FIG. 1A

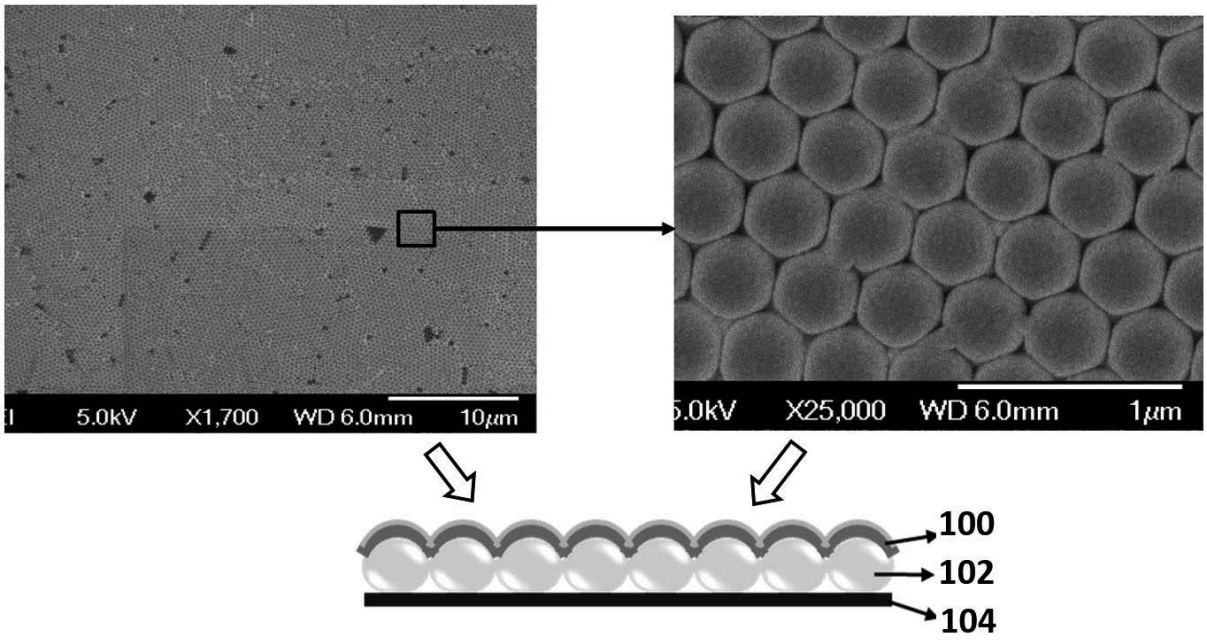

5.0kV X1,700 WD 6.0mm 10μm
5.0kV X25,000 WD 6.0mm 1μm
100
102
104

FIG. 1B

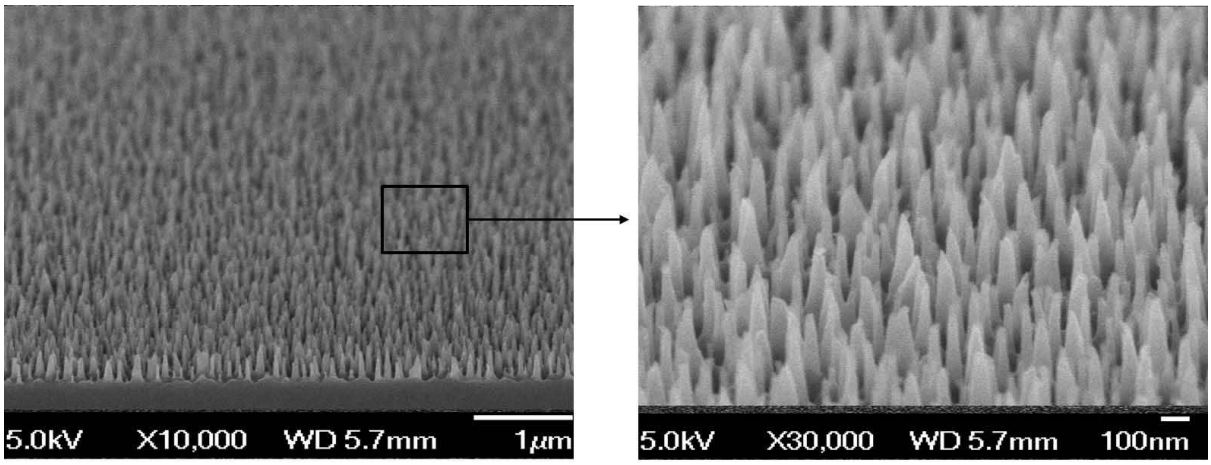

5.0kV X10,000 WD 5.7mm 1μm
5.0kV X30,000 WD 5.7mm 100nm

FIG. 1C

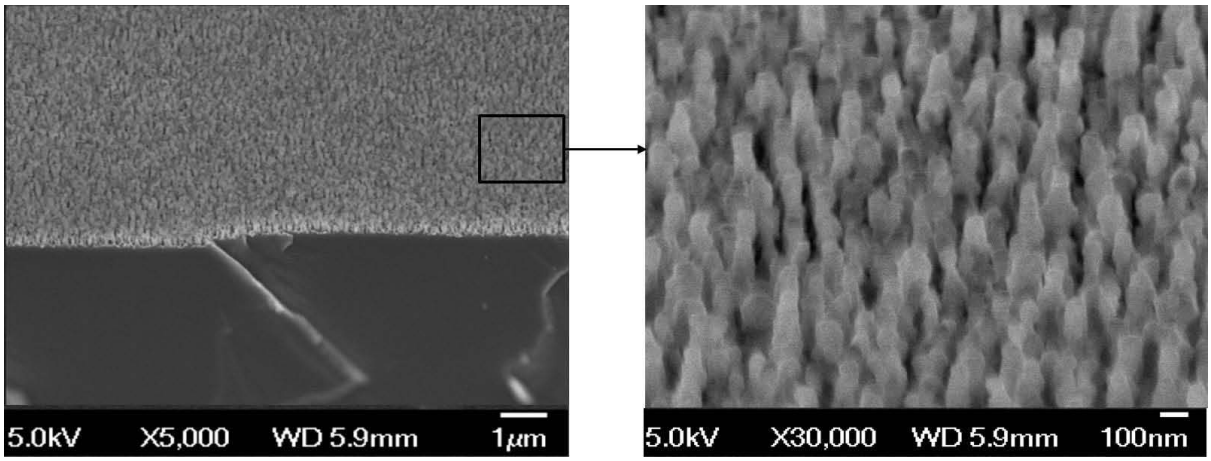

5.0kV X5,000 WD 5.9mm 1μm
5.0kV X30,000 WD 5.9mm 100nm

