Extreme Insulating-to-Conducting Nanowires Promise Novel Applications

Scientific Achievement

Synthesized nearly perfectly crystalline nanowires that exhibit an unprecedented insulating-to-conducting transition, even at room temperature

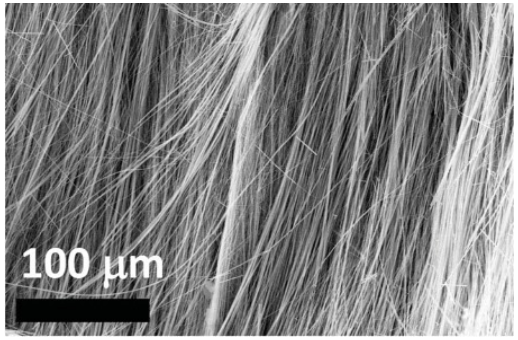
Significance and Impact

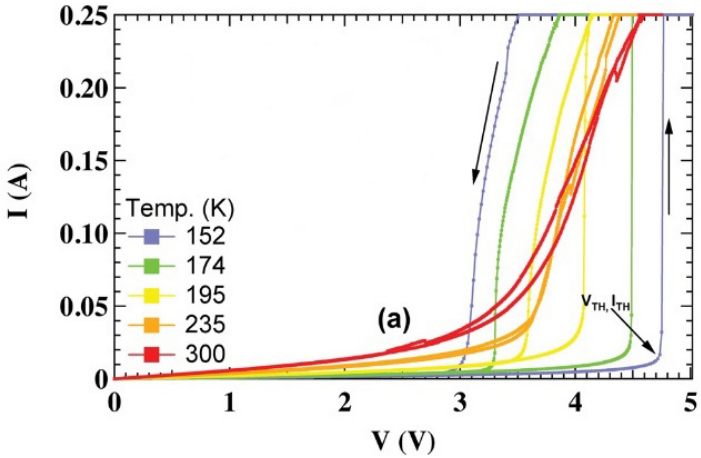
The nanowires have many potential applications, ranging from electrochromic coatings to computer memory to invisibility materials

Research Details

- Created long, relatively narrow nanowires with very high-quality crystal structures
- Compressed the wires into pellets and subjected them to an increasing voltage, then studied them at NSLS using x-ray methods that yielded information on their electronic and atomic structures
- Wires switched dramatically from insulating to conducting even near room temperature, likely caused by "melting" of the ordered electronic structure at a threshold voltage, which floods the wires with electrons

PM Marley, AA Stabile, CP Kwan, S Singh, P Zhang, G Sambandamurthy, S Banerjee, *Adv. Funct. Mater.* 201201513 (2012)





Top: A scanning electron microscope image of the nanowires. Bottom: Current in the wires as a function of voltage applied. At the coldest temp (blue), the dramatic transition is evidenced by a sudden spike in the current. At room temperature (red), the phenomenon is less sharp, although still evident.

Work was performed at Brookhaven National Laboratory