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Real-Time Studies of Ga Droplet Formation for the Directed Seeding of Semiconductor Nanopillars[1] W. YE, B.L. CARDOZO, X. WENG, J.F. MANSFIELD, R.S. GOLDMAN, University of Michigan — The directed self-assembly of low-dimensional semiconductor structures has been achieved using a variety of approaches to producing topographical patterns. However, an approach for producing highly ordered arrangements of nanostructures with well-controlled shapes and size distributions has yet to be developed. Therefore, we are exploring the seeded-assembly of semiconductor nanocrystal and nanopillars on substrates topographically patterned using a focused-ion-beam (FIB). For nanopillar formation, we have seeded ordered arrays of holes with controlled concentrations of Ga droplets using FIB implantation. These holes have nearly uniform sizes and shapes. By controlling the ion beam energy, current, and size, hole arrays with various sizes, depths, and periodicities may be produced. Interestingly, after scanning the ion beam over the patterned area, Ga atoms diffuse to the holes and agglomerate, leading to the formation of ordered arrays of nearly uniform sized Ga dots. We will discuss the mechanisms of Ga droplet formation and present real-time studies of Ga droplet dynamics and their interaction with various gases. We will also discuss the use of these ordered arrays of Ga dots as catalysts for vapor-liquid-solid growth of semiconductor nanopillars.

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R.S. Goldman
University of Michigan

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