

## Spatial and temporal explorations of heterogeneous catalysts using X-ray microscopy

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Solid catalysts are highly complex, porous, multi-elemental and often hierarchically structured materials. Scientists are therefore confronted with a formidable challenge to understand the functioning of solid catalysts and, based on this knowledge, to design and make materials with superior performance and overall stability. Because solid catalysts often change during their operation microspectroscopy is a valuable tool for both *ex-situ* and *in-situ*, or even *operando* catalyst characterization [1].

In this presentation I will focus on our latest work using different X-ray microscopy and X-ray microspectroscopy techniques in 2-D and 3-D and using synchrotron radiation to investigate solid catalysts at meso- and macro-pore length scales. To showcase the power of state-of-the-art X-ray imaging techniques for such studies emphasis will be put on 2-D studies using *in-situ/operando* soft X-ray scanning transmission X-ray microscopy (STXM) of Fischer-Tropsch catalysts and 3-D studies using hard X-ray Holotomography and Ptychography of individual fluid catalytic cracking catalyst particles providing detailed information about the chemical and morphological changes that take place during catalyst operation.

### *References*

[1] F. Meirer and B.M. Weckhuysen, *Nat. Rev. Mater.* **3**, 324–340 (2018).