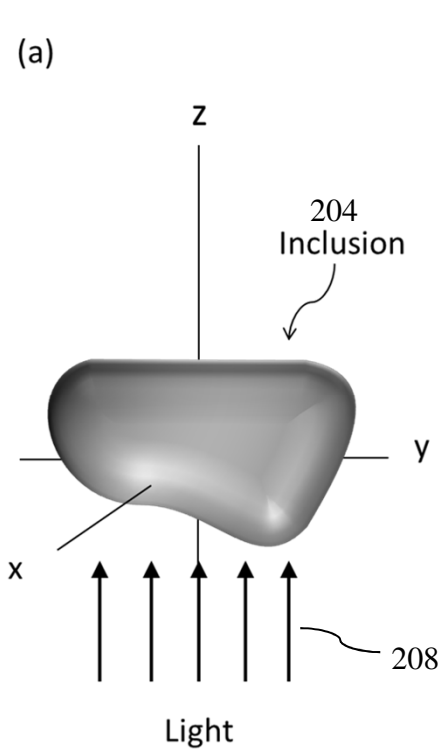
(a)
z
204
Inclusion
y
x
208
Light

FIG. 6A

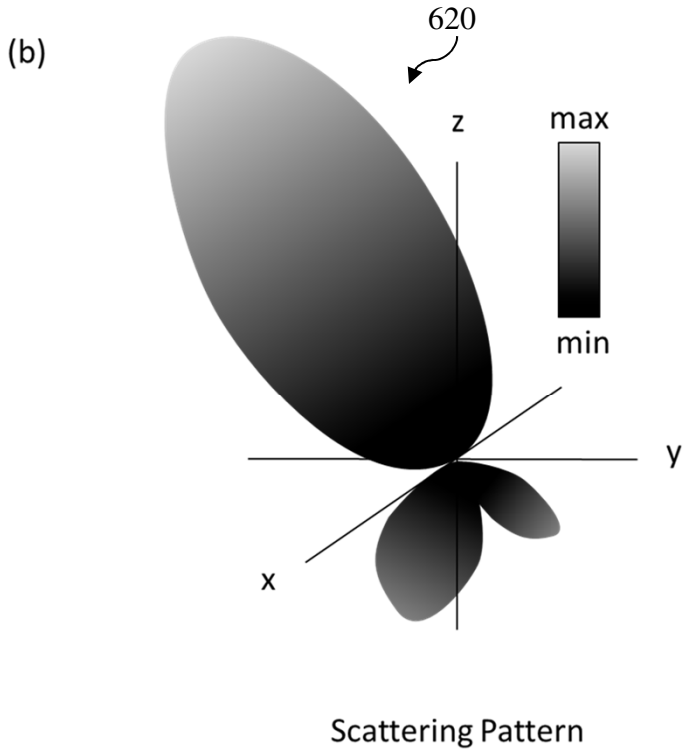
(b)
620
z
max
min
y
x
Scattering Pattern

FIG. 6B

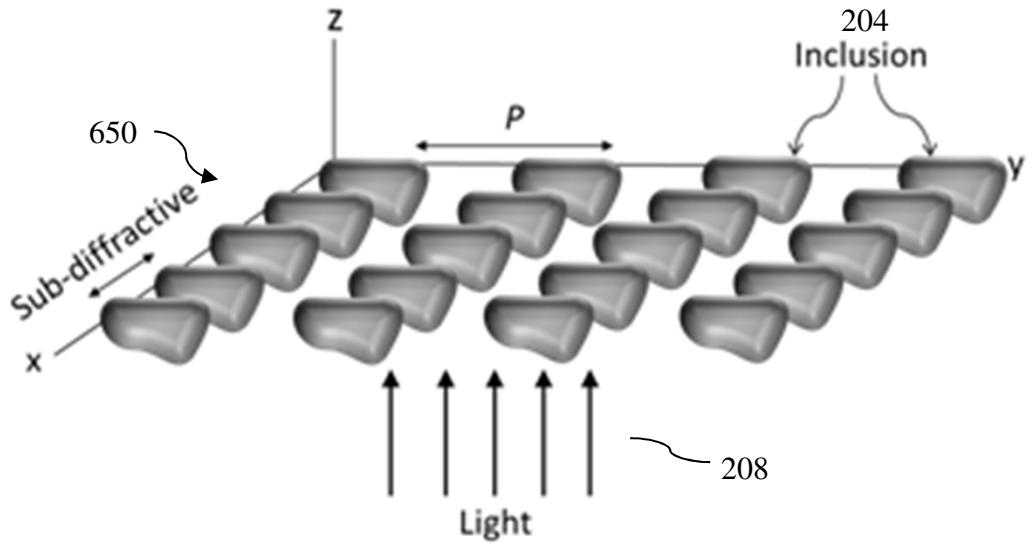
z
204
Inclusion
650
P
y
Sub-diffractive
x
208
Light

FIG. 7A

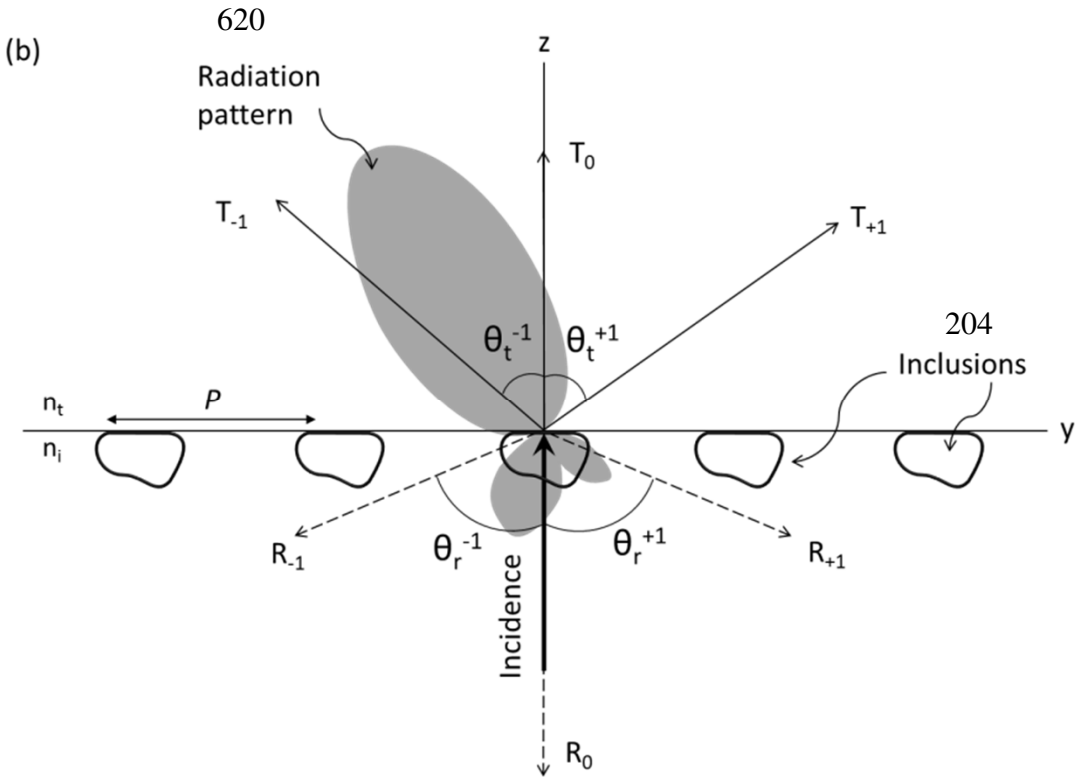
(b)
620
Radiation
pattern
z
T0
T-1
T+1
θt-1
θt+1
204
Inclusions
nt
ni
P
y
R-1
θr-1
θr+1
R+1
Incidence
R0

