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Opportunities at the Carbon edge: Nano-morphological investigation of organic thin films using soft x-rays

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Structural and morphological studies at the nanometer scale are extremely important for many newly developed organic photovoltaics, which are often intentionally or naturally nanostructured for optimisation of performance. Soft X-ray Scattering along with absorption techniques near the Carbon K-edge offer unique opportunities for such studies because of the richness of fine structure arising from sensitivity to chemical environment [1, 2, 3]. I will present results for polymeric blends and bilayers that exemplify the capabilities of a multi-method approach using complementary soft x-ray characterization techniques namely Resonant soft x-ray scattering/reflectivity (RSoXS/R), Polarized resonant soft x-ray scattering (P-RSoXS) and Scanning transmission x-ray microscopy (STXM).

Results presented here include data from recent investigations at the SEXTANTS beamline at Synchrotron SOLEIL on evolution of phase separated domains of P3HT:DTCPA polymeric blends with various loading of DTCPA. P3HT [4] is a well-known thiophene derivative while DTCPA [4] is a highly crystalline conducting organic molecule that has both electron accepting and withdrawing moieties [5]. The investigations show that the samples with moderate loadings of DTCPA have domains of <50nm size and higher efficiencies as compared to other samples. I will also briefly talk about HERMES and SEXTANTS beamlines at SOLEIL that are capable of such investigations.

REFERENCES

1. McNeill, C. R., J.Polymer Sci.B 49, 909-919 (2011).
2. Swaraj, S. *et al.* NanoLett. 10, 2863-2869 (2010).
3. Collins B. A. *et al.* R. T. Wang, Nature mat., DOI: 10.1038/NMAT3310.
4. P3HT - poly(3-hexylethiophene)(P3HT), DTCPA - 7,9 di(thiophen-2-yl)-8H-cyclopenta[a]acenaphthy-len-8-one)
5. Swathi S. K. *et al.*, Solar Energy Materials & Solar cells 96, 101-107 (2012).