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Bridging the gaps; imaging of catalytic materials under reaction conditions

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Industrial catalysis utilizes mainly µm to mm-sized catalyst particles in catalytic reactors instead of powders since this minimizes problems associated with for example back pressure and clogging. In recent times, efforts have been made to study and characterize these 'real life' single particles so as to determine the nature of chemical species present in 2D and 3D during various stages of the catalyst lifetime such as preparation, reaction and deactivation. Traditionally this sort of analysis is performed on ex situ samples using invasive approaches which often interfere with the chemical process under study and the subsequent conclusions that can be drawn. As a result there has been a recent move towards studying these processes non-invasively and where possible, dynamically in order to understand in detail how the chemistry evolves within catalyst particles and how this and the spatial distribution of the various chemical components influence catalytic behaviour. For this purpose we have developed synchrotron-based X-ray Computed Tomography imaging techniques for studying catalytic solids in real time in order to examine how the active phases form, how they behave under reaction conditions and why they eventually deactivate.

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