MAR06-2006-040209

Abstract for an Invited Paper
for the MAR06 Meeting of
the American Physical Society

Electrical Conductivity of Organic and Inorganic Nanowires Measured by Multi-probe Scanning Tunneling Microscopes[1]

MASAKAZU AONO, Nanomaterials Laboratory, National Institute for Materials Science (NIMS), Japan

Since 1998 [1], the authors and co-workers have developed multi-probe scanning tunneling microscopes (MPSTMs), in which two, three or four probes are operated independently. All probes of the MPSTMs can observe STM images independently, but the main role of the multiple probes is to be used as nanoscale electrodes that can contact any points selected in an observed STM image. It is therefore possible to measure electrical conductivity at the nanoscale through the multiple probes. By using MPSTMs and related methods, we measured the electrical conductivity of organic and inorganic nanowires, i.e., single-wall carbon nanotubes (SWCNTs), erbium disilicide (ErSi2) metallic nanowires, and single polydiacetylene (PDA) molecular wires. For a SWCNT and an ErSi2 nanowire, ballistic conduction was observed at lengths less than about 500 and 20 nm, respectively, at room temperature. For a PDA molecular wire, polaron formation due to charge injection caused by applying a voltage to an STM tip placed close to the PDA molecular wire was observed, and when the voltage exceeded a critical value, the PDA molecular wire changed into a metallic state. [1] M. Aono, C.-S. Jiang, T. Nakayama, T. Okuda, S. Qiao, M. Sakurai, C. Thirstrup, Z.-H. Wu: Oyo Buturi (Applied Physics) 67, 1361 (1998) (in Japanese); A brief English abstract is available on INSPEC.

[1]Supported by JST and MEXT, Japan.