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Revealing molecular order inside and between PBTTT nanoribbons through the polarized X-ray scattering BRIAN COLLINS, Washington State University, DEAN DELONGCHAMP, National Institute of Standards and Technology — Electronic and optical properties of conjugated polymers emerge not only through molecular architecture, but also through hierarchical ordering from the molecular to the mesoscale. Characterizing aspects of that ordering critical to properties can be challenging, however. For example, local molecular orientation within and connectivity between ordered structures is considered paramount for charge transport in conjugated polymer films. While some of these aspects can be imaged with state-of-the-art microscopy measurements, true statistical measurements of molecular order and connectivity remain elusive due to the low levels of crystalline packing that limit diffractive and other techniques capable of statistical analysis. Recently, we demonstrated how resonant scattering with polarized soft X-rays (PSoXS) is sensitive to molecular orientation and that such measurements could be used to locate sources and types of ordering within larger nanostructures on a statistical basis. Here we combine forward simulation and measurements of PSoXS on PBTTT nanoribbon films to extract critical information such as the average level of molecular alignment within nanoribbon structures and the level of connectivity between ribbons that promote the dominant charge transport mechanisms in these films. Further development of PSoXS will enable crucial insight into internal molecular order within organic materials tied to optical and electronic properties and how to control these properties for use in novel devices.

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