MS42-P04 | SNBL's BM31 at ESRF beyond 2020 - Combined XRD-PDF-XAS

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The availability of experimental methods that probe a material's structure, complex and dynamic, at different length and time scales is key to obtain fundamental insight in technologically relevant materials. Progress relies on the development of innovative materials utilizing an in-depth understanding of the interplay between a material's structure and its macroscopic properties.

BM31 of the Swiss Norwegian Beam Lines, offers the possibility to combine X-ray absorption spectroscopy (XAS) and X-ray powder diffraction (XRD) in an alternating fashion in the same experimental setup. SNBL aims at extending these capabilities, by upgrading the current setup with a new CdTe area detector and focusing options. This will allow to i) implement pair distribution function analysis (PDF) of total scattering data, enabling combined XRD-PDF-XAS experiments and ii) enhance appreciably both the temporal (~1 s for XAS, ~100 ms for XRD-PDF) and spatial resolution (~100 × 100 μm^2) of the experiments.

The combined XRD-PDF-XAS measurements will allow the acquisition of complementary information of a material under the relevant working conditions: covering the length-scale from short to mid-range atomic arrangements viz. ~ 1 Å to several nm by PDF, the average structure by XRD, as well as the electronic state, and geometry around the element of interest by XAS. All data can be acquired in a temporal and spatially resolved manner in a single experiment. This will constitute a unique tool allowing the detailed study of materials for a wide range of applications, for instance: heterogeneous and electro-catalysis, CO_2 capture, gas separation and batteries.