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Incorporation of Mn into Ge Quantum Dots: Growth Strategies to Control Structure and Magnetism[1] CHRISTOPHER NOLPH, PETRA REINKE, Department of Materials Science and Engineering, University of Virginia
— Manganese doped, magnetic germanium quantum dots are important building blocks for the future of spintronic devices. Our goal is to understand and control how the manipulation of the Mn-environment within the Si(100)-Ge wetting layer-Ge QD systems influence the magnetic properties. We investigate several pathways for Mn-doping of Ge QDs which suppress detrimental germanide formation. The first pathway uses a surface-driven approach: Mn is deposited on the Ge QD surface, forms well-defined clusters on the QD and dissolve during annealing. The second pathway uses co-deposition of Ge and Mn (i) throughout the entire QD growth process, and (ii) only during the formation of the wetting layer. The highest concentration of Mn is about 20%, and the Ge QD growth is only marginally perturbed, albeit germanides begin to form. All processes are observed with scanning tunneling microscopy, which yields morphological and electronic structure information of the reaction sequence. A comprehensive model of all processes will be presented. Preliminary magnetism results, obtained with a vibrating sample magnetometer, indicate a ferromagnetic material with a Curie temperature up to 100K.

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