Si/Ge Nanowires: Nanoscale Growth, Heterostructuring, and Energy Conversion

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High-performance, high efficiency semiconductor devices are driving innovations in architectures from two-dimensional (2D) planar devices to novel three-dimensional (3D) devices. Si/Ge semiconducting nanowires hold promise for such advances, including novel energy harvesting and storage devices. A unique aspect is the synthesis of axial and radial (core/shell) heterogeneous structures which can't be easily obtained by conventional 2D strained layer growth, providing a new approach to band structure engineering.[1] In this presentation we focus on novel aspects of the materials synthesis and heterostructuring processes which arise due to nanoscale size and liquid-mediated growth effects. These effects include a newly observed dependence of Si epitaxy growth rate on the radius of curvature and the strong influence of AuGa alloy catalysts on interface composition and dopant profiles. Examples of heterostructured growth and resulting device properties will also be presented. Finally we will briefly review our results for the application of nanowire arrays to three dimensional photovoltaic devices.[2]

[1] S. T. Picraux, S. Dayeh, P. Manandhar D. E. Perea and S. G. Choi, *JOM*, **62**, (4) 35 (2010).
[2] , J. Yoo, S. A. Dayeh, W. Tang, S. T. Picraux, *Appl. Phys. Lett.* **102**, 093113 (2013).