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Property of individual conducting-polymer nanowires: conductance and FET devices¹

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Electronic devices using organic molecules and nanowires have been intensively studied in dream of a smart life utilizing charming functions of organic materials, that are thin, light, flexible and yet inexpensive and safe for environment. A key step for measuring the property of organic nanowires and evaluating the performance of the nanowire devices is how to access them by appropriate nanoscopic methods. Scanning probe microscopy (SPM) based nanofabrication (SP nanofabrication) has been used to fabricate two- or four-probe fine electrodes and several kinds of nanowires made of conducting polymers have been evaluated by SPM and the fine electrodes made with Pt thin film fabricated on SiO₂/doped Si or sapphire substrates [1,2]. We have tested conductivity of single poly (3,4-ethylenedioxythiophene) / poly (styrenesulfonate) (PEDOT/PSS) nanowires. After cutting each nanowires placed on the fine electrodes, the current was checked and we were able to confirm that the conductivity was derived from the PEDOT nanowires themselves. The temperature dependence of the conductivity was explained by the quasi one-dimensional variable range hopping (VRH) model. We also will discuss on the field-effect-transistor (FET) made of a single nanowire. In collaboration with: S. Heike, M. Fujimori, Y. Suwa (ARL), H. Ichihara, S. Samitsu, A. Inomata, T. Shimomura, K. Ito (Univ. Tokyo), K. Miki, T. Ohno (NIMS), H. Mizuseki (IMR), Y. Terada, H. Shigekawa (Univ. Tsukuba). [1] J. P. Hill, W. Jin, A. Kosaka, T. Fukushima, H. Ichihara, T. Shimomura, K. Ito, T. Hashizume, N. Ishii, and T. Aida, *Science* 304, 1481 (2004). [2] S. Samitsu, T. Shimomura, K. Ito, S. Heike, M. Fujimori, S. Heike, and T. Hashizume, *Appl. Phys. Lett.*, 86, 233103 (2005).

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