Contribution ID: **56** Type: **Keynote**

New possibilities of hard X-rays photon-in/photon-out spectroscopies

Monday, 5 September 2022 15:30 (30 minutes)

Photon-in/photon-out (PIPO) spectroscopies are increasingly applied in the study of physical and chemical properties of materials to investigate the local electronic and geometrical structure with element selectivity. Herein, PIPO spectroscopies refer to the techniques derived from the combination of X-ray absorption and emission spectroscopies (XAS-XES), such as resonant inelastic X-ray scattering (RIXS). The rapidly growing use of these techniques comes in parallel with the recent boom in the development of wavelength dispersive emission spectrometers with energy bandwidth around 1 eV at synchrotron experimental stations and also at X-ray free electron lasers and home laboratories. This contribution will focus on new possibilities of PIPO spectroscopies using hard X-rays, which entails interesting experimental advantages like bulk sensitivity and compatibility with complex sample environments (e.g. liquid phase) [1]. The first part of the contribution will be dedicated to a novel approach for retrieving range-extended XAS in materials with elements causing edge interference. The method of extending the XAS signal beyond unwanted edges using a XES instrument in combination with the standard total fluorescence yield detection will be introduced, discussing experimental aspects and illustrative examples of applications in RE-doped (RE= rare earth) Mn-based perovskites [2,3]. The second part of the contribution will focus on the combination of RIXS with X-ray magnetic circular dichroism (RIXS-MCD) [4] and a recent experimental development at ID26 beamline of the ESRF synchrotron for the investigation of magnetic systems in liquid phase, based on a continuous liquid jet setup coupled with a compact electromagnet. The first results of RIXS-MCD collected in the liquid jet setup on a set of commercial Fe3O4 nanoparticles in solution, show the feasibility of the experimental approach and open up the door for advanced, bulk-sensitive magneto-spectroscopic characterization of magnetic liquids at room temperature (no freezing required) and free of radiation damage [1].

[1] S. Lafuerza et al., "New reflections on hard X-ray photon-in/photon-out spectroscopy"Nanoscale 12, 16270 (2020)
[2] S. Lafuerza et al., "High-resolution Mn K-edge x-ray emission and absorption spectroscopy study of the electronic and local structure of the three different phases in Nd0.5Sr0.5MnO3"Phys. Rev. B 93, 205108 (2016)
[3] G. Subías et al., "Effects of A-site ordering on the Mn local structure and polar phases of REBaMn2O6 (RE: La, Nd, Sm and Y)"(submitted)
[4] M. Sikora et al., "Strong K-edge Magnetic Circular Dichroism Observed in Photon-in–Photon-out Spectroscopy"Phys. Rev. Lett. 105, 037202 (2010)

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