Gold-a Core Player in Plasmon-Enhanced Raman Spectroscopy

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Gold is a core player in plasmon-enhanced Raman spectroscopy (PERS) because it shows unique and tunable plasmonic properties in the visible to the near infrared region, the very good chemical stability and abundant shapes to generate both unique optical and chemical properties. As the result of localized plasmon resonance (LSPR), the gold nanoparticles and nanostructures show enhanced light absorption and scattering, and a significantly enhanced local electromagnetic field. The latter is key to the surface-enhanced spectroscopies.

In this talk, we will present our current experimental effort on separating the absorption and scattering contribution to the extinction spectra in gold system. We further developed a method to make use of the LSPR response of a plasmonic system to understand how LSPR will change the spectral profile. We then proposed an experimental approach to correct such a LSPR-shaping effect, which can be applicable to all surface plasmon enhanced spectroscopy.

We then demonstrate our current development of tip-enhanced Raman spectroscopy (TERS), making use of the electromagnetic coupling between gold single crystal as substrate and gold tip with apex size of 10-20 nm. Such a combination makes the TERS a highly sensitive tool. We then use TERS to characterize the different surface electronic properties of a bimetallic surface and to monitor the gold plasmon induced nanoscale chemical and electrochemical reaction. We further demonstrate the TERS can also be effective used to characterize the surface defects of two dimensional materials.

Figure 1. (a) A method to separate the absorption and scattering contribution of gold nanoparticles; (b) A method to correct the LSPR effect on the relative intensity of SERS spectra; (c) TERS to study the nanoscale plasmon induced reaction.

References


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