DEVELOPMENT OF NANOCRYSTAL-BASED MAGNETOELECTRIC COMPOSITES

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Integration of magnetic nanocrystals into magnetoelectric composites has the potential to add a new dimension to multiferroics, allowing for control of magnetic fluctuations inherent only to nanoscale materials. The magnetic properties of nanocrystals can be synthetically tuned, as the nanoparticle domain size is confined to the physical dimensions of the particle. We explore single-domain nickel nanocrystals, which have a synthetically tunable, size-dependent, magnetic transition from superparamagnetic (SPM) to ferromagnetic (FM). Nickel nanocrystals are highly magnetostrictive, providing a potential for integration into a strain-coupled magnetoelectric composite to control the transition between the SPM and FM states. Development of the composite requires strong strain coupling between the strain medium and the nanocrystals. Here we examine ways to make monolayers of nanocrystals adhered to the composite substrate using self-assembly and tuning of interfacial energies of the system for applications in nanocrystal-based multiferroics.

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