FIG. 1D

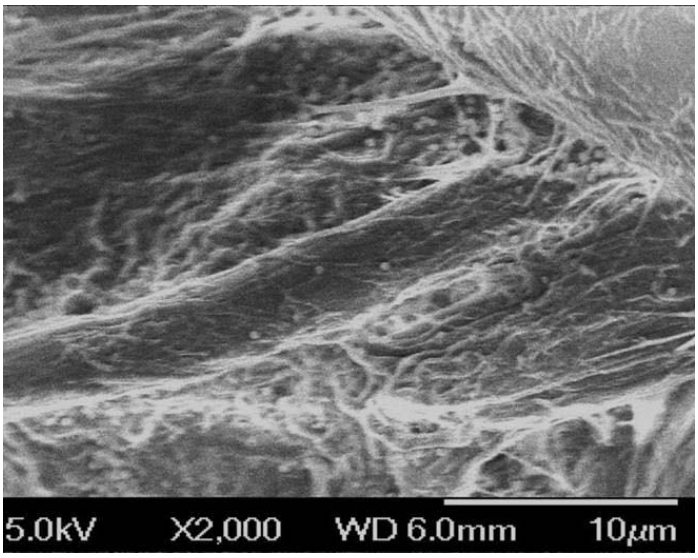

5.0kV X2,000 WD 6.0mm 10μm

FIG. 2A

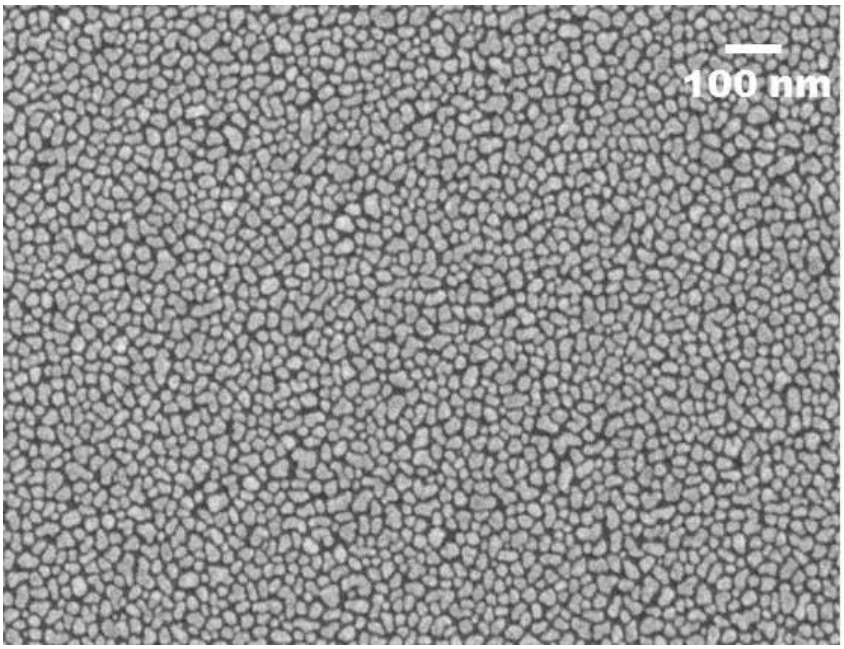


FIG. 2B

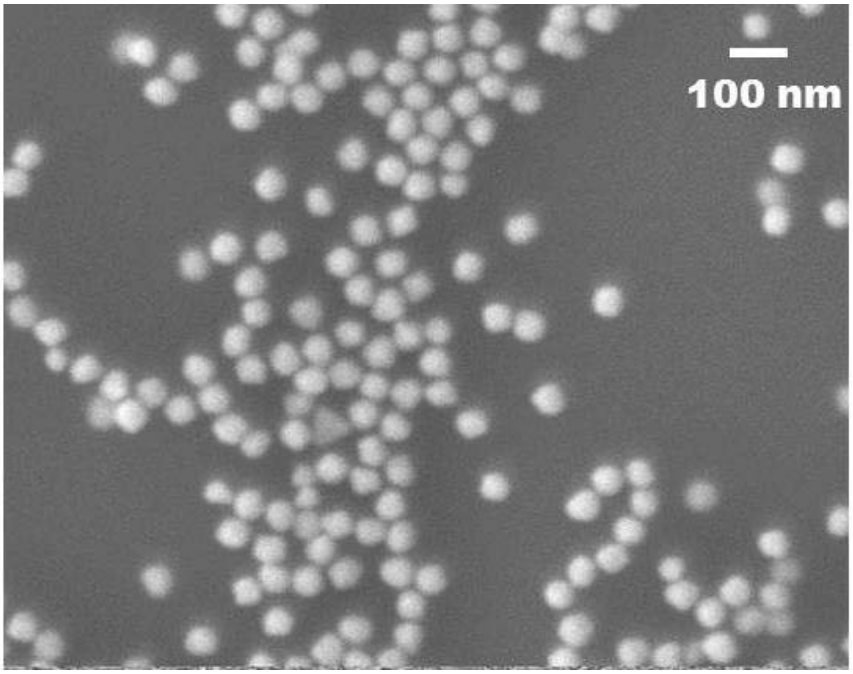


FIG. 3

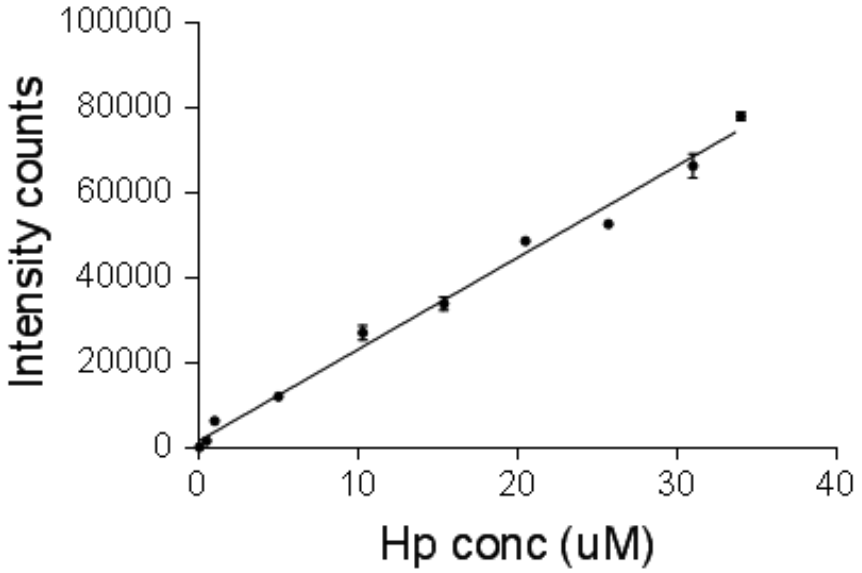

100000
80000
60000
40000
20000
0
Intensity counts
0
10
20
30
40
Hp conc (uM)

