Resonant Tender X-ray Scattering and Diffraction for probing soft matter systems

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Resonant x-ray scattering and diffraction is an emerging technique for the nanostructure characterization of soft matter. While these approaches are widely spread for highly ordered material, the amorphous or paracrystalline nature of most of the soft matter systems limits the use of currently developed method such as diffraction anomalous fine structure technique.

In this presentation, we will illustrate the use of resonant x-ray scattering on conjugated polymers used for optoelectronic devices. The performance of such devices are highly dependent upon the molecular packing however. The presence of sulfur atoms in common conjugated polymer such as P3HT or N2200 enable the use of tender x-rays (sulfur K-edge is around 2.47 keV) to probe and enhance signals from the sulfur atoms. Tracking the intensity variation across the sulfur K-edge and comparing with theoretical calculation enable to discriminate between different packing geometries and to extract important new microstructural information.

We will both present results in the transmission geometry, on thin films deposited on Si3N4 membranes, as well as in the grazing-incidence (GI) geometry on thin film on Si substrate. Especially for the GI geometry, we will discuss the importance of absorption and its impact/distortion on the collected signal.

[1] G. Freychet, et al., J. Am. Chem. Soc. 143, 1409 (2021).
[2] G. Freychet, et al., Mater. Horiz. 9, 1649 (2022).