NANO HIGHLIGHT
Thermal and Thermoelectric Properties of Individual Nanostructures

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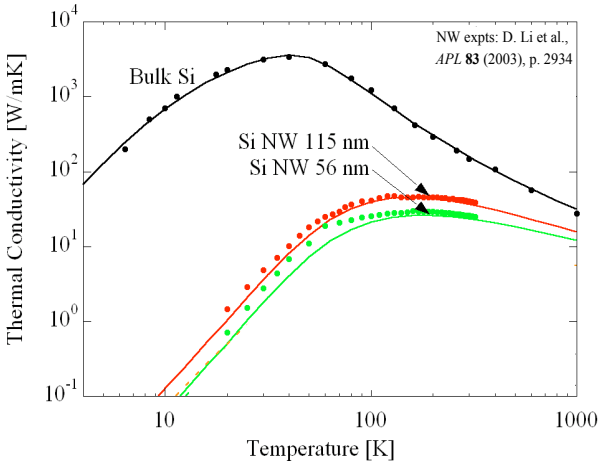
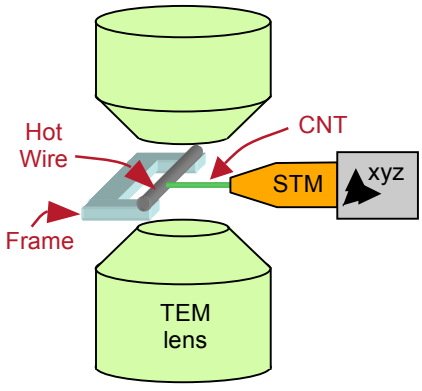
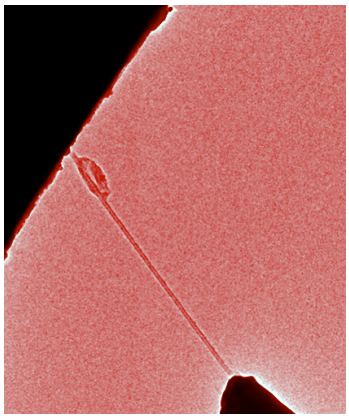
Thermoelectric effects enable direct energy conversion between heat and electricity. In this research endeavor, we are systematically studying thermoelectric transport and energy conversion of individual nanostructures, with an emphasis on both theoretical modeling and commensurate experimentation.

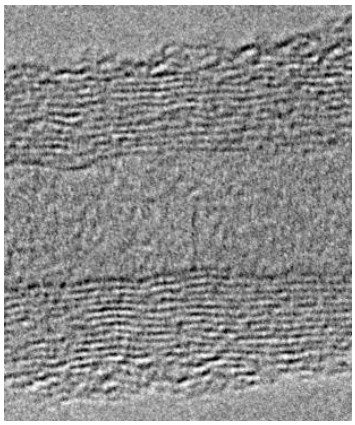
Various size effects can be explored to increase the thermoelectric performance of nanostructures compared to bulk. In semiconductors, the electronic contribution to the thermal conductivity is typically weak, and thus, the majority of heat is conducted by phonons, which are quantized lattice vibrations. Our recent studies of the size effects on the phonon thermal conductivity of silicon NWs show that boundary scattering leads to a significantly lower thermal conductivity compared to bulk silicon.



To experimentally measure the thermoelectric properties of individual nanostructures, we have modified a transmission electron microscope (TEM) with an integrated scanning tunneling microscope (STM) holder, which allows both measurement and manipulation of nanostructures. Utilizing this TEM-STM platform enables one to correlate the measured transport properties with the detailed atomic structure of the samples. The technique that we have developed allows in-situ measurement of electrical and thermal conductivity and Seebeck coefficient.







References:
[1] For further information about this project http://web.mit.edu/nanoengineering or email **gchen2@mit.edu**