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From Seed Size Control to Femtosecond Laser Irradiation: Strategies for the Synthesis of Colloidal Gold Nanorods

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Abstract: Gold is probably, among all metals, the one that has fascinated humankind the most due to its unique luster and oxidation resistance. Likewise, gold nanocrystals stand out above many nanomaterials and withdraw attention because of their ability to interact strongly with light and high chemical stability. Together with their size- and anisotropy-dependent optical properties, such features of gold nanocrystals have contributed to making them an essential component for technology advancement in diverse fields, ranging from biomedicine and optoelectronics to photocatalysis. In particular, nanorods have emerged as the most alluring class of gold nanocrystal due to several reasons, including the possibility to be synthesized with high yield and narrow extinction bands in the visible and near-infrared regions. However, there are still certain challenges, mainly related to the reproducibility of current synthesis methods, that need to be overcome to facilitate their practical implementation in technology.

This talk will introduce different strategies to fabricate colloidal gold nanorods with desired morphological and optical features based on surfactant-assisted seed-mediated growth routes. The discussion will be focused on the phenomena of symmetry breaking and anisotropic growth in gold nanocrystals and how the complex interplay between various synthesis parameters determines the quality of the resulting gold nanorod colloid. Special emphasis will be placed on the seed size, the use of co-surfactants, and the spatiotemporal separation between symmetry breaking and anisotropic growth as critical factors for granting optimal control over the nanorod synthesis process. I will also present recently developed methodologies utilizing ultrafast pulsed laser irradiation to produce nanorod suspensions with ultranarrow extinction bands and chiral additives to grow nanorods with strong chiroptical responses.

References

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[5]. G. González-Rubio *et al*. Simple Determination of Gold Nanocrystal Dimensions by Analytical Ultracentrifugation via Surface Ligand-Solvent Density Matching. *Nanomaterials*. **2021**, 11, 1427.