

Semiconductor Nanowires: A Platform for Nanoscience and Nanotechnology

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Abstract

Advances in nanoscience and nanotechnology depend critically on development of nanostructures whose properties are controlled during synthesis. Here we focus on this critical concept using semiconductor nanowires, which provide the capability for synthetic design to realize unprecedented structural and functional complexity in building blocks, as a platform material. First, a brief review of the synthesis of complex modulated nanowires in which rational design can be used to precisely control composition, structure and most recently structural topology will be discussed. Second, the unique functional characteristics emerging from our exquisite control of nanowire materials will be illustrated with several selected examples from nanoelectronics, quantum electronics and nano-enabled energy. Third, the remarkable power of nanowire building blocks will be further highlighted through their capability to create unprecedented active electronic interfaces with biological systems. Recent work pushing the limits of both multiplexed extracellular recording at the single cell level and the first examples of intracellular recording will be described, as well as the prospects for truly blurring the distinction between nonliving and living information processing systems.