Contribution ID: **29** Type: **Invited/plenary talk**

INVITED: Ambient Pressure Soft-x ray absorption experiments @APE-HE

Tuesday, 6 December 2022 14:20 (30 minutes)

A wide collection of invaluable probes in material science is provided by synchrotron-based hard X-ray techniques: for example, hard X-ray absorption spectroscopy (XAS) is an irreplaceable tool in the investigation of local atomic and electronic structures of materials. [1] Moreover, operando XAS experiments with hard X-rays are well-established, and almost every experimental condition can be reached to simulate realistic reaction environments. [2] On the contrary, in the soft X-ray regime, the applications of XAS (soft-XAS) in material science were often limited to a "surface science"approach, i.e., to the study of clean surfaces in high-vacuum conditions. In fact, the low penetration depth of X-rays with energies lower than 1 keV and the severe vacuum limitation have somehow hindered the development of operando experiments. However, soft-XAS is capable to give invaluable information for a complete understanding of the mechanisms of phenomena taking place at material surfaces and interfaces, such as catalysis, intercalation, electrochemistry, etc. Unexpectedly, these subjects have been mainly approached with XPS, by developing the electron energy able to work at pressure up to 1 bar [3]. Despite these latest developments, performing XPS close to ambient pressure remains experimentally challenging. In this framework, soft-XAS represent an interesting alternative to access in operando condition the electronic structure of the working catalyst at ambient pressure with great surface sensitivity and with an experimental apparatus relatively simple. During the presentation I will present the instrumental solutions that are adopted to measure soft x ray absorption spectroscopy at ambient pressure and the possibilities that are now offered at the APE-HE beamline at the Elettra synchrotron [4]. Afterwards I will present few examples of application of the soft XAS to the study of working catalyst ranging from the study of cathode fuel cells [5] to the investigation of the mechanism of tin oxide based sensors [6] to the study of the catalyst promoting the polymerization of polyolefin [7].

[1] S. Bordiga et al., Chem. Rev. 113, 1736–1850,(2013)
[2] A. Minguzzi et al., ACS Catal. 5, 5104–5115, (2015)
[3] J.J. Velasco-Vélez, et al., Rev. Sci. Instrum. 87, 053121 (2016)
[4] C. Castán-Guerrero, et al. Rev. Sci. Instrum. 89, 054101 (2018)
[5] A. Felli et al., ACS Appl. Energy Mater. 5, 6687 (2022)
[6] L. Braglia et al., Phys. Chem C, 124, 14202 (2020)
[7] A. Piovano et al., ACS Catal. 11, 9949 (2021)

if "Other", please specify:

I apply for a travel grant

No

Presenter: TORELLI, Piero (IOM-CNR)

Track Classification: Other - please specify below