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Gate electric-field tuning of contact barriers between metals and organic semiconductor crystals J. TAKEYA, M. YAMAGISHI, K. NAKAYAMA, T. UEMURA, Osaka University — Metal / organic semiconductor junctions are by all means essential in many organic electronics devices such as organic transistors, reasoning importance of understanding microscopic physics of carrier injection at the boundary. In this presentation, we focus on charge conductance through the metal / organic semiconductor contacts and their gate-electric field effects, fabricating structure of interfacing hole-rich rubrene single crystal crystals with metal electrodes. The hole-rich regions are formed at the top surface of the crystals either by field-effect accumulation using secondary gate electrodes or charge transfer from acceptor films of fluoro-silane molecular layers or F4-TCNQ layers. Application of gate voltage on the bottom surface of the crystals has given rise to a very sharp switching in the conductance through the contacts, because of very short (nanoscale) active length for the conductivity modulation. For the mechanism of the result, energy-level tuning between the metals and the hole-rich rubrene surface is suggested as the result of gradual band-bending in the direction of crystalline thickness. The minimum working length of the device is highly advantageous in high-frequency response and densities of the device integration.

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