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Chemical tools for creating energy-relevant nanomaterials

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An important pre-requisite for using nanoscale materials in energy-related applications is the ability to make them on-demand and to rigid and pre-determined standards. For example, creating nanoscale solids with controllable composition, crystal structure, size, morphology, and surface chemistry is necessary for optimizing and fine-tuning their properties, as well as spatially organizing them and interfacing them with other components in a device. This talk will summarize our efforts to controllably and rationally synthesize shape-controlled nanocrystals of complex multi-element metallic and semiconducting materials. Collectively, these results provide reliable and predictable guidelines for designing and synthesizing complex nanomaterials of solids that are typically viewed as challenging to make. The focus will be on applying these ideas to energy-relevant nanomaterials, including nanostructured superconductors with high critical fields, metal hydrides for hydrogen storage applications, nanoparticle catalysts relevant to fuel cells, and metal-based compounds for thermoelectric, battery, and photovoltaic applications.