FIG. 7B

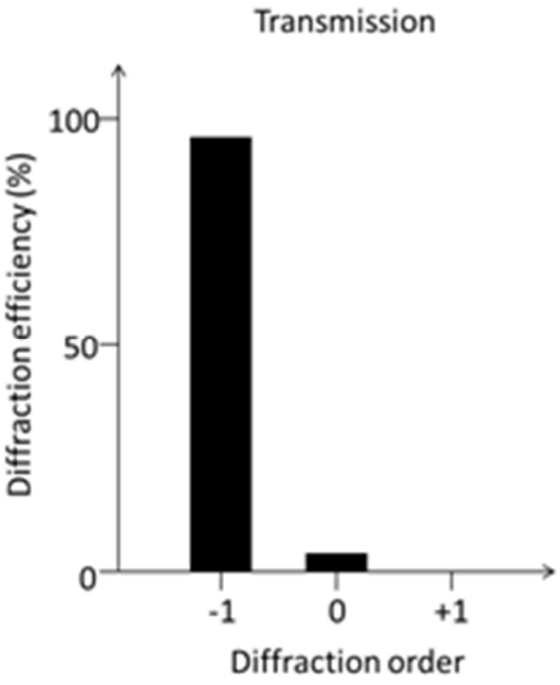


FIG. 7C

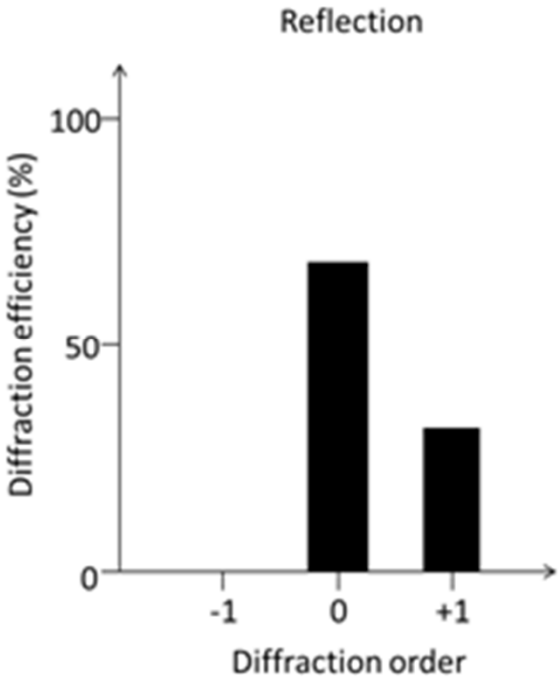


FIG. 7D

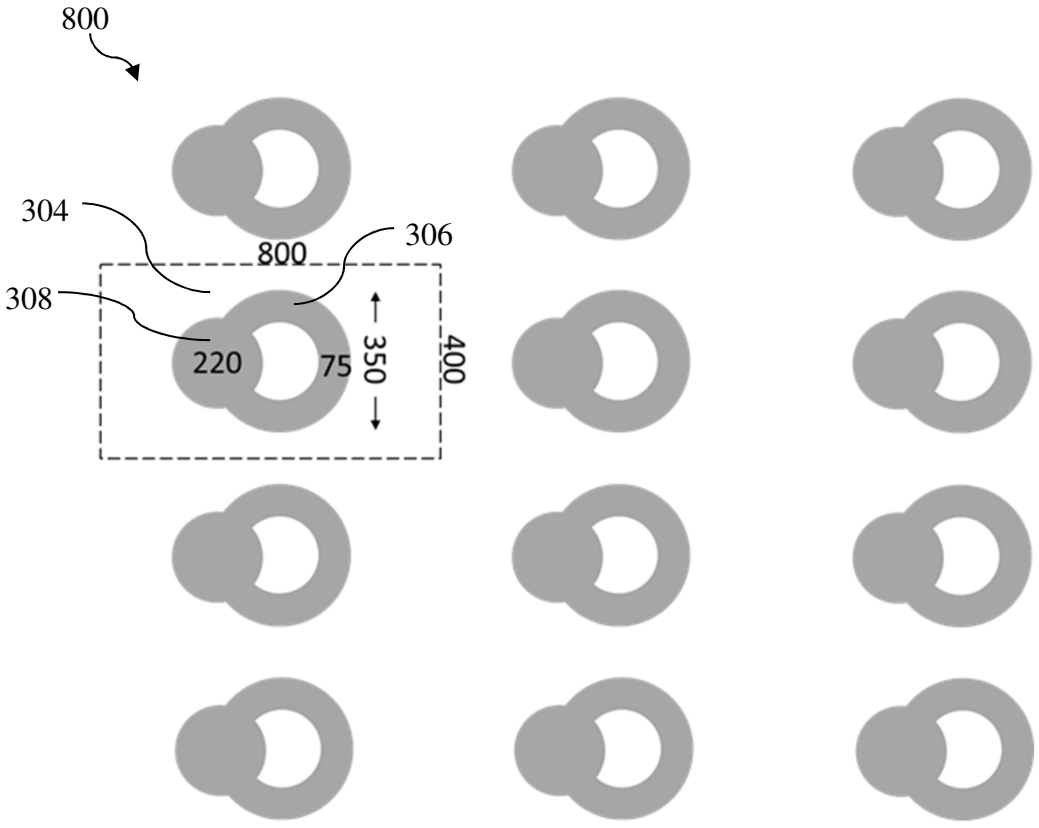


FIG. 8

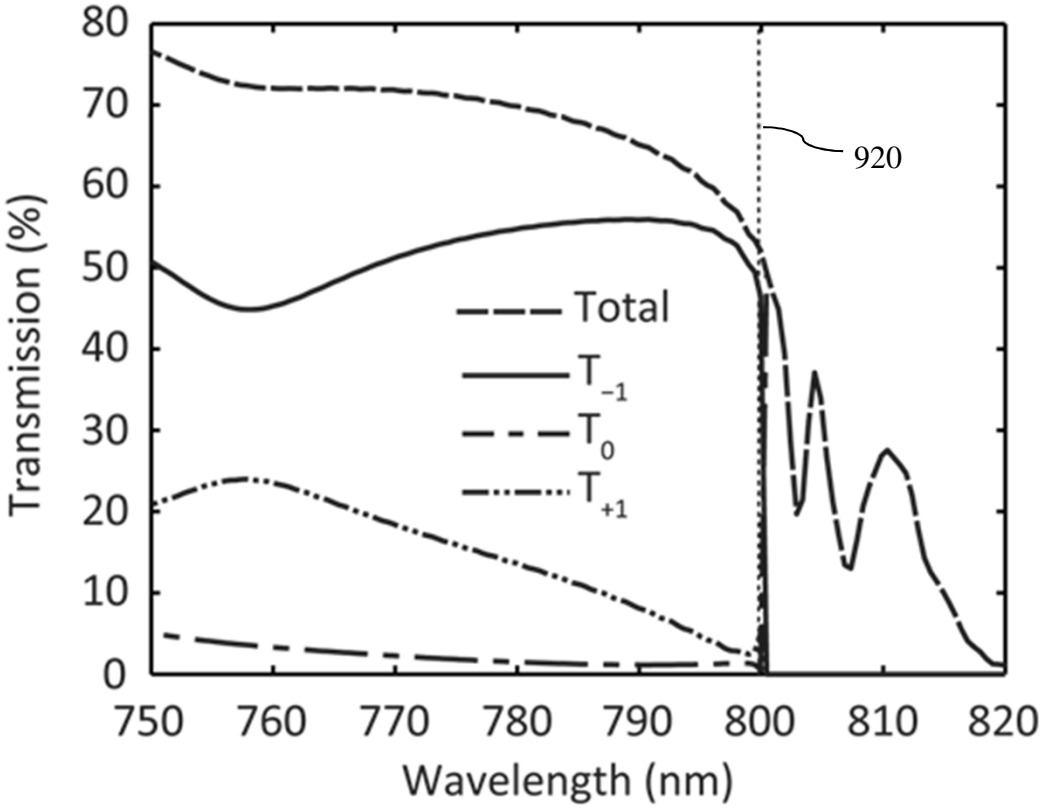
80
70
60
50
40
30
20
10
0
Transmission (%)
750
760
770
780
790
800
810
820
Wavelength (nm)
920
Total
T−1
T0
T+1

FIG. 9A

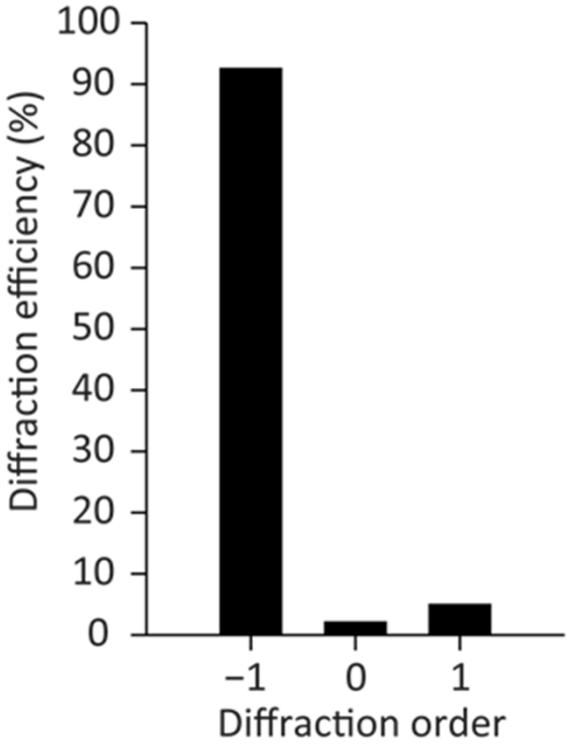
100
90
80
70
60
50
40
30
20
10
0
Diffraction efficiency (%)
−1
0
1
Diffraction order

