

ELECTRICAL CONDUCTIVITY OF LOW-DIMENSIONAL NANOSTRUCTURES

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Since 1998, the authors and co-workers have developed multi-probe scanning tunneling microscopes (MPSTMs), in which two, three or four probes are operated independently¹⁾. 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-walled carbon nanotubes (SWCNTs), erbium disilicide (ErSi₂) metallic nanowires and polymerized short chains of fullerene (C₆₀) molecules. For SWCNTs and ErSi₂ nanowires, ballistic conduction was observed at lengths less than about 400 and 20 nm, respectively, at room temperature; at larger lengths, diffusive conduction with conductivities of about 10 and 1 k Ω /nm, respectively, was observed at room temperature. As for polymerized C₆₀ short chains, their conductive state can be changed into an insulating state due to depolymerization of C₆₀ molecules caused by the application of an appropriate voltage.

¹⁾ M. Aono, C.-S. Jiang, T. Nakayama, T. Okuda, S. Qiao, M. Sakurai, C. Thirstrup, Z.-H. Wu: *Oyo Butyri (Applied Physics)* **67**, 1361 (1998) (in Japanese); A brief English abstract is available on INSPEC.