Synthesis of hybrid materials doped with metal nanoparticles for SERS detection

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Abstract

The major goal of this research is to develop a SERS (Surface Enhanced Raman Scattering) platform based on hydrogels doped with Au nanoparticles that can be used for reliable detection. We fabricate two different types of hydrogels: polyacrylamide [pAA] and poly(N-isopropyl-acrylamide) [pNIPAM].

The hydrogels doped with Au nanoparticles are synthesized by mixing pre-made nanoparticles[2] functionalized with PEG [*O*-[2-(3-mercaptopropionylamino)ethyl]-*O´*-methyl-poly(ethylene glycol)][3] with a hydrogel solution followed by free-radical polymerization[4]. Thus hydrogel doped with different amount of Au nanospheres are prepared. Besides, in order to study the effect of the particle size, Au nanoparticles with different sizes (from 60 to 120nm) have been used to fabricate the hydrogels (Figure 1). The as prepared hydrogels were characterized by VIS-NIR spectroscopy. Figure 2 shows an increase in the intensity of the absorbance upon hydrogel drying.

Finally the performance of the different sensing platforms is analyzed using 1-naphthalenethiol (1-NAT) as Raman probe. The best results were obtained using gold particles with diameters of ca. 120nm. Interestingly, the Figure 3 shows that the SERS enhancing ability of the hydrogel is homogeneous through the entire surface, which reveals that this is an extremely clean and efficient substrate for SERS.

References:

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Figures

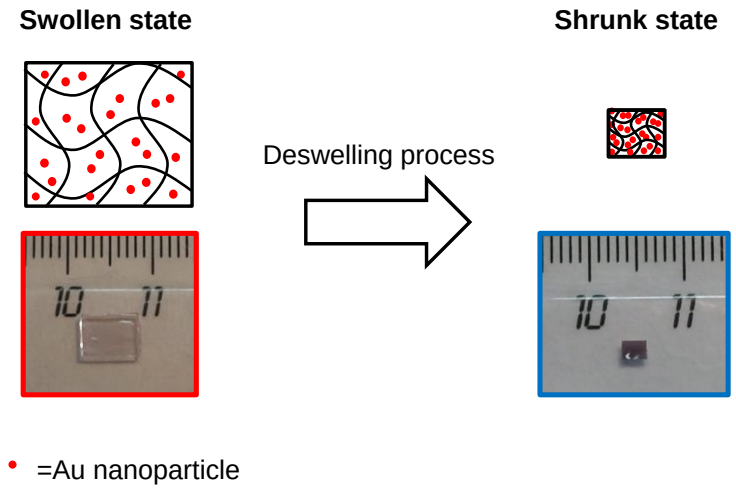

Figure 1. Schematic illustration of the structures of hydrogels doped with Au nanoparticles at swollen and shrunk state.

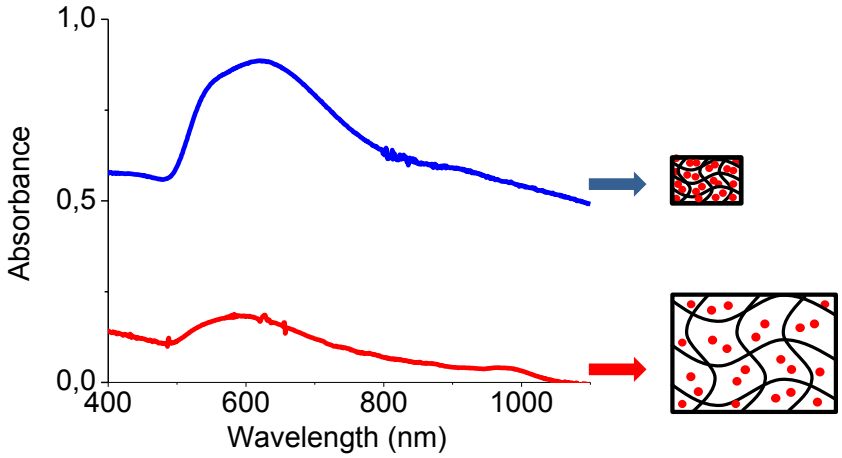

Figure 2. UV-Vis spectra of Acrylamide hydrogel doped with Au 120nm at swollen and shrunken state.

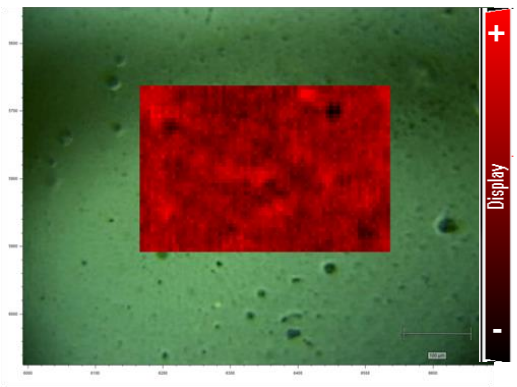

Figure 3. StreamLine map of Acrylamide hydrogels doped with Au 120nm with 1-NAT (785nm), 2870 Spectra.