Carrier Transport in Molecular Beam Epitaxially Grown GaAs/InAs Core-Shell Nanowires

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Semiconductor nanowires produced by metal-catalyzed vapour liquid solid (VLS) growth continue to attract strong interest for applications in electronics [1, 2], optoelectronics [2], and biological sensing [3]. Charge transport in nanowires has been shown to be strongly influenced by ionized impurities [4, 5], surface roughness scattering [6], and charged surface states. Recently we discovered that dynamic capture of electrons producing repulsively charged traps can strongly modulate the conductance of back-gated InAs nanowires, and shift threshold voltage by more than 100 mV, and that the modulation in conductance depends sensitively on nanowire diameter. To obtain high performance field effect transistors and sensors, scattering from charged centers and surface roughness should be reduced as much as possible. With the goal of improving surface properties in mind, we recently we began investigation of growth of InAs/GaAs core/shell heterostructure nanowires. We discuss preliminary results from this study along with some device-oriented applications.

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