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Structural and Magnetic Characteristics of p-GaAs/MnAs Nanocluster Hybrids DAVID RENCH, PETER SCHIFFER, NITIN SAMARTH, Department of Physics and Materials Research Institute, The Pennsylvania State University, University Park, Pennsylvania 16802, USA — A possible route towards semiconductor spintronic devices involves the controlled synthesis of hybrid materials that combine ferromagnetic (FM) nanoclusters within a doped semiconductor host lattice. We use molecular beam epitaxy of (Ga,Mn,Be)As followed by in situ annealing to synthesize a systematic set of samples wherein FM nanoclusters are embedded in a p-GaAs matrix. High resolution transmission electron microscopy (HRTEM) and magnetometry demonstrate our ability to reproducibly synthesize two distinct classes of materials: (a) type I samples consisting of uniformly distributed, small clusters (∼6 nm); (b) type II samples consisting of a bimodal distribution of small (∼6 nm) and large (∼25 nm) clusters. HRTEM studies show that while the large clusters are clearly MnAs with NiAs structure, the smaller clusters are possibly zinc blende in structure but with a more complex composition. We analyze the magnetic behavior of these two classes of samples and show measurements of their transport properties. Supported by the ONR-MURI program.

David Rench
Dept of Physics and Materials Research Institute,
The Pennsylvania State University,
University Park, Pennsylvania 16802, USA

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