



SEMINAIRE ISMO

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Bragg Ptychography : When Crystallography Meets Microscopy

Imaging complex crystalline materials at the nanoscale is a major challenge of nanoscience, which calls for a microscopy method combining sensitivity to the crystalline properties, 3D imaging capability, in situ compatibility and high spatial resolution. In this context, the recent advents of x-ray lensless imaging methods, based on Bragg coherent diffraction, have opened promising perspectives filling the gap between direct microscopies (AFM, SEM, TEM) and reciprocal-space based x-ray Bragg diffraction analysis.

3D Bragg ptychography microscopy is a coherent diffraction imaging method developed at third generation synchrotron sources, and which merges concepts developed in inverse microscopy and crystallography. This modality is based on the acquisition of far-field Bragg coherent intensity patterns; it exploits the partially redundant information obtained by scanning a finite beam spot size transversally to the sample, while measuring the corresponding 3D far-field intensity diffraction pattern by scanning angularly the sample along the rocking curve. Instead of lenses, numerical tools are employed to retrieve the lost phase and hence the complex-valued sample scattering contrast. Thereby, it ensures access to truly quantitative information, such as the crystalline displacement field, from which the 3D strain component and crystalline plane rotations can be derived, with nanoscale spatial resolution. 3D imaging of extended crystalline samples is then possible, opening Bragg coherent diffraction microscopy to a large range of applications.

In this presentation, the general concepts of Bragg ptychography will be first detailed, illustrated by recently proposed developments. We will further describe how Bragg ptychography can be exploited to bring new insights on a specific class of materials, the biominerals, which are characterized by a complex hierarchical crystalline structure. Perspectives with respects to the understanding of the biomineralization mechanisms will be finally presented.

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Note : Le séminaire sera en français mais les diapositives seront en anglais.