FIG. 4

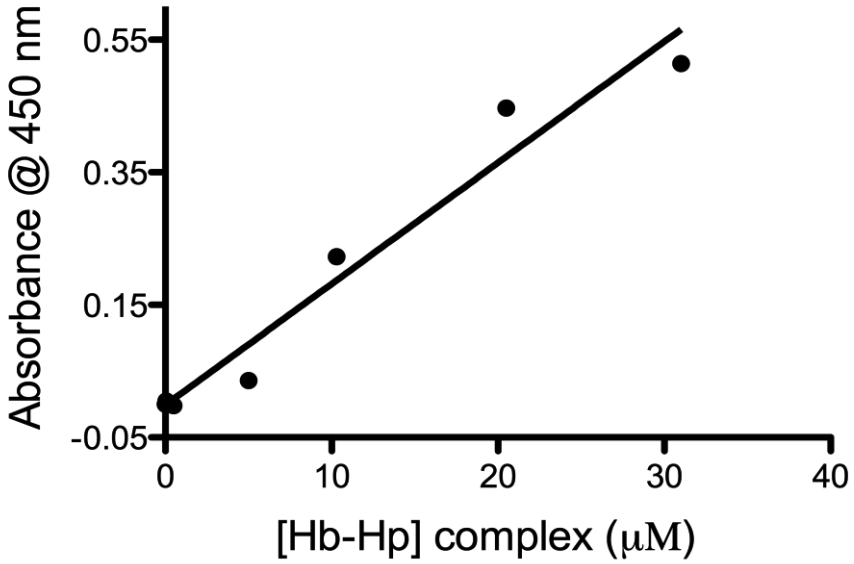

0.55
0.35
0.15
-0.05
Absorbance @ 450 nm
0
10
20
30
40
[Hb-Hp] complex (μM)