FIG. 9B

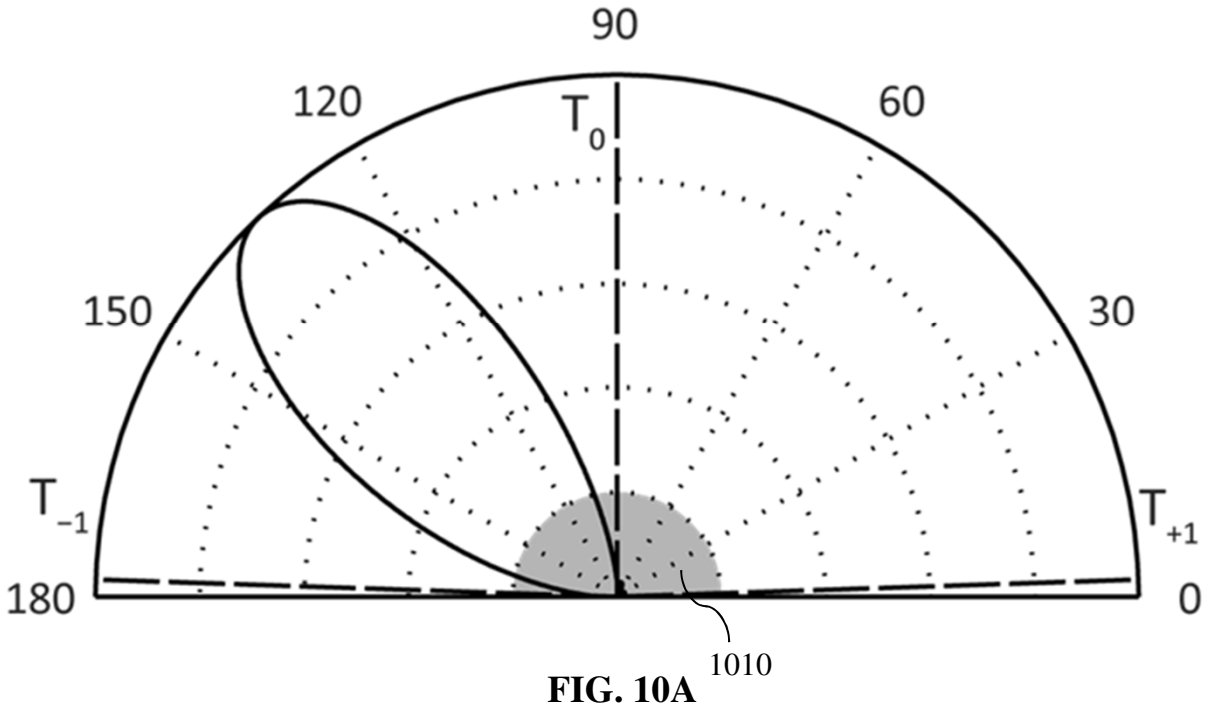


FIG. 10A

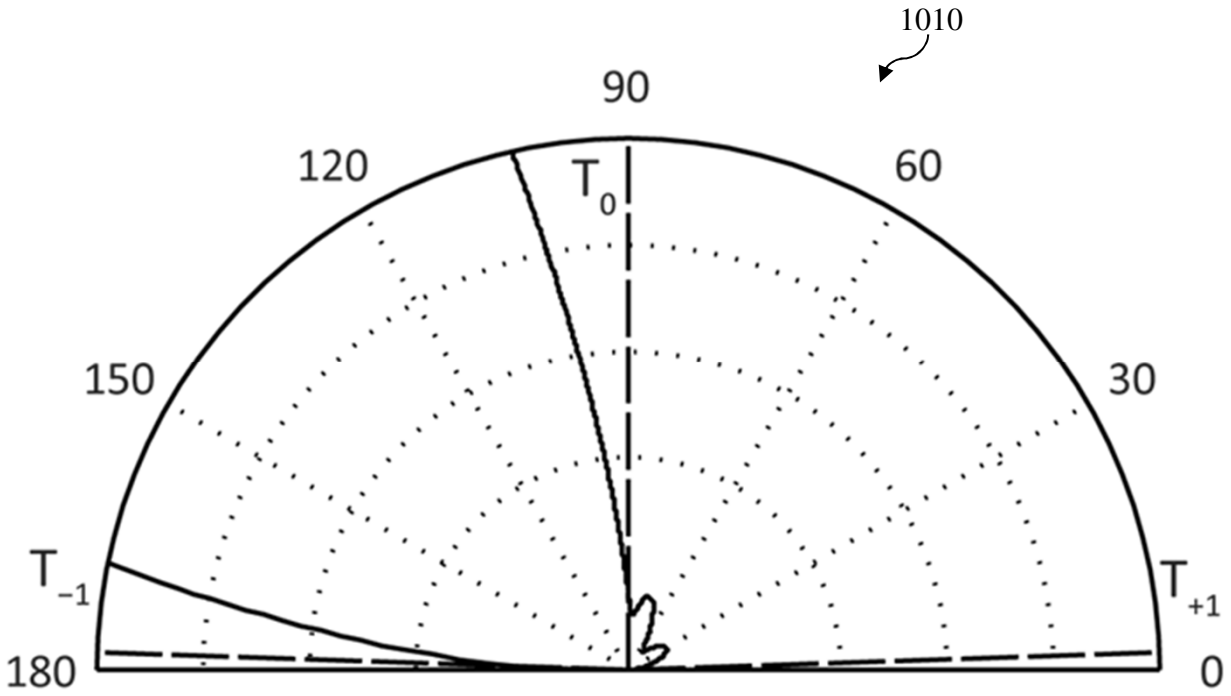


FIG. 10B

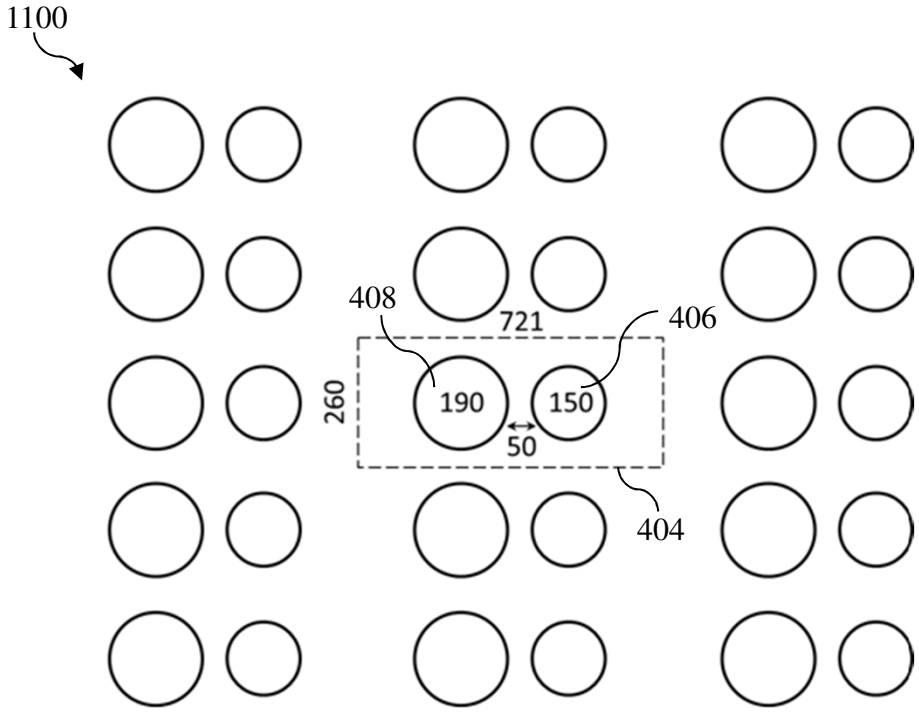


FIG. 11

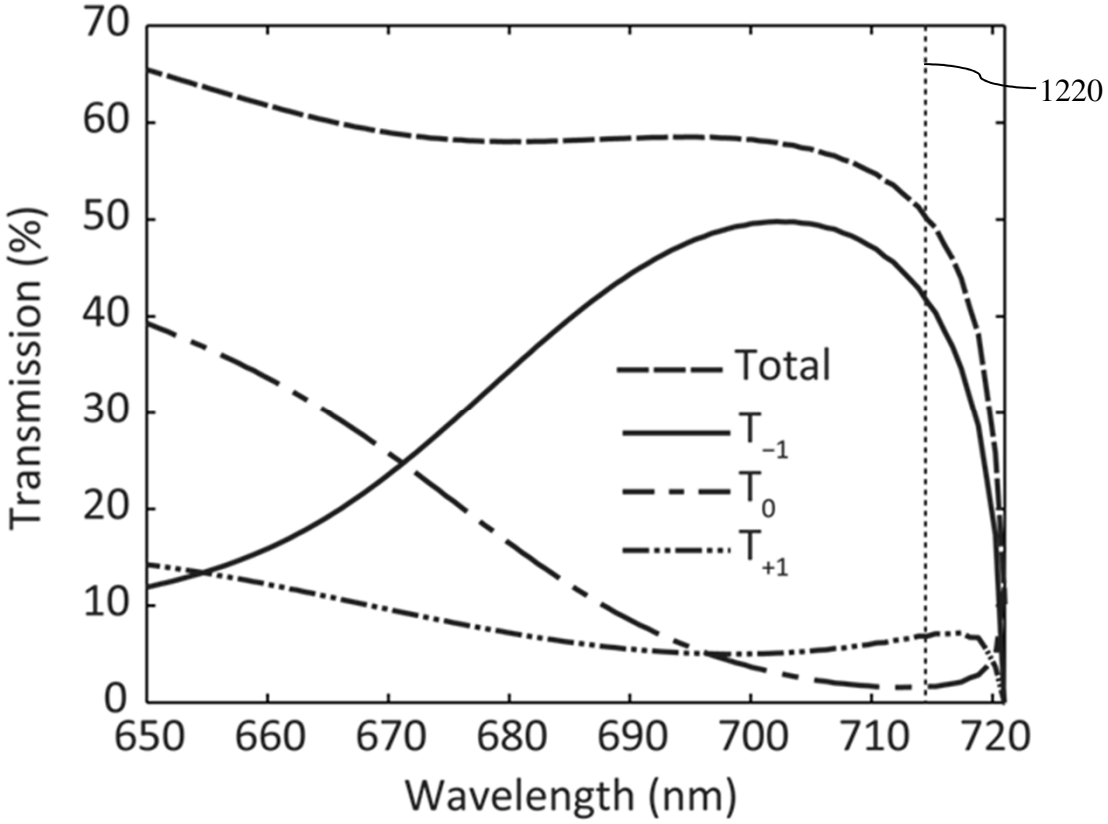


