Organic Field-Effect-Transistors: Its mechanism, application and recent advances

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Organic electronics is attracting recent attention because it provides a flexible, printable, and large-area low-cost devices. Organic light-emitting diodes (OLEDs) are now frequently appearing in consumers' market, and organic field-effect-transistors (OFETs), organic photovoltaics (OPVs) and organic sensors are under intense development to be implemented in ambient-electronics devices.

In the first part of this lecture, focuses will be made on fundamental mechanism, fabrication, material development, and requirements for application uses, of OFET devices. Those OFET devices made of neutral molecules such as pentacene and rubrene can be understood within the framework of normal semiconductor physics. In the second part, another type of organic FET that utilizes electric phase transition will be discussed, where an additional physics on correlated electrons are required. These are called 'phase transition transistors', because the switching of the device is performed by changing the electronic phases. Although organic phase transition transistors can be operated only in low temperature for the moment, it provides many opportunities for fundamental science and future development for application at room temperature. [1-2]

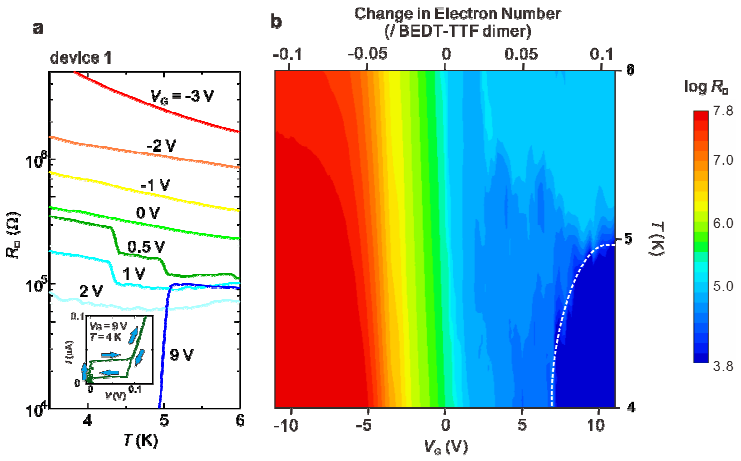

Figure 1 Resistivity of organic superconducting FET.

[1] Y. Kawasugi, H. M. Yamamoto et al, *Phys. Rev. Lett.* **2009**, *103*, 116801.

[2] H. M. Yamamoto, M. Nakano, and R. Kato, *Nature Commun*, **2013**, *4*, 2379.