FIG. 5

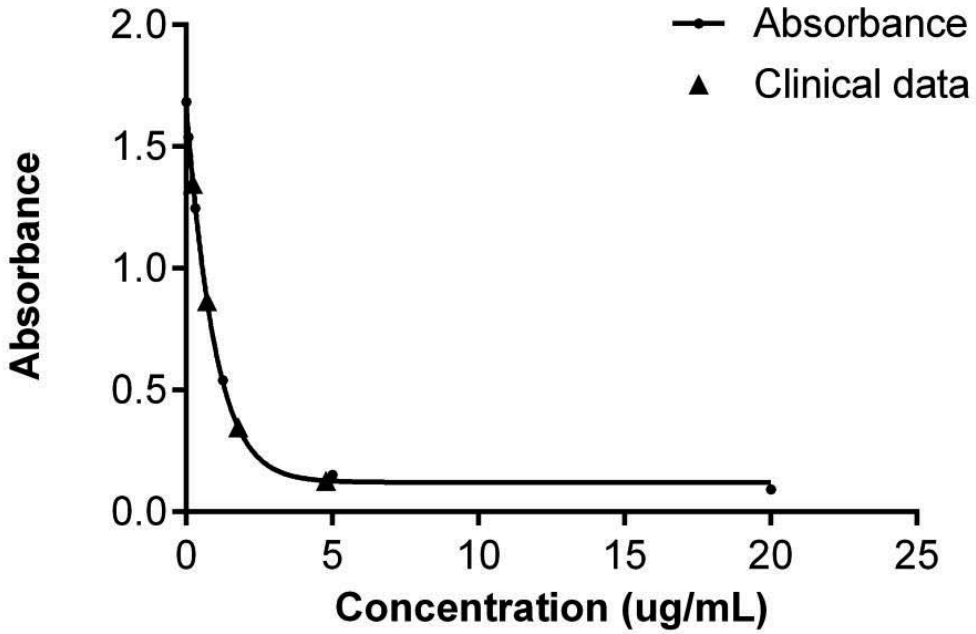


FIG. 6

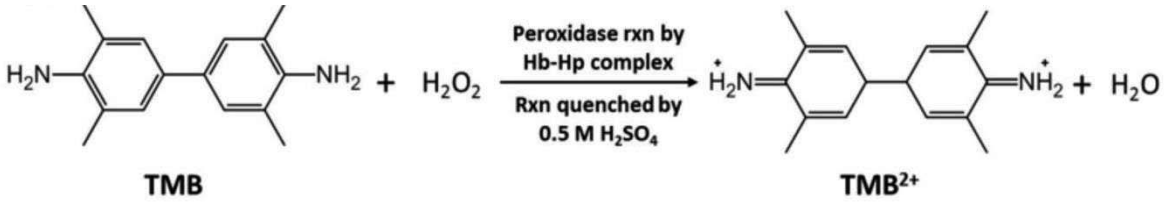


FIG. 7



FIG. 8

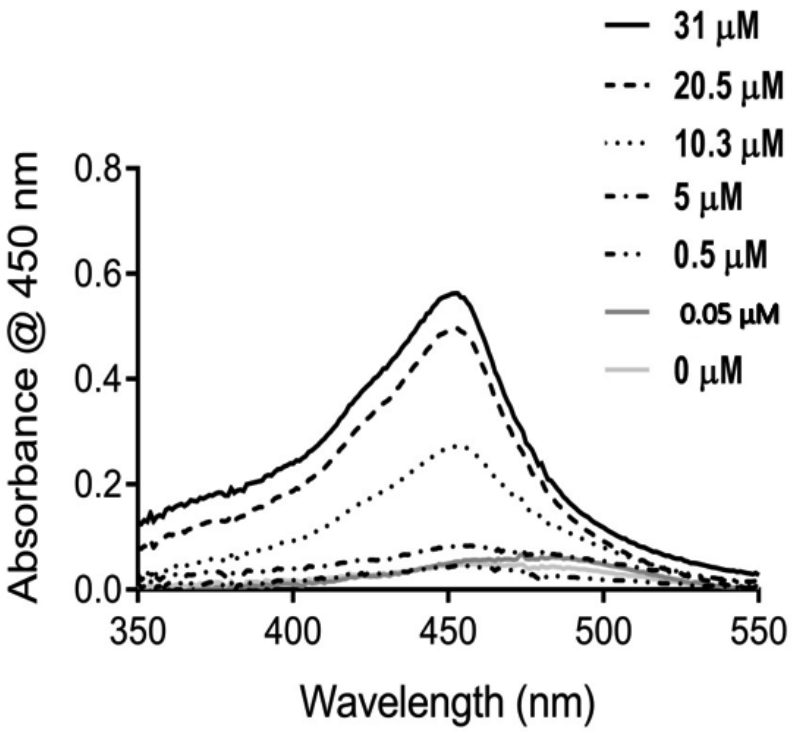

31 μM
20.5 μM
10.3 μM
5 μM
0.5 μM
0.05 μM
0 μM
Absorbance @ 450 nm
0.0
0.2
0.4
0.6
0.8
350
400
450
500
550
Wavelength (nm)

FIG. 9

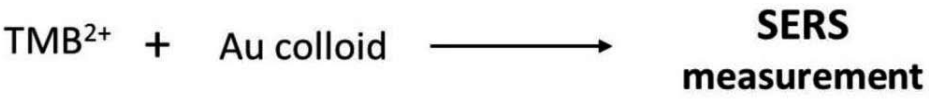

TMB2+
+
Au colloid
SERS