FIG. 12A

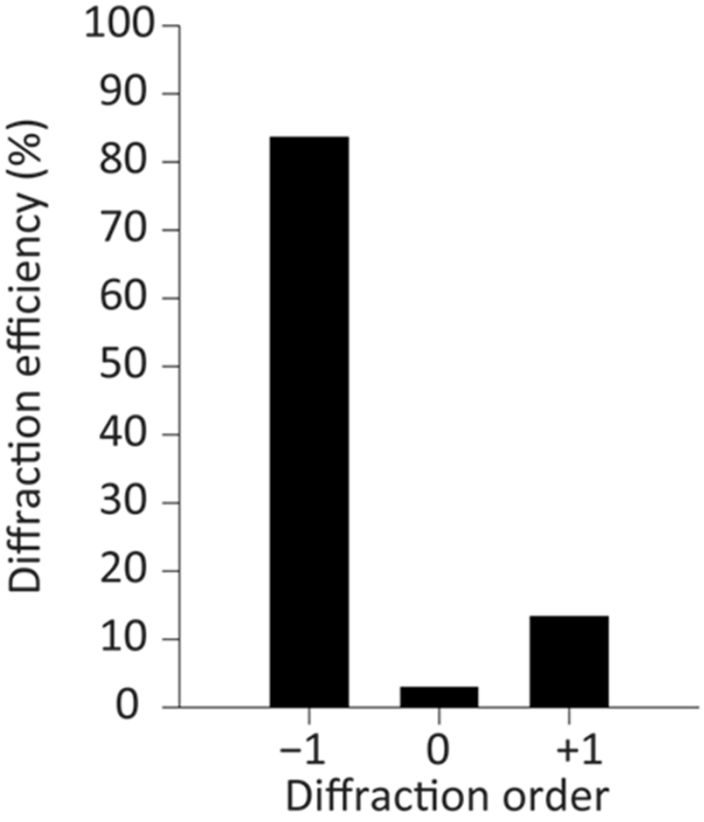


FIG. 12B

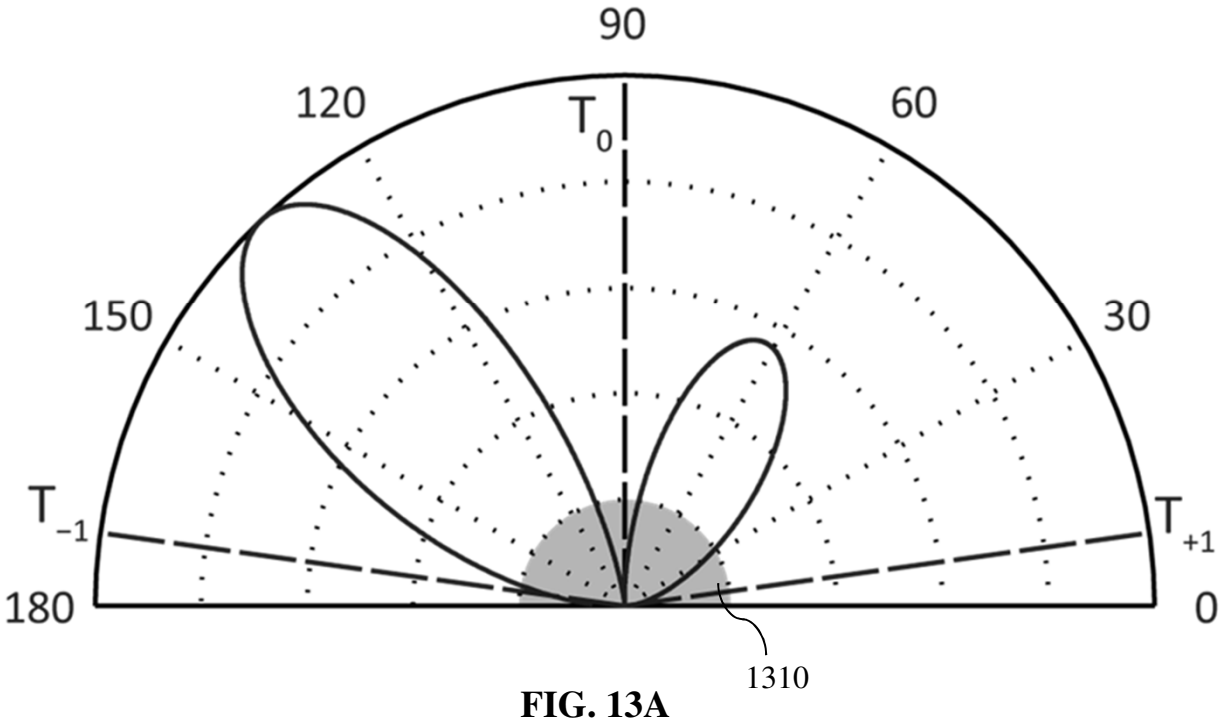


FIG. 13A

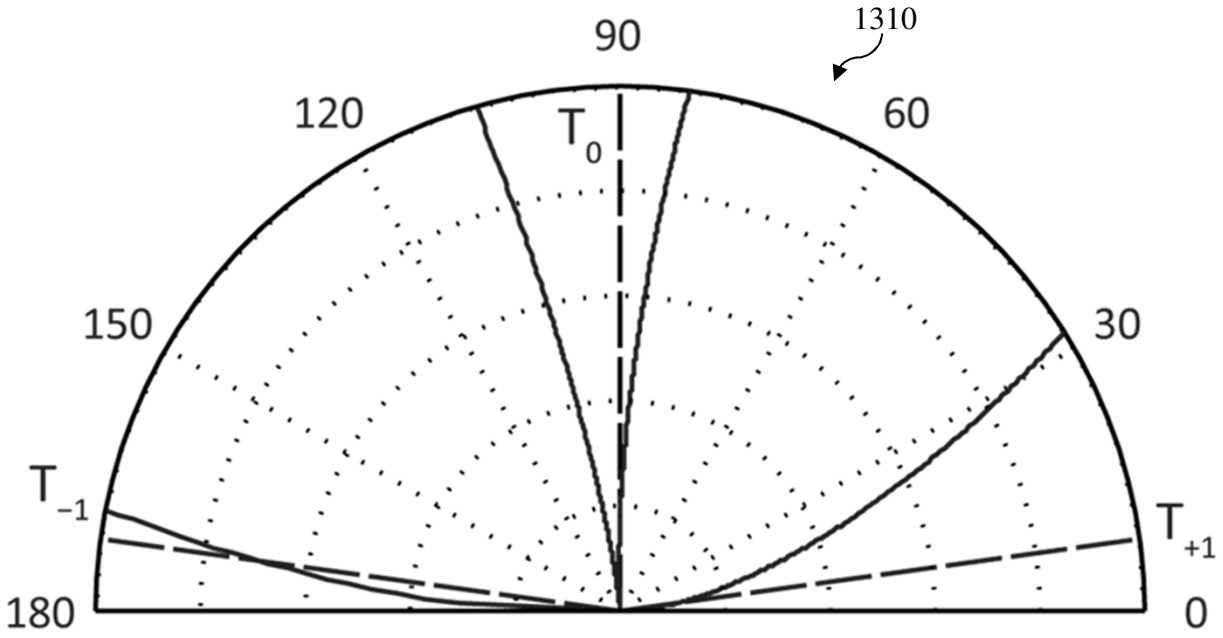


**FIG. 13B**

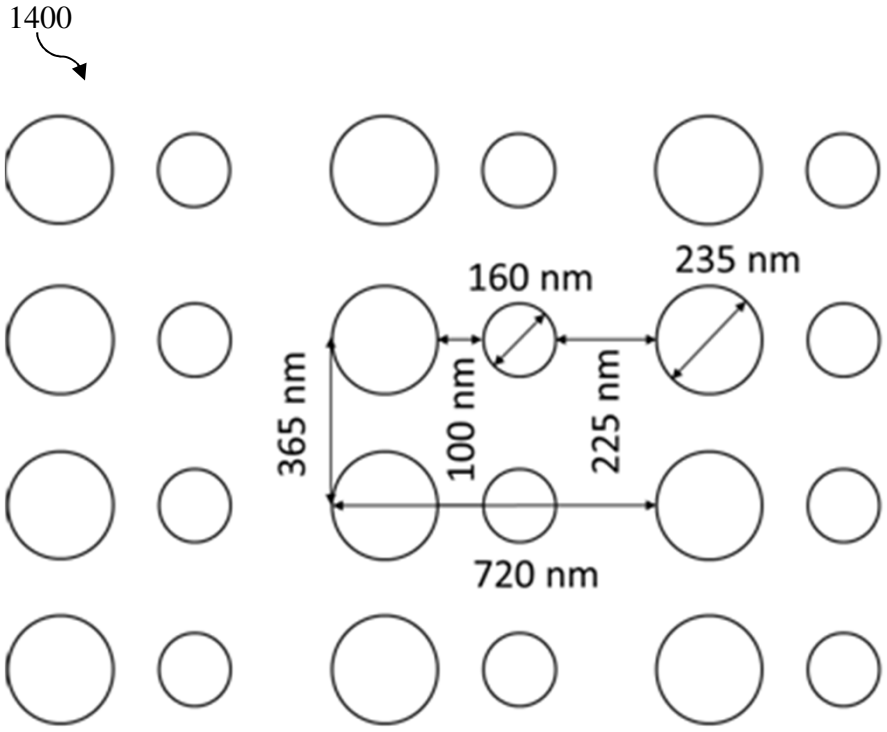


