

# Nanoscale materials analysis by soft X-ray Scanning X-ray Microscopy

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**Amphithéâtre SOLEIL**

Soft X-ray scanning transmission microscopy (STXM) [1,2] is a powerful tool for nanoscale materials analysis, with significant advantages over analytical X-ray microscopies for studies of radiation sensitive materials. Ptychography (scanning coherent diffraction imaging) [3], can be measured using soft X-ray STXMs. Significant improvements in spatial resolution can be achieved with ptychography (3-14 nm) relative to conventional STXM (15-30 nm). 4D imaging – quantitative chemical mapping in 3D by tilt angle tomography at multiple energies – can be performed with both STXM [4] and ptychography [5]. STXM and ptychography methods will be described, with emphasis on spectromicroscopy, the use of chemical mapping by imaging at many photon energies. Performance will be illustrated by recent 2D and 3D studies of cathodes of low temperature, proton exchange membrane fuel cell (PEM-FC) systems [6,7].

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- [1] A.P. Hitchcock, *Soft X-ray Imaging and Spectromicroscopy* in *Handbook on Nanoscopy*, eds. G. Van Tendeloo, D. Van Dyck and S. J. Pennycook (Wiley, 2012).
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- [4] G. Schmid, et al., *Characterization Tools for Nanoscience & Nanotechnology* **5** (2016) 43.
- [5] Yu Y, et al. *Nature Communications* **9** (2018) 921.
- [6] A. Putz et al. *ECS Transactions* **15** (2016) 3.
- [7] J. Wu et al *J. Power Sources* **381** (2018) 72.



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