measurement

FIG. 10

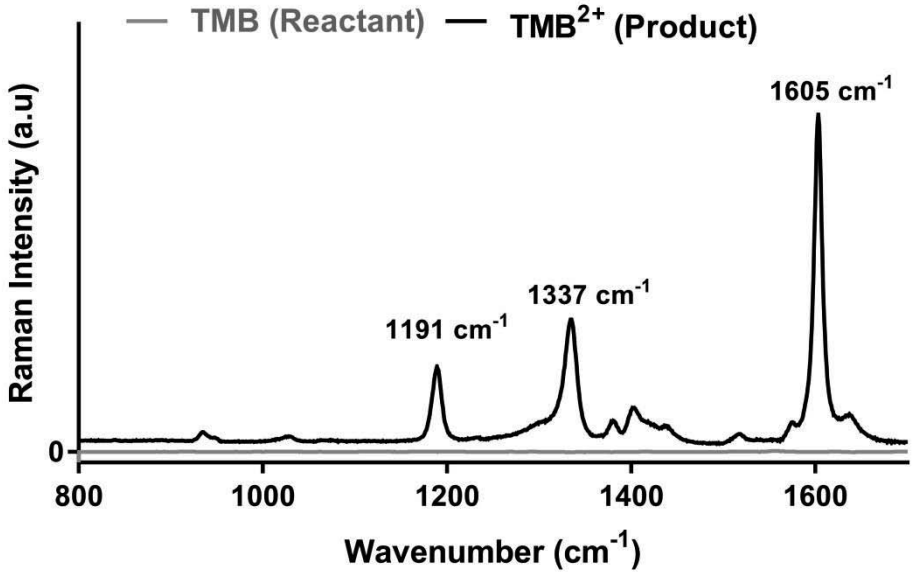

TMB (Reactant)
TMB2+ (Product)
1605 cm-1
1337 cm-1
1191 cm-1
Raman Intensity (a.u)
0
800
1000
1200
1400
1600
Wavenumber (cm-1)

FIG. 11

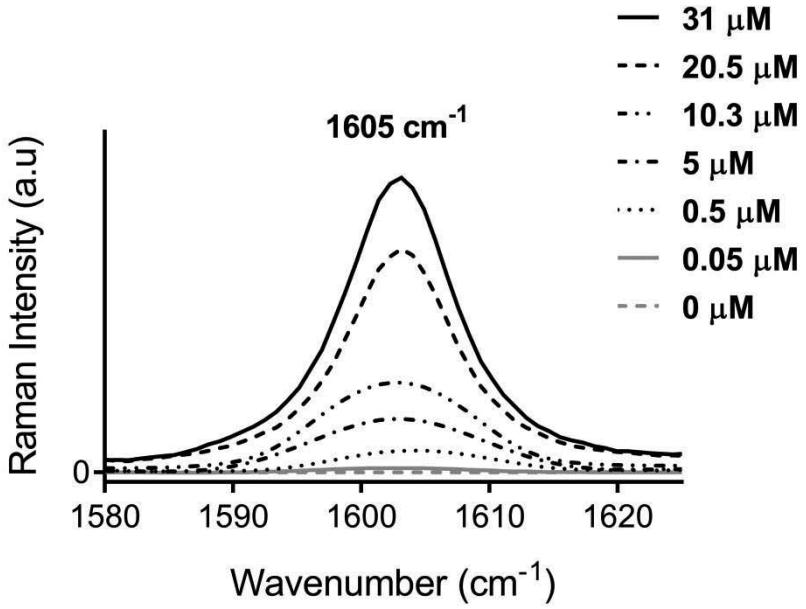

31 μM
20.5 μM
10.3 μM
5 μM
0.5 μM
0.05 μM
0 μM
1605 cm-1
Raman Intensity (a.u)
0
1580
1590
1600
1610
1620
Wavenumber (cm-1)

