Chemical Transformation and Assembly of Nanocrystals for Electrocatalysis

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For the advanced synthesis of nanocrystals (NCs), chemical transformations of as-synthesized NCs are an emerging and powerful method to tailor the composition and morphology of NCs. Nanosynthetic chemistry has centered on creating new NCs using these transformations. However, beyond works employing empirical qualitative analysis, few works have addressed the underlying atomic mechanisms for these transformations. Works using chemical transformations of NCs for applications are also an under-studied field. This presentation spans from fundamental understandings of the atomic structural evolutions and mechanisms in chemical transformations and synthesis of metal phosphide NCs, to use of these methods to create and characterize new structures, to assembly of those NCs through electrophoretic deposition, to the final applied stage of electrocatalysts for hydrogen evolution with these metal phosphide NCs. We demonstrated that hydrogen evolution reaction catalytic activity of NCs can be improved by synthetic control such as composition, doping, and crystallinity, as well as deposition control through utilization of electrophoretic deposition technique.