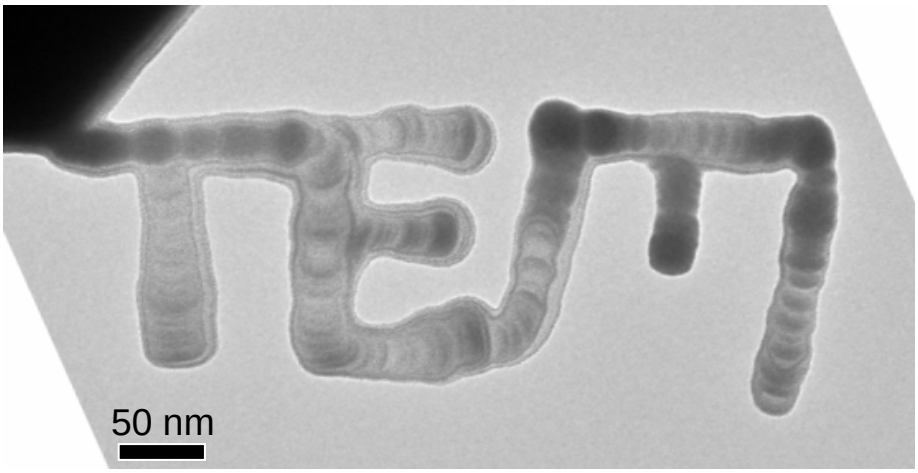
In Situ Measurement of Thermoelectric Properties of Individual Nanowires and Nanotubes

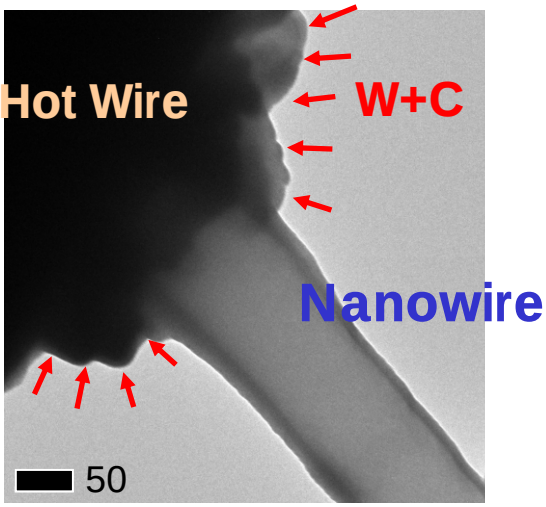
Nanotubes, nanowires, and other nanostructures are difficult to characterize at the individual scale. A collaboration of researchers at MIT, Boston College, and the University of California have developed a tool for the ready and accurate measurement of thermoelectric properties of single nanowires, nanotubes, and other nanostructures. The new device can be used in conjunction with a transmission electron microscope or scanning electron microscope to characterize important features of these materials.

- The new device allows for measurement of electrical resistance (electrical conductivity), Seebeck coefficient, and thermal resistance (thermal conductivity), all on the same sample.
- The device can be constructed from off the shelf parts and doesn't require any microfabrication
- The device also allows for patterned deposition of tungsten lines as small as 15 nm with controllable shapes, which allows for local formation of nanoscale bonds for improved electrical, thermal, and mechanical contact.

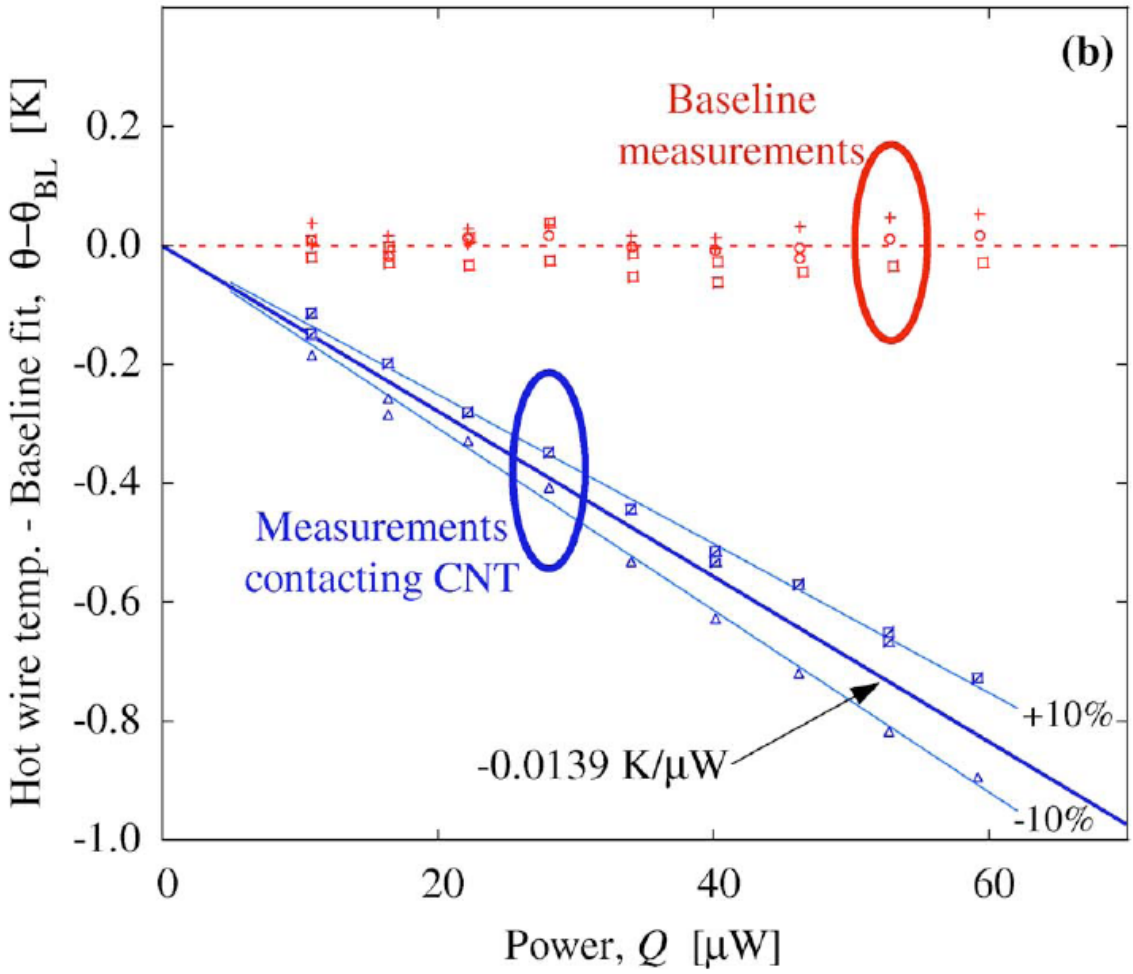
For more information, see: C. Dames, S. Chen, C. T. Harris, J. Y. Huang, Z. F. Ren, M. S. Dresselhaus, and G. Chen, "A hot-wire probe for thermal measurements of nanowires and nanotubes inside a transmission electron microscope". *Review of Scientific Instruments* **78**, 104903 (2007).



Example of patterned tungsten+carbon lines in arbitrary shapes. Features as small as 15 nm are possible.



Tungsten plus carbon is used as a bond to join a nanowire in a solid connection to the thermal probe (the hot-wire).



Example of using the probe for thermal measurements of a single carbon nanotube, showing repeatability with a temperature noise level of approximately ± 30 mK. This data corresponds to a carbon nanotube with thermal resistance of 3.3×10^7 K/W ±10%.