

Catalysis research with laboratory XAFS – two first application examples

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While the origins of X-ray absorption spectroscopy go back to the 70s, the nowadays broad range of its application in chemical research developed with the advent and expansion of 2nd and 3rd generation synchrotron radiation facilities. These facilities offer versatile experimental stations, which usually facilitate challenging XAFS studies.

In recent years, one witnessed promising developments of laboratory XAFS. Our own development [1] is based on the use of a special, very efficient type of crystal which is used as dispersive element. This graphite mosaic crystal is called Highly Annealed Pyrolytic Graphite (HAPG) developed by Optigraph GmbH. Its first use in X-ray spectrometers was demonstrated by Legall et al. [2] in 2009. By now, the spectral resolving power can be as high as $E/\Delta E \approx 4000$ in first order of reflection, good enough to resolve major XANES features. Due to its high efficiency, the spectrometer also is capable of taking EXAFS spectra within reasonable time.

While far from being as versatile as synchrotron XAFS, the intriguing perspective that comes with laboratory XANES and EXAFS is the easy access to instrumentation, that one operates in its own laboratory.

Within this contribution we will present two successful applications of laboratory XANES in catalysis research. One is a contribution to research with (Mn,Fe)Ox-promoted Rh nanoparticles for the hydrogenation of CO to higher alcohols [3]. The second is related to the use of Cu/mordenite for the selective oxidation of methane to methanol [4]. The emphasis will be on the specific experimental strategies and particularities for laboratory XAFS. By means of the two examples possibilities and perspectives as well as restrictions and constraints will be illustrated. A discussion of future developments to address the latter ones will complete the contribution.

[1] C. Schlesiger et al., *J. Anal. At. Spectrom.* (30), 2015, 1080-1085.

[2] H. Legall et al., *J. Appl. Crystallogr.* (42), 2009, 572-579.

[3] M. Dimitrakopoulou et al., *Faraday Discuss.*, 2017, <http://dx.doi.org/10.1039/C7FD00215G>

[4] Le, H. V. et al., *ACS Catal.*, 7 (2), 2017, 1403–1412