Visualizing novel nanowire behaviors: doping and dissipation

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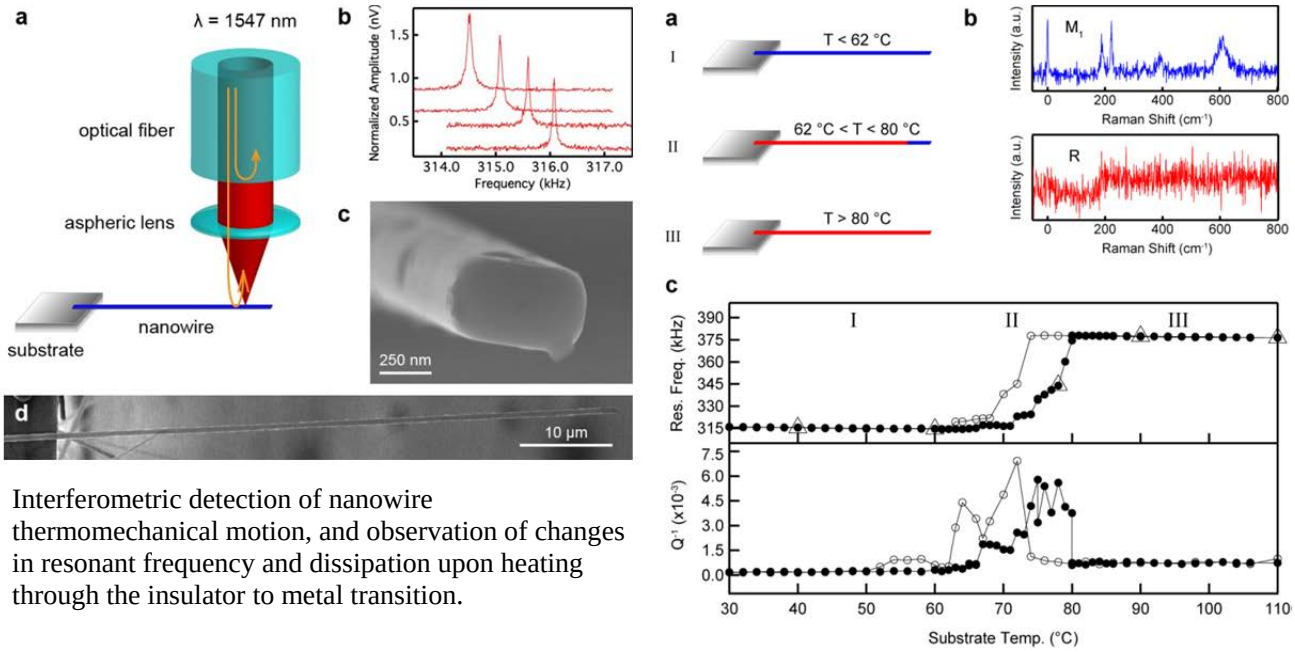
The talk will focus on two strands of nanowire research in which advances in measurement have provided new insights into physical processes related to nanowire growth and thermomechanical behaviors. First, we will describe ongoing efforts to understand how the vapor liquid solid process, including thermodynamic constraints and intentional modification of kinetics, influences the in situ incorporation of dopants [1] and the formation of ordered defects.[2] These studies employ atom probe tomography and aberration corrected transmission electron microscopy to visualize doping and defect distributions, respectively, in silicon and germanium nanowires. Second, we will describe unpublished studies of the insulator to metal transition in vanadium dioxide nanowires using scanning infrared fiber optic interferometry. We will report the direct observation of anomalous variations in elastic modulus and energy dissipation upon driving the phase transition by either substrate heating or local laser excitation, leading to new opportunities for sensing using nanomechanical resonators.[3]



Interferometric detection of nanowire thermomechanical motion, and observation of changes in resonant frequency and dissipation upon heating through the insulator to metal transition.

[1] J. G. Connell, K. Yoon, D. E. Perea, E. J. Schwalbach, P. W. Voorhees and L. J. Lauhon, *Nano Lett*, **13**, 199 (2013).
[2] N. Jeon, S. A. Dayeh, and L. J. Lauhon, *Nano Lett*, **13**, 3947 (2013).
[3] A. Holsteen, I. S. Kim, and L. J. Lauhon, *unpublished*.