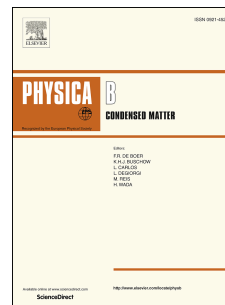


# Accepted Manuscript

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## Effect of High Energy Ions on the Electrical and Morphological Properties of Poly(3-Hexylthiophene) (P3HT) Thin Film

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### Abstract

The spin-coated thin films of Poly(3-Hexylthiophene) (P3HT) on the glass and Si (double side polished) substrates have been irradiated with 55 MeV Si<sup>+4</sup> swift heavy ions (SHI) at fluences in the range from  $1 \times 10^{10}$  to  $1 \times 10^{12}$  ions/cm<sup>2</sup>. Structural modifications produced by energetic ions are observed by characterization of pristine and irradiated P3HT thin films. Different techniques like high-resolution X-ray diffraction (HR-XRD), micro-Raman spectroscopy and Fourier transform infrared spectroscopy (FTIR) were used to analyse the structural changes in the material. A significant increase in crystallinity and room temperature electrical conductivity of P3HT film has been detected on exposure to the heavy ions. The observed increase in the electrical conductivity with increased fluences is explained in the light of improved ordering of polymer chains after irradiation. Mott's variable range hopping model has been used to explain the conduction mechanism in the material in the temperature range of 230 – 350 K. The modification in surface properties also observed using AFM analysis and contact angle measurement. It is observed that nature of the P3HT thin films remains hydrophobic after irradiation.

Keywords: P3HT; Polymer structure; Electrical conductivity, contact angle.

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