

# LIGHT SCATTERING STUDIES OF ORGANIC FIELD EFFECT TRANSISTORS

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## ABSTRACT

Organic semiconductors hold a great promise of enabling new technology based on low cost and flexible electronic devices. 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 (OFETs), organic light emitting diodes (OLEDs), and organic photovoltaics (OPVs) is realized. Among such work, a further development of diagnostic tools that characterize charge transport and device robustness more efficiently is required.

The work consists of a combined electro-optical study of the metal-semiconductor interface in OFETs. It is highly desirable that a method that can be used to understand the mechanisms of device performance degradation be developed. We demonstrate that the surface enhanced Raman (SERS) effect (at the metal-semiconductor interface) can serve as such a method. By combining electrical, optical, and density functional theory studies, we show that the SERS effect shows an extreme sensitivity to disorder in these semiconductor films.

We further show how the SERS spectrum evolves after the device has been subjected to a bias-stress (i.e. applying both gate and drain voltages for an extended period of time). Thus, we confirm 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, in-situ opto-electronic visualization tool that can be used to characterize charge transport in organic semiconductor devices