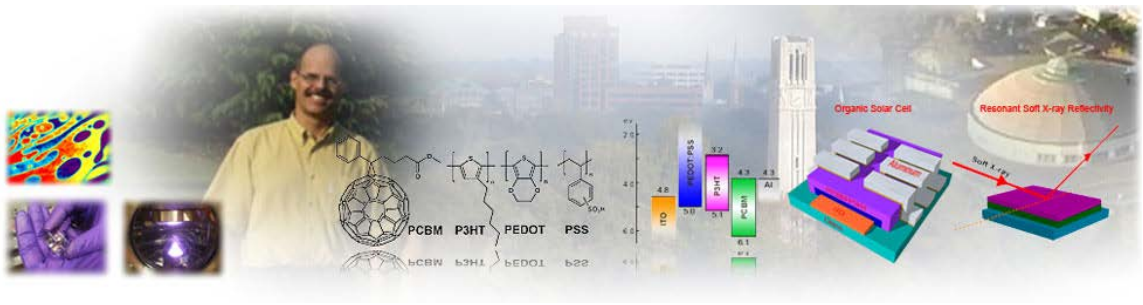

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Organic devices: Insights provided by soft x-ray characterization methods

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Conjugated, semi-conducting polymers have tremendous potential for use in cheap, flexible, light weight devices and have been widely studied in thin film transistors (TFT), light emitting diodes, and photovoltaics. Such devices offer the potential to create cheap energy, consume less energy, or be simply cheaper and more practical. Despite great empirical advances during the recent past and a rapidly growing research community, fundamental understanding of device function is still lacking in many instances. For example, soft x-ray microscopy measurements have shown that the morphology in even the most studied photovoltaic materials systems (P3HT:PCBM) is still not well understood and that these and most other donor and acceptor materials are partially miscible. This results in impure domains whose impact on the devices performance and long term stability remains to be clarified. Similarly, resonant soft x-ray scattering using polarization contrast has uncovered a fundamental relationship between the correlation length of the polymer backbone orientation (LC director) and saturation mobility in PBTTT TFT devices. Lastly, resonant reflectivity measurements have shown in P(NDI2OD-T2) based top-gate TFTs that the deposition of the polymer dielectric can affect the interface structure even when deposited from an orthogonal solvent. The observed differences in the interfacial widths explain the previously reported absence of the dipolar disorder effect on the performance of these TFTs. We will discuss a number of important issues in plastic devices that could be resolved and important questions that are raised due to recent use of soft x-ray characterization methods.