Contribution ID: **84** Type: **Oral**

ENHANCING GOLD BY GOLD: PLASMON ENHANCED LUMINESCENCE OF GOLD NANOCLUSTERS ON GOLD NANORODS

Thursday, 10 September 2020 08:30 (20 minutes)

One of the fundamental features of nanotechnology is that properties of a certain material can be changed just by varying its shape and size. This exactly is the case for the two types of gold nanostructures in our study, where luminescent gold nanoclusters (AuNCs) benefit from the presence of plasmonic gold nanorods (AuNRs). Despite the limited number of atoms, AuNRs with characteristic dimensions ranging from ˜10 to 100 nm still retain their metallic properties. Consequently, collective oscillations of the nearly free conductive electrons (so called localized surface plasmon resonance; LSPR) can be excited in AuNRs upon interaction with an incoming electromagnetic radiation. In recent years, LSPR has been widely used to enhance the optical performance of other nearby objects (e.g. surface-enhanced Raman scattering or luminescence).
The electronic structure of AuNCs with diameter of ˜1 nm is, on the other hand, rather molecular-like, which can result in near-infrared photoluminescence from the nanoclusters. In the present study, we attempt to increase the radiative rate in AuNCs by coupling their emission to plasmons of AuNRs in a core@shell AuNRs@AuNCs structure. By measuring the changes in luminescence of AuNCs upon attachment to AuNRs we demonstrate that it is indeed possible to enhance gold by gold.

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Session Classification: Parallel sessions