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Artificial neural networks, operando X-ray powder diffraction CT and functional devices

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X-ray chemical tomography methods are non-destructive techniques that provide hyperspectral images of a sample's cross-section. These methods merge spectroscopy or scattering techniques with tomographic data collection, resulting in coloured images containing spatially-resolved physico-chemical information. Each pixel in these reconstructed images corresponds to a complete spectrum or scattering pattern, uncovering information typically lost in bulk measurements. However, these powerful characterization methods generate large datasets. For instance, modern X-ray powder diffraction computed tomography (XRD-CT) experiments at synchrotron facilities produce 100,000s to 1,000,000s of diffraction patterns.

In this presentation, I will show case studies where we have applied synchrotron XRD-CT to examine, under operating conditions, commercially available and industrially relevant samples, like cylindrical Li-ion batteries used in electric vehicles. Additionally, I will discuss cutting-edge deep learning developments we have been recently making, including ultra-fast data analysis, self-supervised data denoising and tomographic image reconstruction.

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XRD-CT

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