**FIG. 14A**

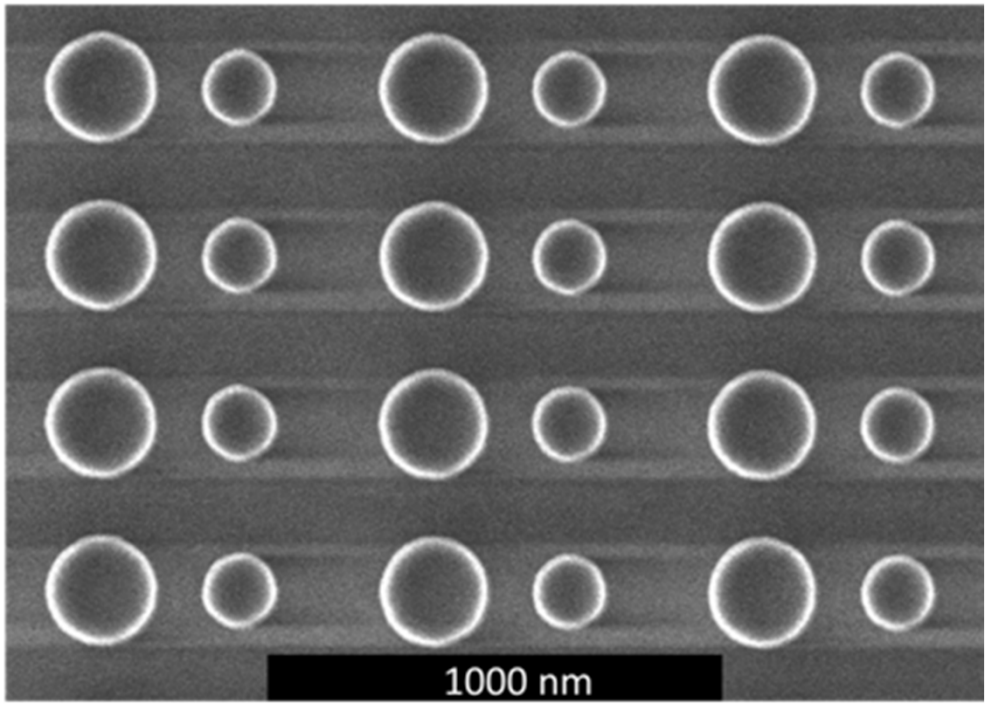


FIG. 14B

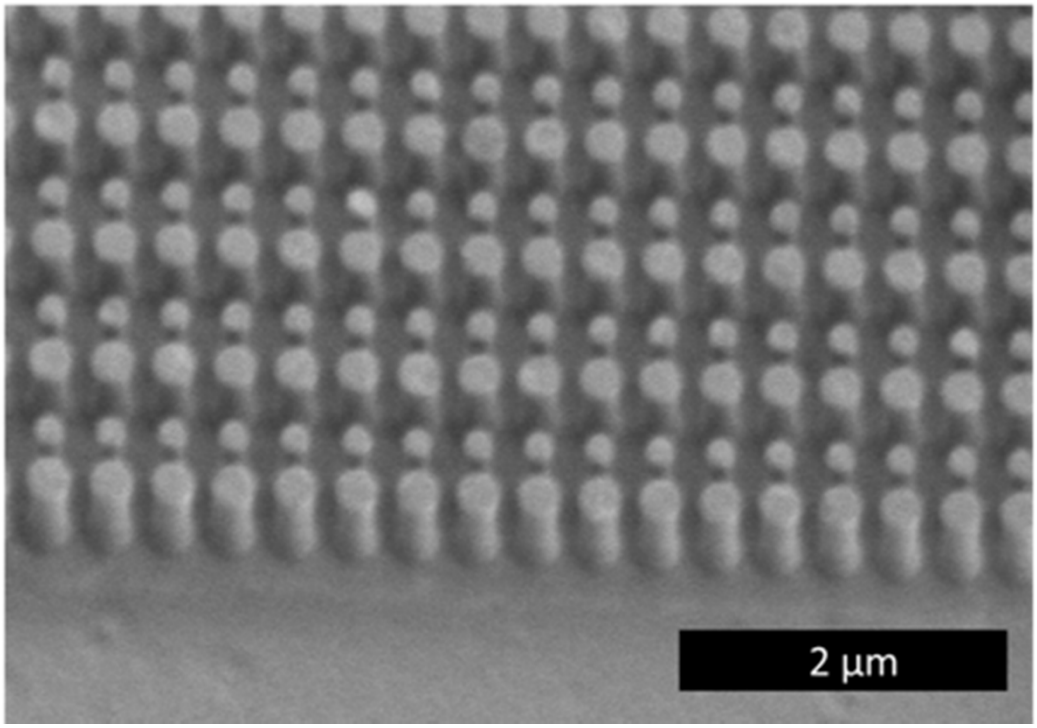


FIG. 14C

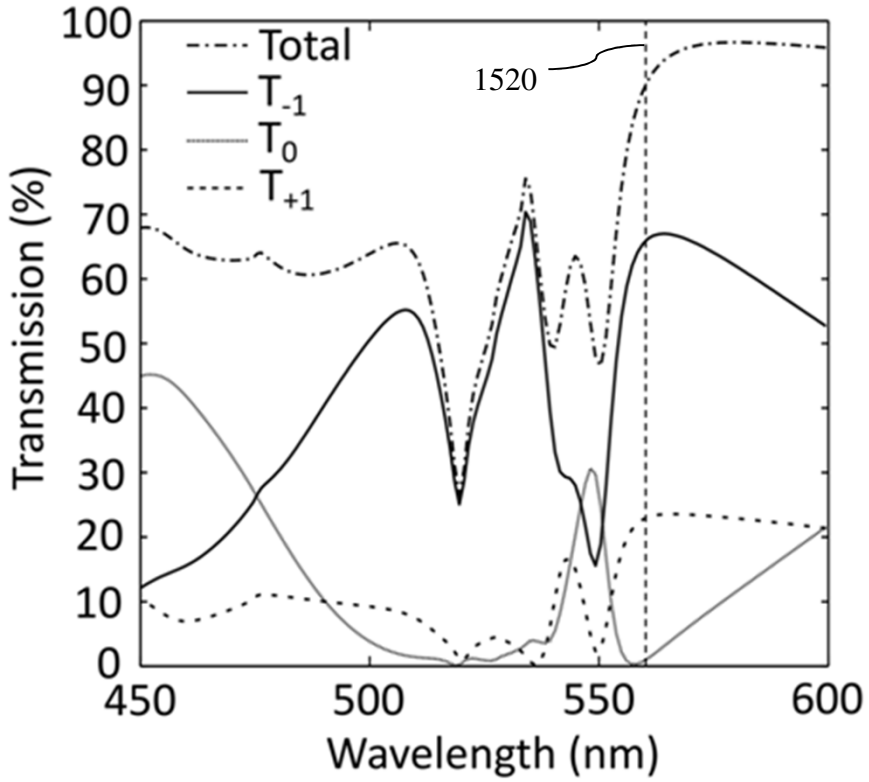


FIG. 15A

