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Operando characterisation of heterogeneous catalysts by combination of Quick-XAS with Raman Spectroscopy

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Combining Raman with XAS offers a simultaneous access to a multitude of information. Not only complementary information on the local order of the catalyst are obtained when both techniques probe the catalyst at the same spatial point but information on the catalytic activity can be also obtained by Raman spectroscopy when the Raman probe head analyses the reaction products at the cell gas outlet. In this presentation we will describe two studies carried out on the SAMBA beamline [1, 2].

First, a detailed description of the calcination and activation processes of two metal species of a bimetallic hydrodesulfurisation catalyst will be presented. The combination of Raman and high time resolution of Q-XAS enabled to identify upon calcination the presence of an intermediate phase such as tetrahedral molybdate (MoO₄²⁻). Additionally the Raman analysis of the outlet gas composition upon activation under H₂S/H₂ of catalysts provides us unique information on the sulfiding mechanism as a function of the temperature comparable to the information obtained by means of temperature-programmed sulfiding (TPS).

Finally we will present a study of a cobalt based Fischer-Tropsch (FT) catalyst combining structural characterisation (by Quick-XAS combined with XRD) and Raman time-resolved monitoring of hydrocarbons produced by FT synthesis [3].

[1] V. Briois et al. UVX 2010, EDP Sciences 2011.

[2] E. Fonda, et al. J. Synchrotron Rad., 19 (2012) 417.

[3] A. Rochet et al. Catal. Today, submitted.

Primary author: Dr ROCHET, Amelie (SOLEIL)

Co-authors: Dr PICHON, Christophe (IFPEN); Dr BRIOIS, Valérie (SOLEIL); Dr MOIZAN, Virginie (IFPEN)

Presenter: Dr ROCHET, Amelie (SOLEIL)

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