Synthesis and controlled assembly of Janus gold-Silica plasmonic particles

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As researchers began to investigate the Surface enhanced Raman scattering (SERS) effect using colloidal nanoparticles (NPs), it soon became apparent that the extremely intense SERS signals originate mainly from aggregated NPs.[1]

Our group reported a simple strategy to assemble gold nanorods (AuNRs) into long-term stable dimers based on kinetics control. [2] Both experimental (SERS) and theoretical (DDA calculations) studies of the near-field characteristics revealed two-orders of magnitude increase of the SERS enhancement factor for dimers as compared to isolated AuNRs. [3] However, isolated AuNRs constituted an unavoidable byproduct. Increasing the fraction of dimers is particularly desirable given that such a configuration has been clearly shown to provide much higher enhancement. [2] To this end, important issues related to the purification of the final colloidal assembly containing AuNRs dimers and monomers remain unresolved for solution-based SERS. In this work, a bottom-up approach has been adopted for addressing these critical issues in solution-based SERS experiments and advancing the search for an optimal SERS substrate.

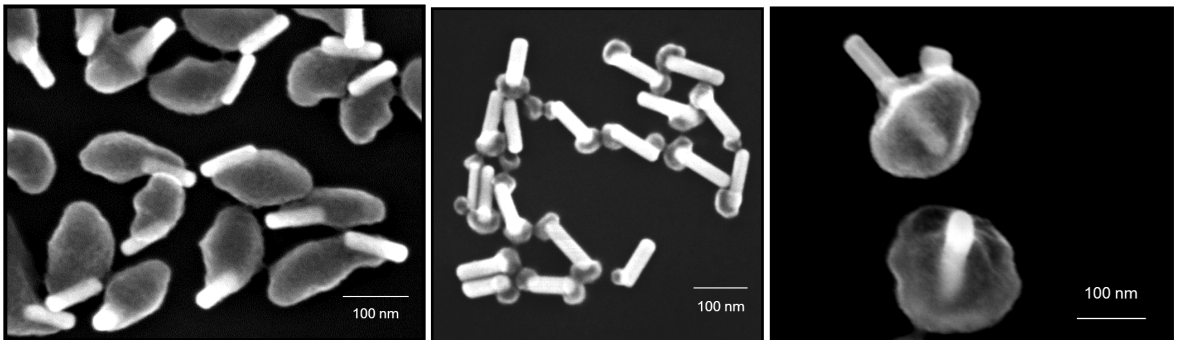

Figure 1. SEM micrographs of different Metal-silica Janus anisotropic nanoparticles

The control of the number of AuNRs involved in each cluster and their relative arrangement would rely on the partial and regioselective coating of GNRs tips with a mesoporous silica layer (Au@SiO_2 Janus nanorods). We explored in the detail different synthetic strategies to control the architecture of the anisotropic Janus particles which are the building blocks for assembly. [4] Besides thermal and colloidal stability, mesoporous silica coating of nanoparticles imparts other notable advantages due to its porosity which can be exploited for drug or dye loading.

References

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