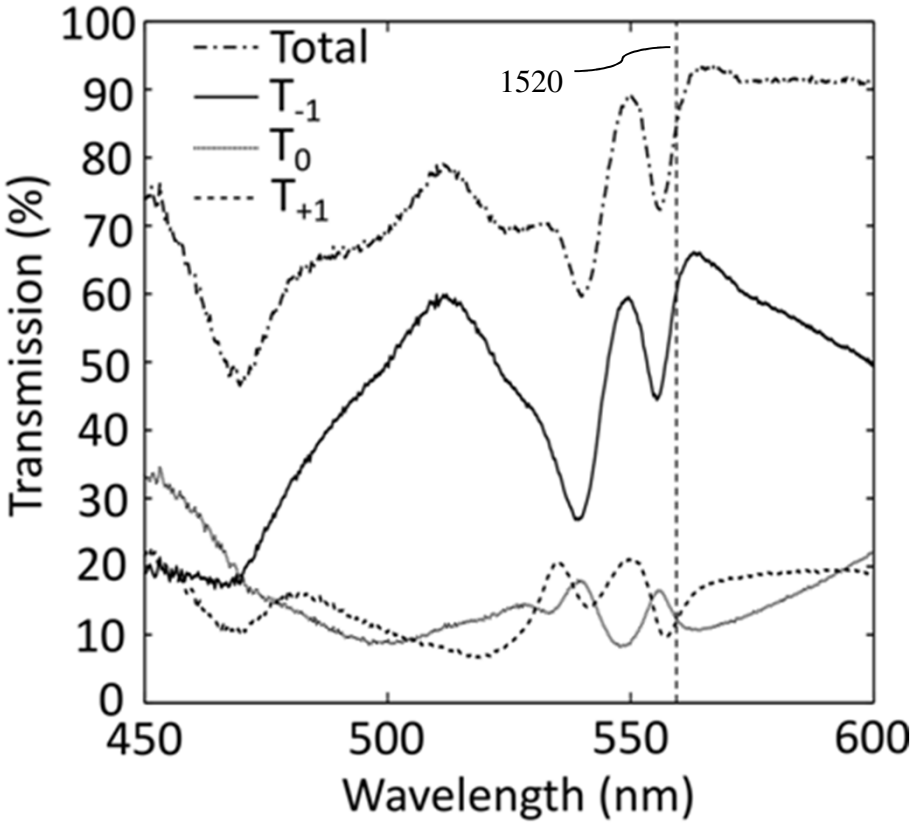


FIG. 15B

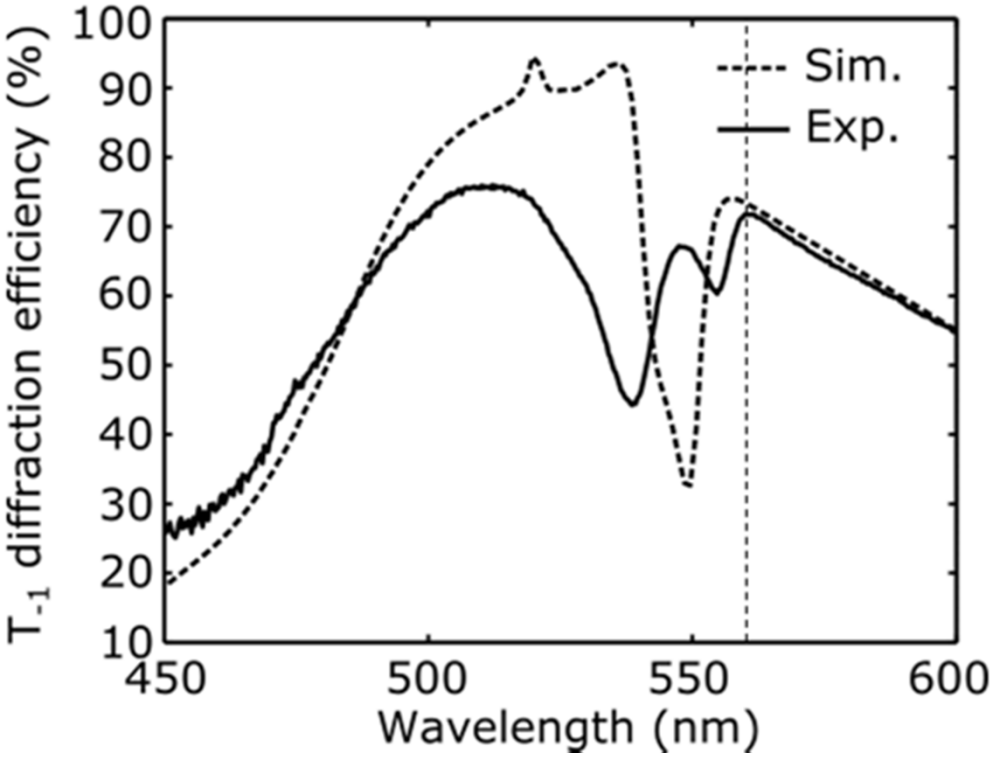


**FIG. 15C**

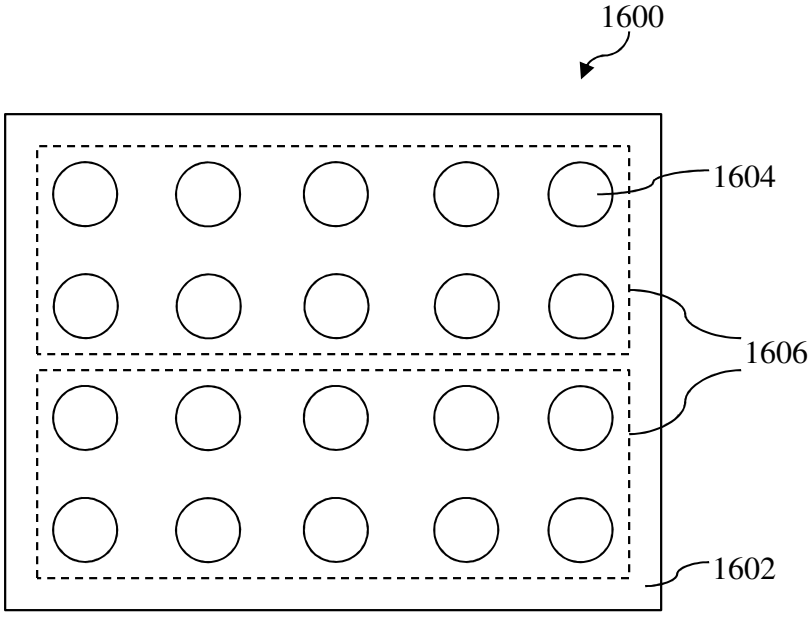


**FIG. 16A**

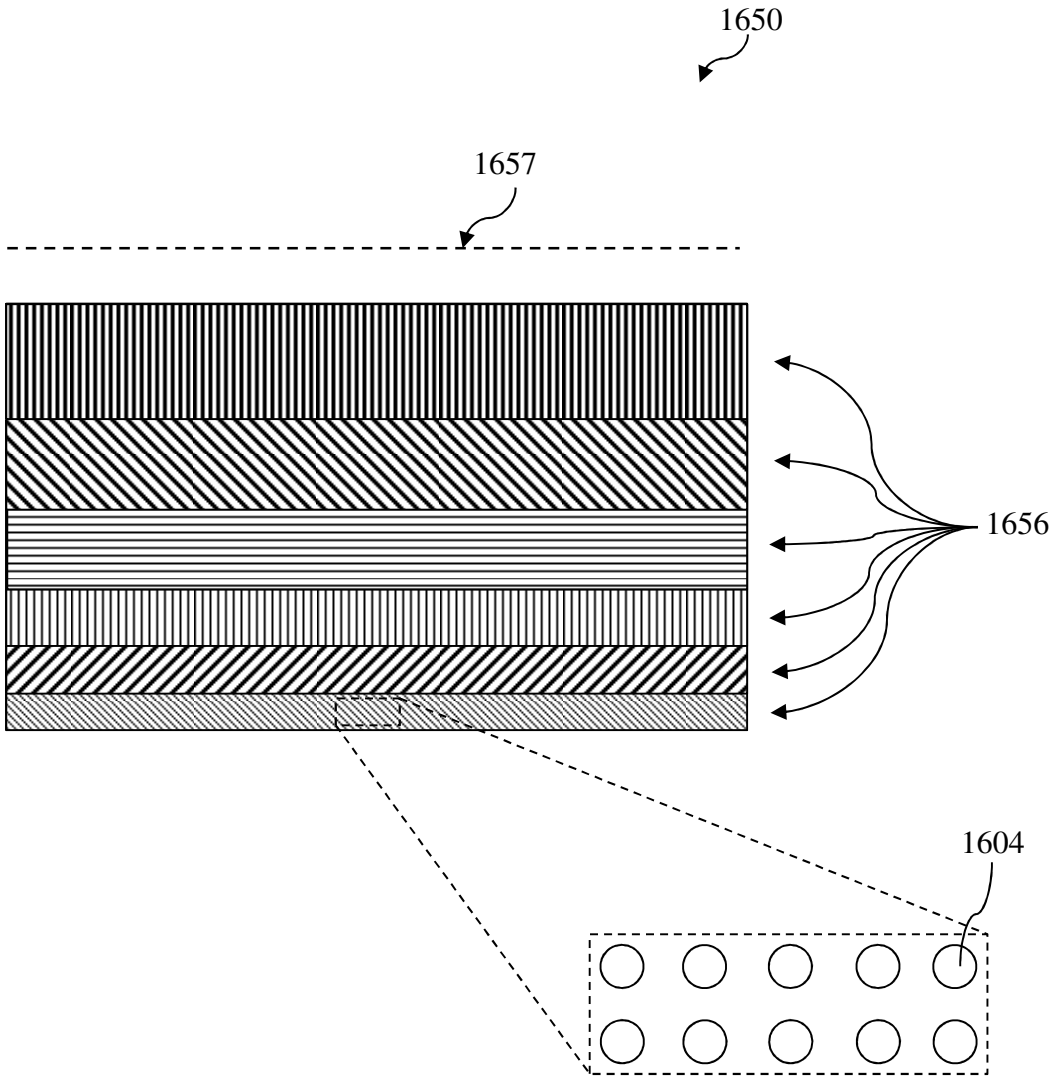


