Charge injection and transport in nanowires.

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Semiconductor nanowires show promise in electronic, optoelectronic, and sensing devices. To realize this promise, a fundamental understanding of charge injection and electronic transport in these novel nanomaterials is necessary. In this presentation, I will discuss recent work that couples experiment and theory to address this topic. For example, in GaN and InAs nanowires, we achieve efficient charge injection and find that space-charge-limited currents are unusually strong [1,2]. In contrast, charge transport across individual Au-nanoparticle/Ge-nanowire interfaces is injection-limited, and surprisingly, the conductance increases with decreasing nanowire diameter due to a dominance of electron-hole recombination [3]. Furthermore, we find that transport in GaAs nanowires is governed by charge traps, which can be activated to reveal the nature of the charge injection at the contacts [4]. More generally, our results indicate that a broad range of electronic transport regimes can be observed in semiconducting nanowires depending on the particular material system and growth process.

References

[1] AA Talin, F Léonard, B Swartzentruber, X Wang, S Hersee. *Physical Review Letters* **101** (2008) 076802.
[2] AM Katzenmeyer, F Léonard, AA Talin, ME Toimil-Molares, JG Cederberg, JY Huang, and J Lensch-Falk. *IEEE Transactions in Nanotechnology* **10** (2011) 92.
[3] F Léonard, AA Talin, B Swartzentruber, T Picraux. *Physical Review Letters* **102** (2009)106805.
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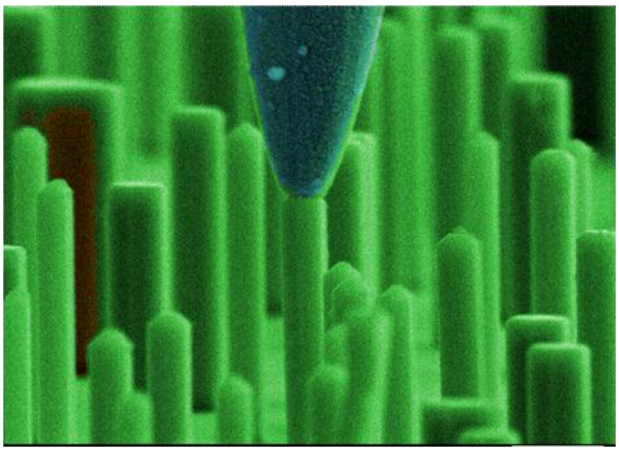
Figures



A conducting tip retrofitted inside of a scanning electron microscope measures the electronic properties of individual nanowires.