FIG. 12

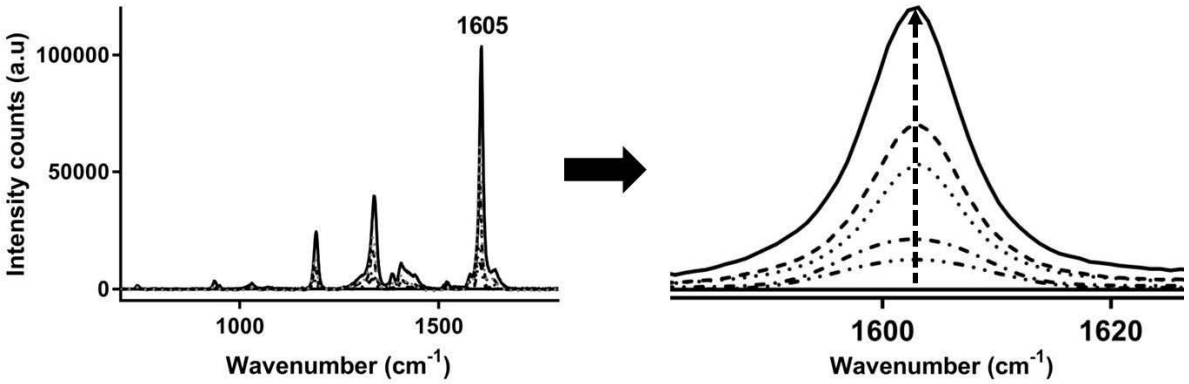

1605
100000
50000
0
Intensity counts (a.u)
1000
1500
Wavenumber (cm-1)
1600
1620
Wavenumber (cm-1)

FIG. 13

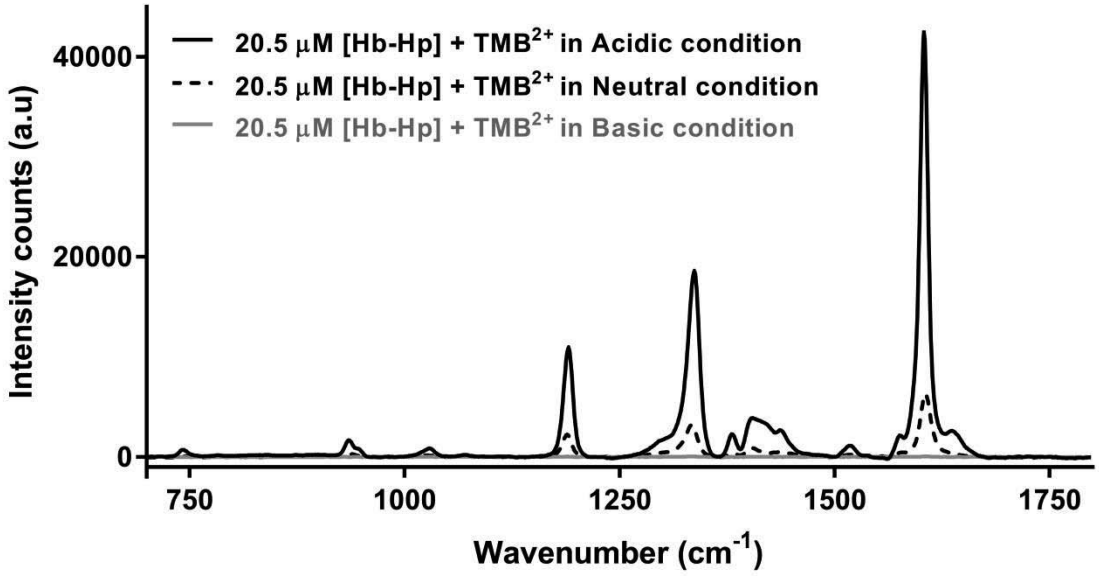

20.5 μM [Hb-Hp] + TMB2+ in Acidic condition
20.5 μM [Hb-Hp] + TMB2+ in Neutral condition
20.5 μM [Hb-Hp] + TMB2+ in Basic condition
40000
20000
0
Intensity counts (a.u)
750
1000
1250
1500
1750
Wavenumber (cm-1)

