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Temperature dependent charge transport properties of poly(3-hexylthiophene) block poly(styrene) copolymer field-effect transistor FIROZE HAQUE, PAUL STOKES, LEI ZHAI, SAIFUL I. KHONDAKER, NANOSCIENCE TECHNOLOGY CENTER, DEPARTMENTS OF PHYSICS AND CHEMISTRY, UNIVERSITY OF CENTRAL FLORIDA TEAM — Regioregular poly-3-hexythiophene (rr-P3HT) is considered to be one of the most promising and well studied organic semiconductor. Recently attention has been focused in developing di-block copolymers of rr-P3HT by attaching non conjugated blocks which allows one to tune the electrical properties of rr-P3HT. To properly utilize these new types of materials it is necessary to understand the relationship between their molecular structure and electronic transport properties. In this talk we present electronic transport characteristics of poly(3-hexylthiophene) block poly(styrene) copolymer (rr-P3HT-b-PS) field effect transistor at various temperatures. We show that the current voltage characteristic at different temperature follow SCLC type conduction mechanism with $I \propto V^n$, where n varies from 1.5 to 2.2. We also show that the room temperature hole mobility is $\sim 3.5 \times 10^{-5}$ cm^2/Vs, and that the mobility decreases with decreasing temperature. The temperature dependent mobility follow activated hoping process. The space charge limited current along with the low mobility of the devices indicates that the charge transport is limited by the insulating polystyrene segment of the di-block polymer.

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