

High-Resolution Scanning X-Ray Diffraction Microscopy

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Scanning transmission x-ray microscopy (STXM) and coherent diffractive imaging (CDI) are imaging techniques that have evolved quite separately. STXM features straightforward data analysis but its resolution is limited by the spot size on the specimen. As for CDI, its promises to reach resolutions below 10 nm are often hindered by stringent requirements on the quality of the collected datasets and on the characteristics of the specimen. I will describe an imaging method based on ptychography that addresses these challenges by bridging the gap between CDI and STXM through the collection of coherent diffraction patterns at each point of a STXM scan. We demonstrated this approach at the Swiss Light Source in a hard X-ray experiment, obtaining a five-fold improvement in resolution compared to the focal spot dimensions. The reconstruction algorithm extracts from the data not only the complex-valued transmission function of the specimen but also the complete structure of the wavefield incident on it. The method allows high-resolution imaging of a wide range of materials and life science specimens.