FIG. 14

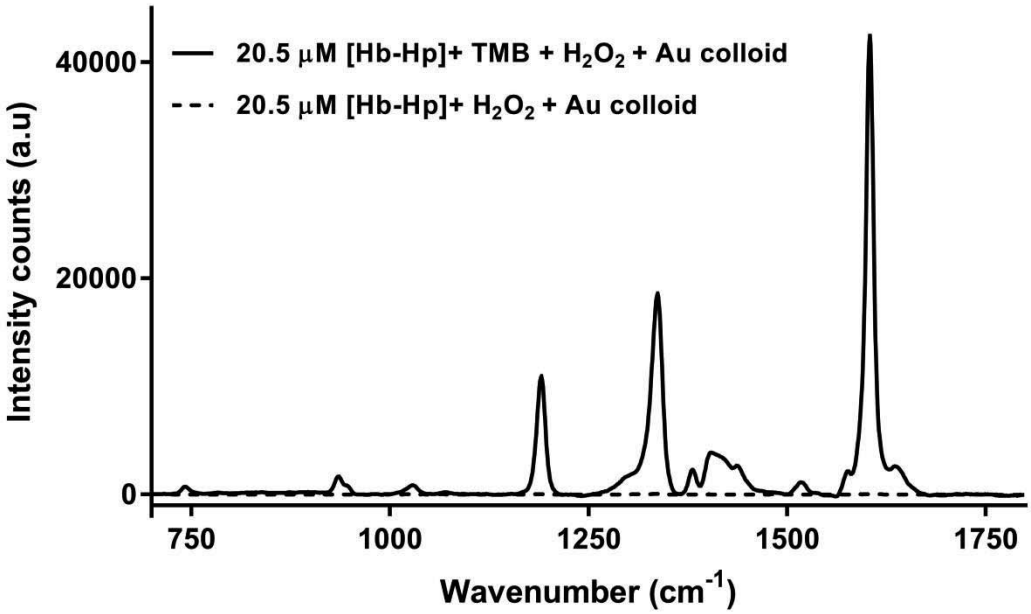

20.5 μM [Hb-Hp]+ TMB + H_2O_2 + Au colloid
20.5 μM [Hb-Hp]+ H_2O_2 + Au colloid
Intensity counts (a.u)
40000
20000
0
750
1000
1250
1500
1750
Wavenumber (cm^{-1})

FIG. 15

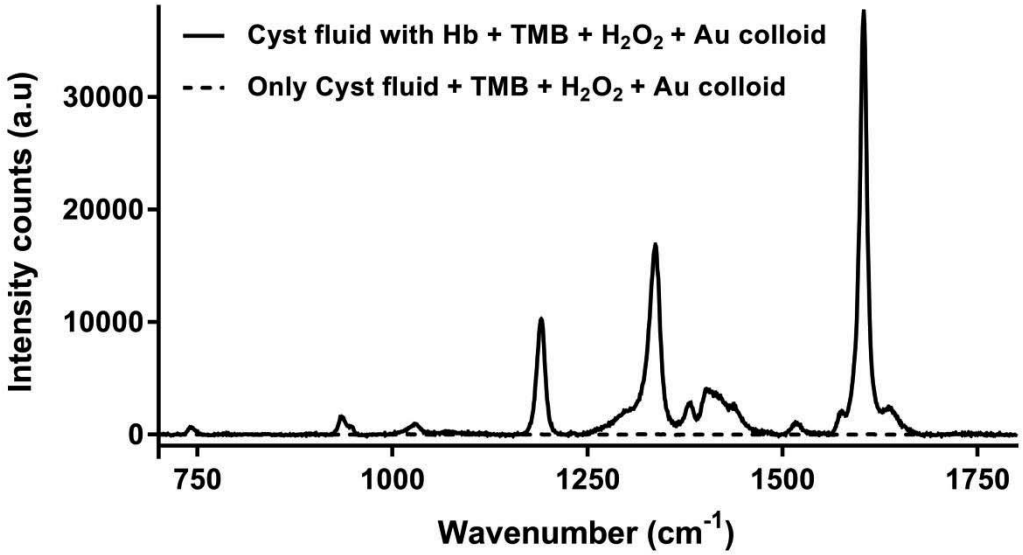

Cyst fluid with Hb + TMB + H_2O_2 + Au colloid
Only Cyst fluid + TMB + H_2O_2 + Au colloid
Intensity counts (a.u)
30000
20000
10000
0
750
1000
1250
1500
1750
Wavenumber (cm^{-1})

