Chemical Transformations of Colloidal Nanocrystals

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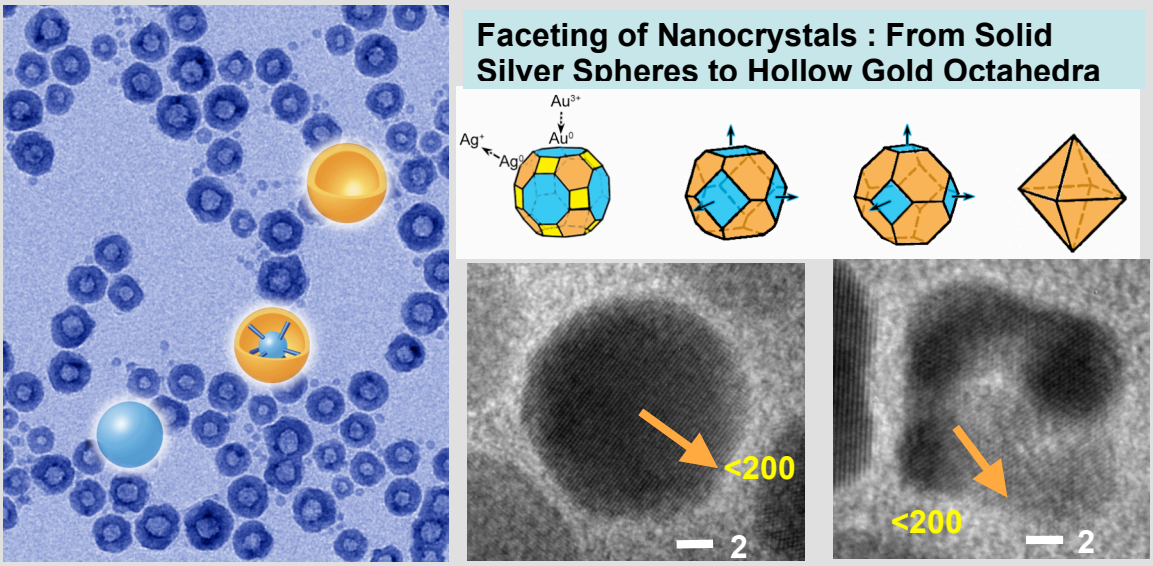

Figure. *(left) Hollow Cobalt Sulfide Nanocrystals. (right) Transformation of spherical Ad nanocrystals into octahedral hollow Au nanoparticles via* galvanic displacement reaction.

The chemical transformation of colloidal nanocrystals has been used as a powerful method for producing functional nanostructures with new compositions, morphologies, and properties. Hollow nanomaterials can be synthesized through the nanoscale Kirkendall effect based on the difference in diffusion rates of two species resulting in accumulation and condensation of vacancies [1]. Galvanic displacement reactions can also be employed in synthesis of hollow nanostructures. Single crystalline silver nanoscrystals with a spherical shape transform in the presence of Au^{3+} into hollow Au nanocrystals with truncated octahedral shape [2]. The growth of significantly faceted particles from spherical precursors is made possible by surface effects, namely surfactant binding and/or an enhanced role for surface energetics in smaller nanocrystals. Production of hollow Au nanocrystals with faceted geometry allows increased tunability of optical properties as the surface plasmon resonance of a hollow metallic nanocrystal depends strongly not only on the shell thickness, but also on the detailed shape.

1. Y. Yin, C. Erdonmez, S. Aloni, A. P Alivisatos *Faceting of Nanocrystals during Chemical Transformation: From Solid Silver Spheres to Hollow Gold Octahedra* , J. Am. Chem. Soc.; **128**, 1267 (2006).

2. Y. Yin, Can K. Erdonmez, A. Cabot, S. Hughes, A. Paul Alivisatos, *Colloidal synthesis of hollow cobalt sulfide nanocrystals.* Advanced Functional Materials, 16, 1389 (2006).