

"The Role of Heterogeneous Catalysis in the Defossilization of the Chemical Industry"

In this talk I will elaborate on strategies to decouple the chemical industry from traditional fossil fuels to reduce the emission of greenhouse gasses as well as to improve carbon circularity. I will showcase the discovery of new catalytic systems, illustrating how "luck favors the prepared", and how the right tools allow us to establish molecular design principles to improve promising systems. The team practices a convergence research approach, combining materials synthesis and characterization, kinetics and reaction engineering, in situ spectroscopy and computational description and prediction. One powerful tool that I will highlight is Modulation Excitation Spectroscopy, a dynamic technique where the concentration of one of the reagents is periodically altered. By studying the response of the system to this perturbation we can filter out noise and signals stemming from spectator species and obtain kinetic insights in the activation and transformation of reagents over participating sites at the fluid-solid interface. The overarching scientific principles of active site restructuring and site cooperation will be illustrated for chemical transformations of contemporary interest.