FIG. 16

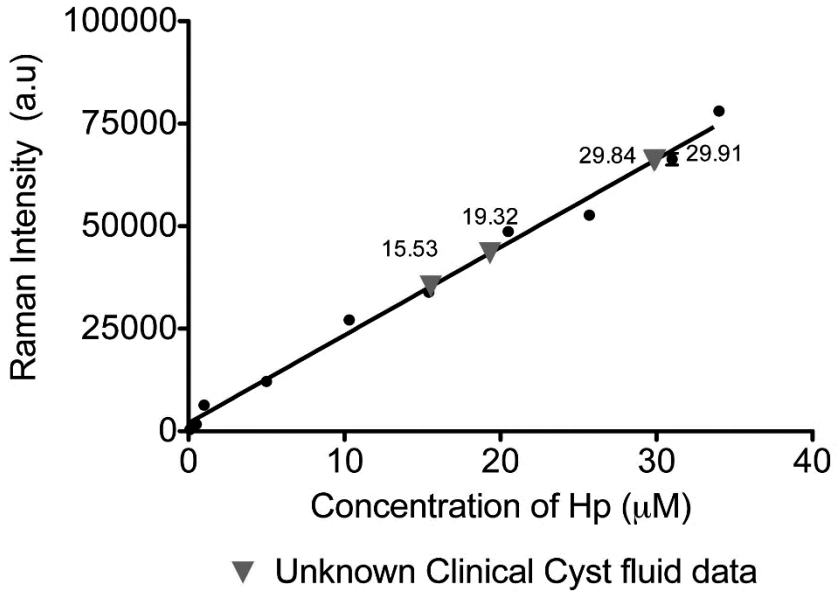

100000
75000
50000
25000
0
Raman Intensity (a.u)
0
10
20
30
40
Concentration of Hp (μM)
15.53
19.32
29.84
29.91
Unknown Clinical Cyst fluid data

FIG. 17

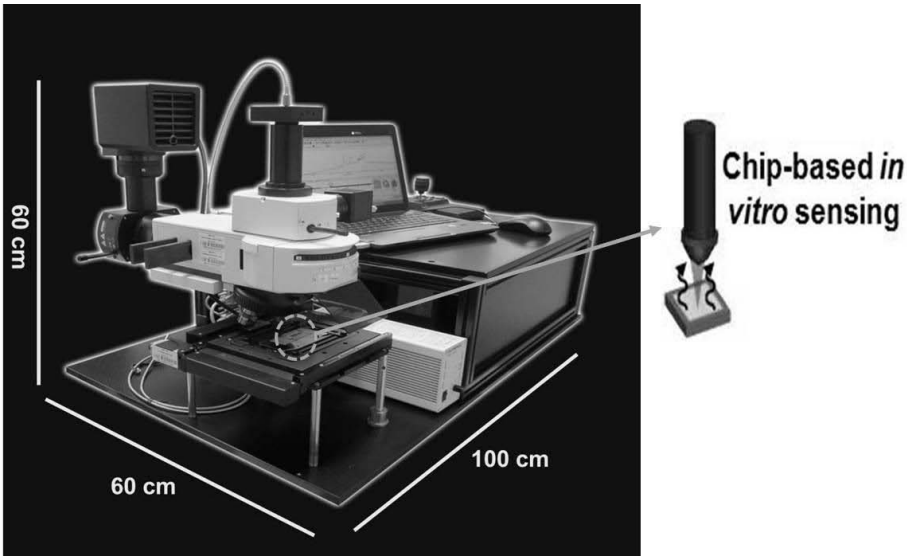

60 cm
60 cm
100 cm
Chip-based *in vitro* sensing

FIG. 18

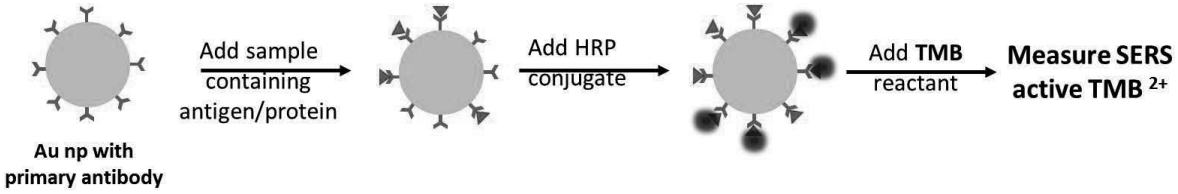
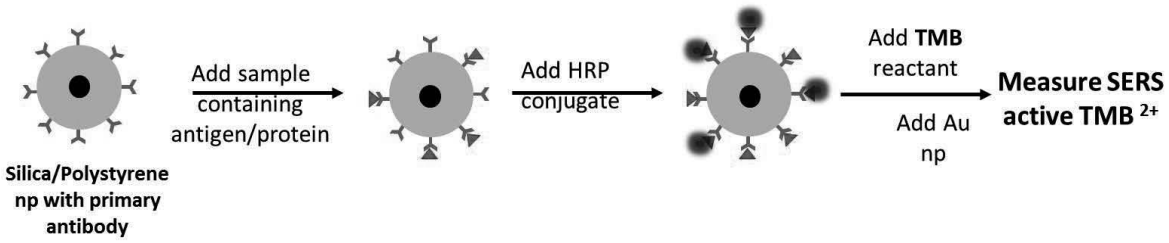

Au np with primary antibody
Add sample containing antigen/protein
Add HRP conjugate
Add TMB reactant
Measure SERS active TMB 2+

FIG. 19


Silica/Polystyrene np with primary antibody
Add sample containing antigen/protein
Add HRP conjugate
Add TMB reactant
Add Au np
Measure SERS active TMB 2+