KINETIC CONTROL: A VERSATILE APPROACH FOR SHAPE-CONTROLLED SYNTHESIS OF METALLIC NANOCRYSTALS

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In principle, both thermodynamic and kinetic approaches can be employed to control the shape of metal nanocrystals during a synthesis. Generally, thermodynamic approaches are limited to producing nanocrystals enclosed by low-energy surfaces and with highly symmetric shapes (e.g., spheres and polyhedrons) as constrained by the obligation to minimize the surface free energy of a system. In contrast, the products of kinetic control are not confined by thermodynamics, allowing for the generation of novel nanocrystals having high-energy facets, and/or concave structures, or asymmetric shapes. This presentation will discuss our mechanistic understanding on kinetically controlled synthesis of metal nanocrystals, as well as synthetic strategies for experimentally manipulating the reaction kinetics of a synthesis. Case studies of different metals including Pd, Pt, Ir, Ag, and their combinations will be highlighted. More details can be found in our recent Perspective published in JACS (2015, 137, 7947-7966). We hope that the insights provided in this presentation can provide solutions to design and synthesize metal nanocrystals with desired shapes for specific applications.

Keywords: Metallic nanocrystals, Shape control, Kinetics

References:


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