**FIG. 16B**

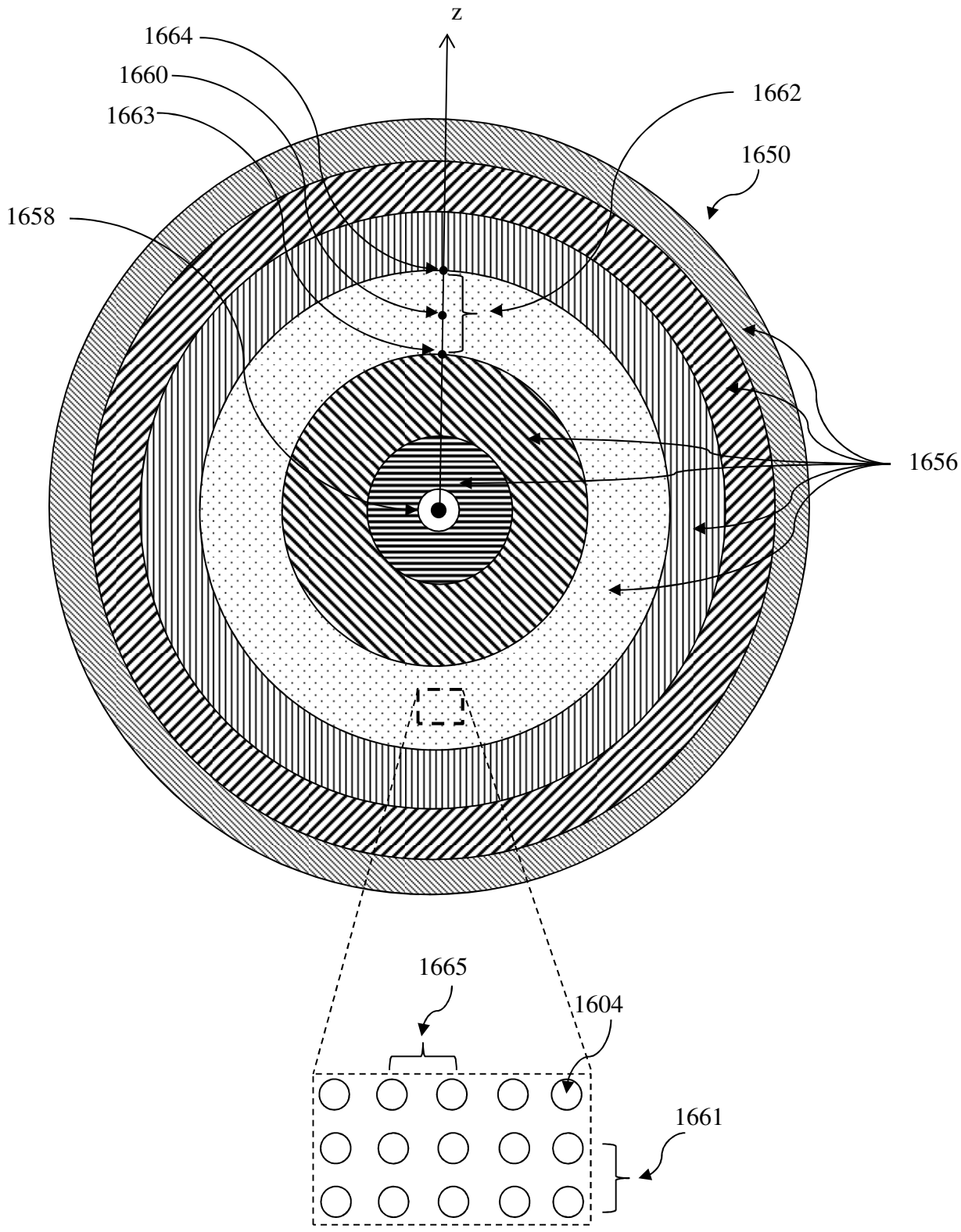


**FIG. 16C**

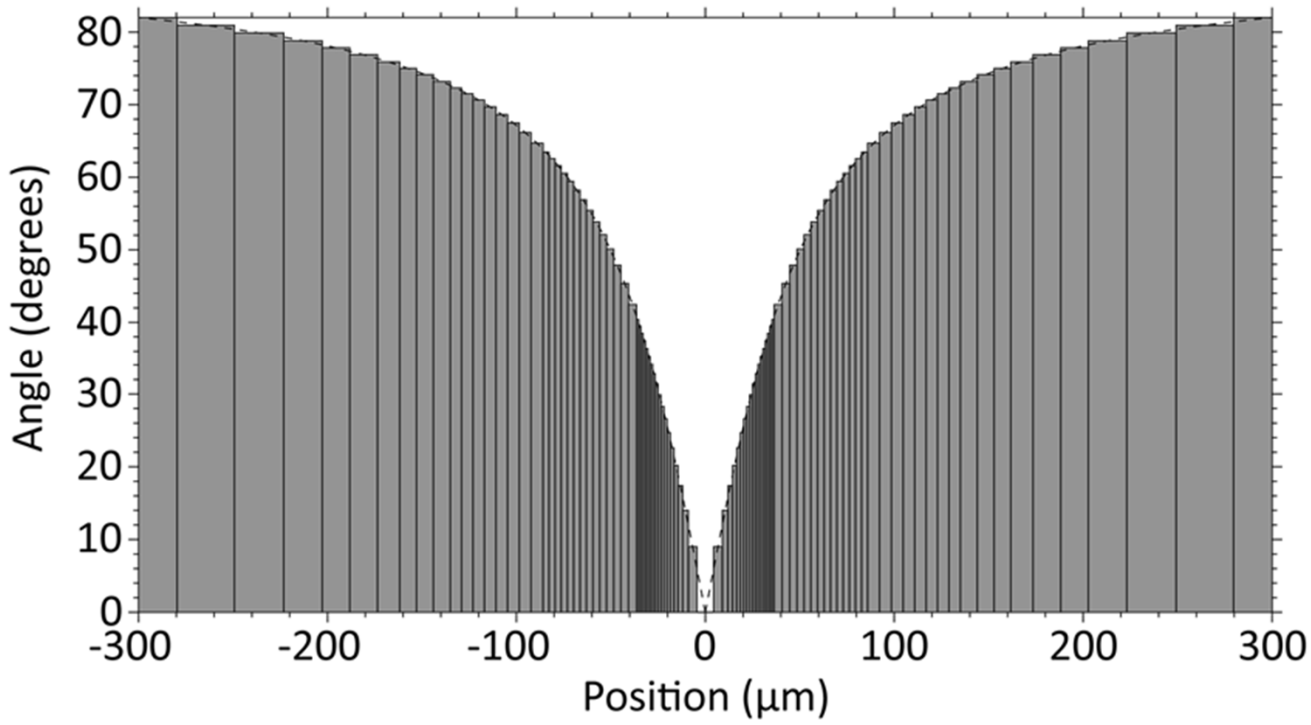
Angle (degrees)
80
70
60
50
40
30
20
10
0
-300
-200
-100
0
100
200
300
Position (µm)

