Western Nanofabrication Facility

Fabrication of new Nanostructures for High Sensitivity Raman Spectroscopy

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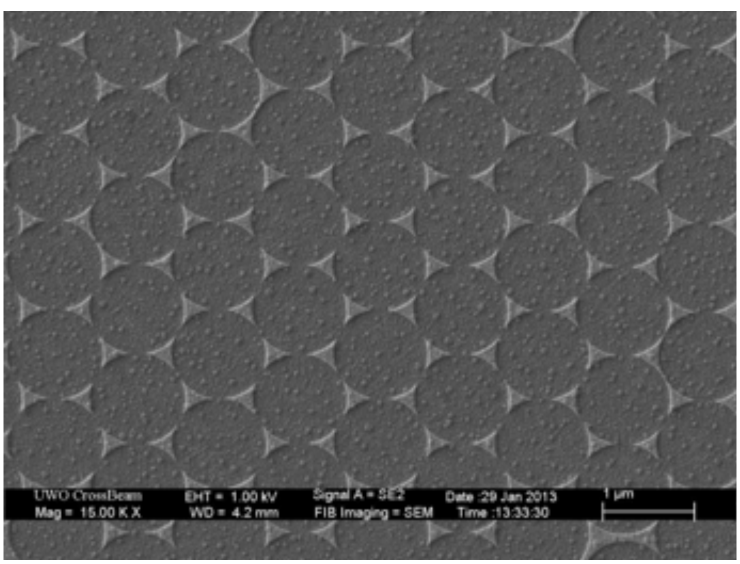
When a metal surface is irradiated with an electromagnetic field, the strong interaction between the light and the free electrons of the metal, induce a collective oscillation of the electron-waves that propagate along the interface. This phenomenon is called surface Plasmon polariton (SPP). When isolated metal nanostructures are irradiated, the field is confined in the vicinity of the nanostructure yielding an accumulation of charges near the sharp metal nanostructure. Such effect is known as localized surface plasmon resonance (LSPR) and is responsible for the colors of metallic nanostructures. Noticeably, it is possible to change the optical properties of the metallic particles by designing nanostructures with different geometries and sizes in order to tune the frequency of the electronic waves leading to a variety of potential applications. More specifically, this effect can be applied to detect small amounts of molecules through an enhancement of the electromagnetic effect mediated by a plasmonic effect. This can lead to the development of ultra-sensitive biosensors.

Using the Western Nanofabrication Facility, we fabricated new multilayered nanostructures for applications in Raman spectroscopy. On gold mirrors, 30 nm of silicon dioxide was sputtered. Next, a monolayer of polystyrene nanospheres was deposited followed by the evaporation of 3 nm of titanium and 30 nm of gold onto the compact monolayer of nanopsheres. After the removal of the nanospheres by sonication, the nanostructures were functionalized with thiolated molecules and probed under a Raman microscope. We have demonstrated that the new nanostructure improve the Raman sensitivity of a monolayer of 4-NTP.



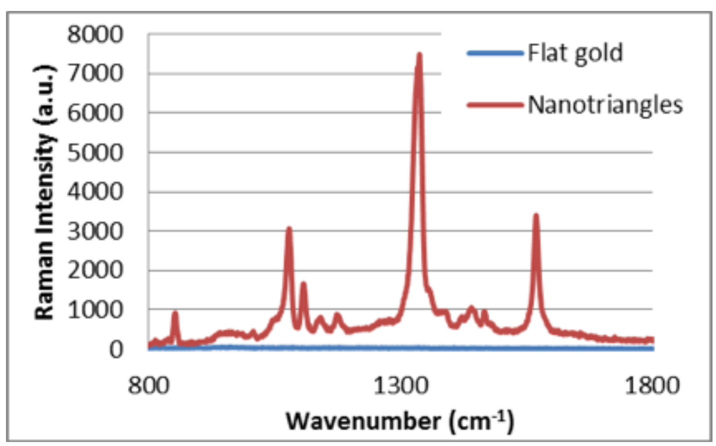


Figure (a) Plasmonic nanostructure fabricated at Western Nanofabrication Facility. **(b)** Raman spectra of a monolayer of 4-NTP adsorbed on the nanostructured surface (nanotriangles) and on a flat gold substrate.

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