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MECHANISM OF PREFERENTIAL CARBON MONOXIDE OXIDATION OVER Pt-Fe CATALYSTS: AN OPERANDO SPECTROSCOPY APPROACH

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https://psich.zoom.us/j/65975666933

Project Summary: More than one million tons of hydrogen are lost every year during inefficient purification. Preferential carbon monoxide oxidation (PROX) allows for avoiding these losses by selectively oxidizing the traces of carbon monoxide in a hydrogen stream. Despite being commercially viable, this process requires a highly efficient catalyst. Finding the right catalyst and optimizing the process are the greatest challenges to this date. Supported platinum-based catalysts are used commercially and their promotion with iron allows for achieving one of the highest specific reaction rates. At the same time, the influence of iron on the structure of the active sites and the reaction mechanism is strongly debated, due to the reconstruction of the catalyst surface under reaction conditions and the high fraction of inactive iron species not involved in catalysis. This work sheds light on the dynamic structure of synthesized supported Pt-Fe catalysts under realistic PROX conditions and determines the role of the pretreatment procedure in shaping the structure of the active sites. The co-existence of various active sites is uncovered using operando X-ray absorption and infrared spectroscopies and supported by complementary mass spectrometry and chromatography. The unique operando insight allowed clarifying the catalytic mechanism and suggested strategies for the optimization of the structure of Pt-Fe-based catalysts as well as the operation conditions.

CV: Since 2019, Ilia Sadykov works at Paul Scherrer Institute in the group of Dr. Maarten Nachtegaal pursuing his doctorate studies under the supervision of Prof. Jeroen A. van Bokhoven at the Institute of Chemical and Bioengineering of ETH Zürich.