

Large-scale Synthesis of Uniform-sized Nanocrystals for Energy and Catalytic Applications

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We developed a new generalized synthetic procedure, called as “heat-up process,” to produce uniform-sized nanocrystals of many transition metals and oxides without a size selection process. We were able to synthesize uniform magnetite nanocrystals as much as 1 kilogram-scale from the thermolysis of Fe-oleate complex.

We report the large-scale synthesis of magnetite nanocrystals imbedded in a carbon matrix and hollow hematite nanocapsules. These iron oxide-based nanomaterials exhibited very high specific capacity and good cyclability. We reported a very simple and large-scale synthesis of uniform-sized bismuth (Bi) nanocrystals with controlled sizes, and characterized size-dependent thermoelectric properties.

A simple synthesis of heterodimer nanocrystals of Rh-Fe₃O₄ and Pd-Fe₃O₄ was achieved by controlled one-pot thermolysis of a mixture solution composed of Fe(acac)₃, M(acac)₃, oleic acid, and oleylamine. The nanocrystals exhibited excellent activities for the selective reduction of nitroarenes and Suzuki coupling reactions. Furthermore the nanocrystal catalyst could be easily separated by a magnet, and recycled many times without losing the catalytic activity.