FIG. 17A

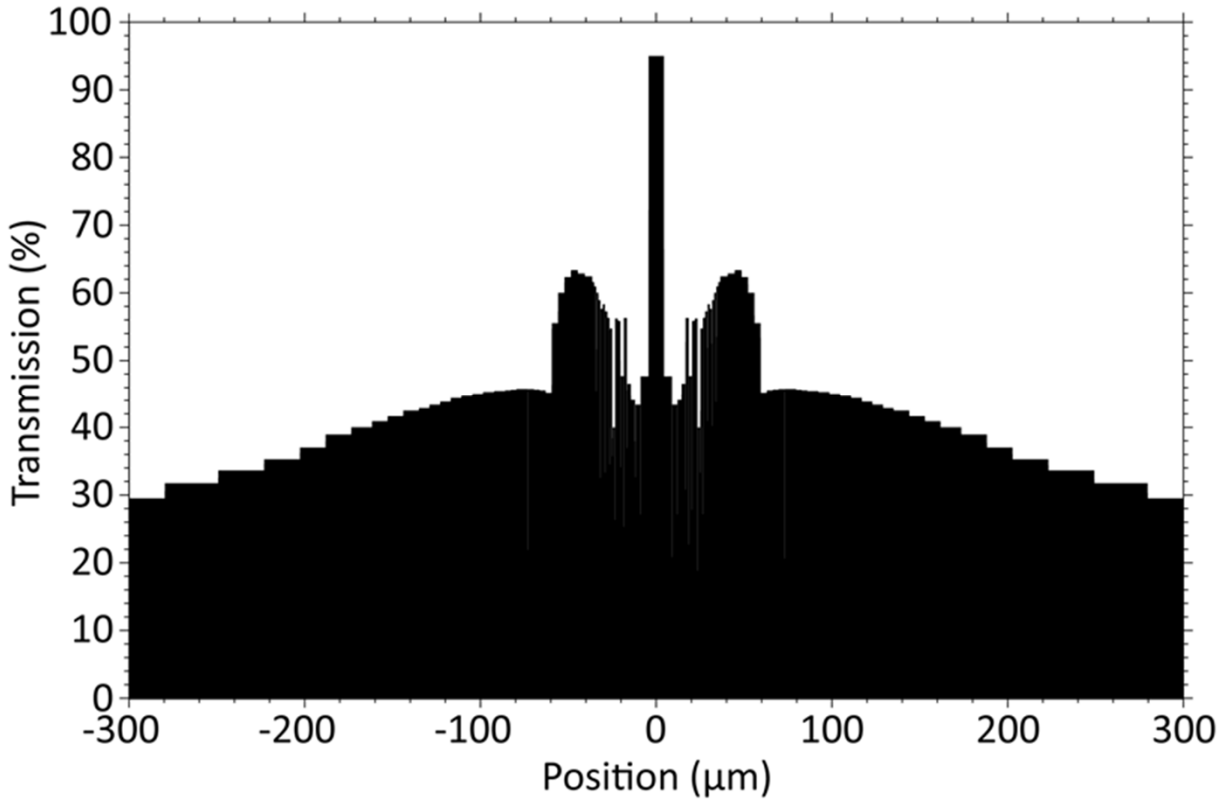


FIG. 17B

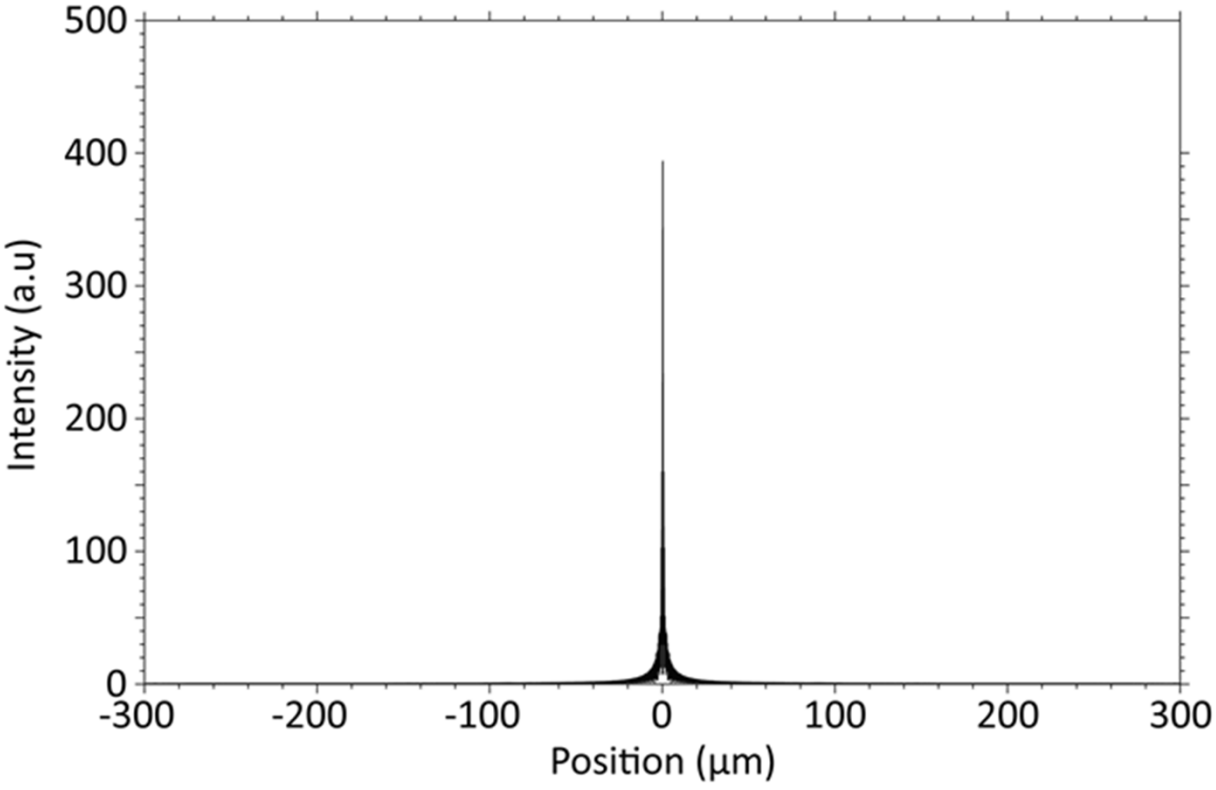


FIG. 18A

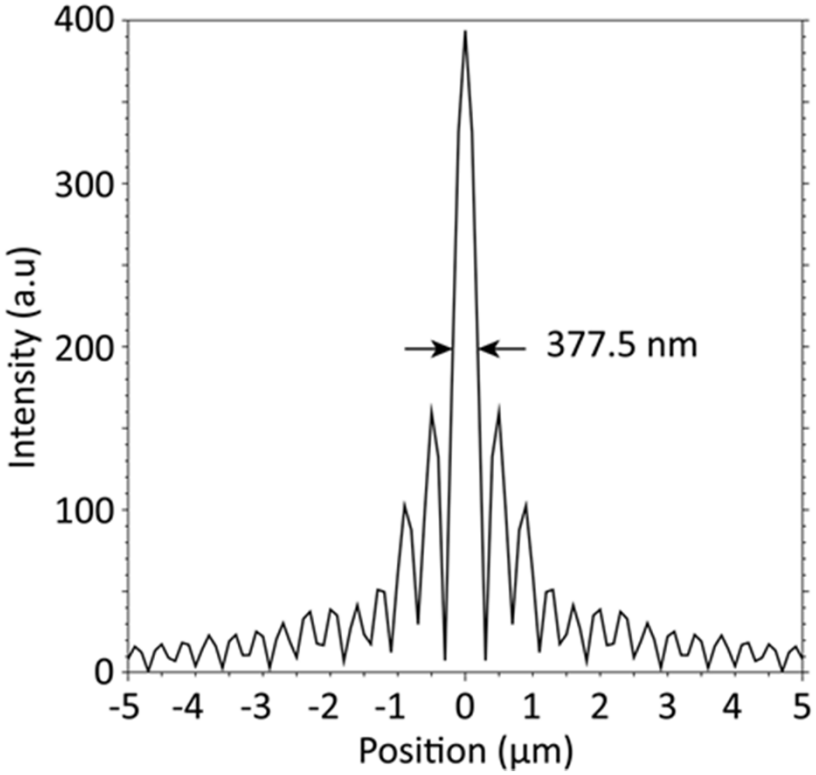


FIG. 18B

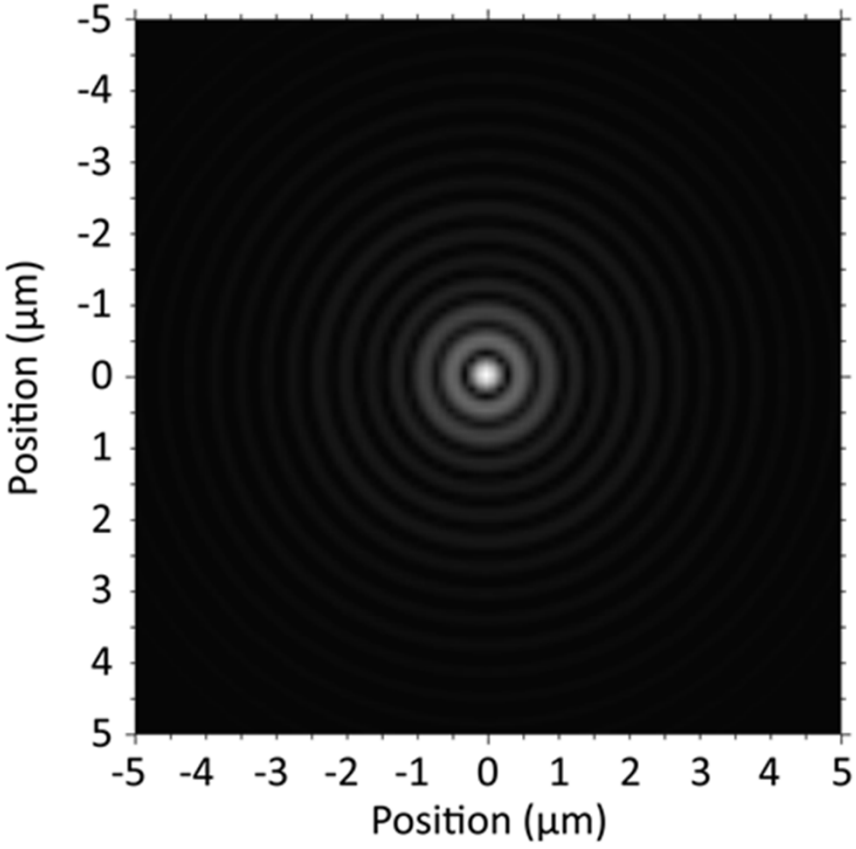


FIG. 18C