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High Performance Phototransistor based on Nanostructured Regioregular Poly (3-hexylthiophene) TANUSRI PAL, M. ARIF, SAIFUL I. KHONDAKER, University of Central Florida Nanoscience Technology Center and Dept. of Physics — We have demonstrated high performance phototransistors based on regioregular poly 3-hexylthiophene (rr-P3HT) by tuning the nanomorphology of the P3HT thin film. The morphology of the solution processing polymer has been controlled by the selection of organic solvents (p-xylene, dichlorobenzene and chloroform). Under illumination of light drain current increased significantly and threshold voltage shifted towards positive direction whereas mobility remains unaffected. Change in threshold voltage corresponds to change in carrier density due to illumination. Conversely the field-effect mobility is relatively unaffected, indicates that the electronic structure of the polymer is not affected by the illumination. Devices made from p-xylene and dichlorobenzene solution show responsivity (Photocurrent/Optical power) of 16 A/W and 21A/W respectively at V_G=0V. The responsivity further increased up to one order of magnitude high by tuning the gate bias. While devices made from chloroform solvent show maximum responsivity of up to 2A/W. The maximum photosensitivity (Photocurrent/ Dark current) of our device is $3.8X10^3$.

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