

Public Abstract

First Name:Danish

Middle Name:

Last Name:Adil

Adviser's First Name:Suchi

Adviser's Last Name:Guha

Co-Adviser's First Name:

Co-Adviser's Last Name:

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Department:Physics

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Title:Light Scattering Studies of Organic Field Effect Transistors

Organic semiconductors hold a great promise of enabling new technology based on low cost and flexible electronic devices. Organic semiconductors are essentially plastics that can be made to conduct current. While much work has been done in the field of organic semiconductors, the field is still quite immature when compared to that of traditional inorganic based devices. More work is required before the full potential of organic field effect transistors, organic light emitting diodes, and organic photovoltaics is realized. This work harnesses the subtle way that light interacts with matter in a combined electro-optical study of organic field effect transistors. We demonstrate that the surface enhanced Raman (SERS) effect can serve as a tool to study the origins of device performance degradation in such devices. By combining electrical, optical, and theoretical studies, we show that the SERS effect shows an extreme sensitivity to disorder in these semiconductor films. We further show that the SERS spectrum can be used as a diagnostic tool for correlating transport properties to structural changes, if any, in organic semiconductor films. In conclusion, we develop a non-invasive, opto-electronic visualization tool that can be used to characterize charge transport in organic semiconductor devices.