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In-crystal carriers in organic single crystal transistors JUN TAKEYA, Y. TOMINARI, M. YAMAGISHI, Y. IWASAKI, Osaka University, OSAKA UNIVERSITY TEAM — The intrinsic semiconductor character of organic semiconductors, consisting of one molecular species, causes peculiar features different from those of doped inorganic semiconductors, when they are built in field-effect transistors (FETs). The effect can be most drastic with purified organic single crystal devices because of their minimized impurity (defect) concentrations of $\sim 10^{14}$ cm^{-3}, resulting in relatively long length scale (more than 1 μm) of band bending and carrier distribution in the direction of the crystalline thickness. In this presentation, we report effects of the in-crystal carriers in two FET structures of clean rubrene single-crystals with the thickness comparable to the length scale of the distribution. With a double-gate device incorporating two transistor structures on the both sides of the crystal, we found that each transistor cross-talks with each other, inducing high-mobility (higher than 30 cm^2/Vs) carriers inside the crystal. The similar cross-talking events are observed also for a device with an acceptor layer of F_4-TCNQ on one side of the rubrene crystal.

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