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Semiconductor Nanowires: From Materials to Devices

Ray LaPierre
McMaster University, Canada

Extended Abstract

Semiconductor nanowires (NWs) are being developed for the next generation of optoelectronic devices such as photodetectors, photovoltaics, betavoltaics and thermoelectrics. The self-assisted vapor-liquid-solid method is now a well-established technique for the growth of group III-V compound semiconductor NWs. In this method, an array of holes in a SiO2 film is used for metal droplet formation, which seeds the growth of vertically oriented NWs within a periodic array. The free lateral surfaces of NWs allow elastic relaxation of lattice misfit strain without the generation of dislocations, permitting unique heterostructures and the direct integration of III-V materials with silicon substrates. Furthermore, NWs permit high optical absorption due to an optical antenna effect. The optical absorption in NW arrays can exceed that from to a thin film of equivalent thickness, enabling high efficiency NW-based photonic devices. NW materials and devices will be presented for photonic, energy and defense applications.