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Temperature dependent charge transport in regioregular poly (3-hexylthiophene) crystalline nanoribbon field effect transistor MUHAMMAD ISLAM, M. ARIF, Univ. of Central Florida, Nanoscience Technology Center and Dept. of Physics, LEI ZHAI, Univ. of Central Florida, Nanoscience Technology Center and Dept. of Chemistry, SAIFUL I. KHONDAKER, Univ. of Central Florida, Nanoscience Technology Center and Dept. of Physics — In order to fabricate high performance devices with enhanced morphology for improved charge carrier transport, one (1D) and two dimensional (2D) crystalline nanostructures based on self organized P3HT in the form of nanowires, and nanofibres are creating significant interest for next generation optoelectronic devices. In this work we report the fabrication of organic field effect transistors (FETs) using low molecular weight poly (3-hexylthiophene) (P3HT) crystalline nanoribbons and study charge transport at low temperature. At room temperature the devices show p type behavior with maximum saturation mobility as high as $1 \times 10^{-2} cm^2/Vs$ and current on/off ratios of 3×10^4. The temperature dependent measurements show that the mobility decreases with decreasing temperature, indicating thermally activated hopping type transport. The threshold voltage shows a significant shift with temperature indicates that a large fraction of the mobile charges are trapped in the defect states. In addition we have measured resistance as a function of temperature which also indicates the hopping type behavior.

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