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Title： Toward a Quantitative Understanding of Shape-Controlled Synthesis of Colloidal Metal Nanocrystals

Abstract: Despite the incredible developments made to the synthesis of colloidal metal nanocrystals, it is still challenging to produce them in a reproducible and predictable manner. This drawback can be attributed to the fact that the protocols continue to be built upon qualitative observations and empirical laws. However, recent studies suggest that reduction kinetics play an important role in determining the outcome of a colloidal synthesis of metal nanocrystals. The reduction rate not only controls the internal defect structure of a seed formed in the nucleation step but also governs the growth pattern (symmetric vs. asymmetric), growth mode (island vs. layer-by-layer), and elemental distribution (core-shell vs. alloy) of the seed in the following steps. In this talk, I will start with a brief introduction to our recent success in quantifying the kinetic parameters, including the rate constants and activation energies, for many systems. Then, I will illustrate how this knowledge can be applied to deepen our understanding of the nucleation and growth processes, moving towards the ultimate goal of achieving deterministic and predictable synthesis. The quantitative measure and control allow us to precisely and reproducibly tailor the properties of colloidal metal nanocrystals for a broad range of catalytic applications.