

Master Project

Bioenergy and Catalysis Laboratory, Paul Scherrer Institut, 5232 Villigen

Hierarchical zeolite catalysts for the methanol-to-olefins process

Methanol can be converted into alkenes through zeolite/zeotype catalysts in the so called methanol-to-olefins (MTO) process. Olefins, higher than ethylene/propylene, are the targeted products because they are intermediates for the production of synthetic kerosene. A higher selectivity can be characteristic of specific zeolite frameworks, usually featuring 1D/2D channel structures with 10-membered ring micropores. However these suffer from both low activity and fast deactivation due to diffusion limitation given by the intrinsic nature of the zeolite topology. By carefully introducing mesoporosity while preserving the quality of the micropores, hierarchical zeolites with improved catalyst stability and selectivity to medium length olefins can be synthesized.

The aim of this project is to study a designed synthesis method for hierarchical structures starting from selected zeolite frameworks in order to improve the performance of the catalyst in the MTO process. A full characterization will be necessary to pinpoint the structure-performance relationship: standard *ex situ* characterization encompasses the use of spectroscopic methods (FT-IR, NMR), microscopic methods (SEM/TEM/STEM), diffractometric methods (PXRD) as well as physisorption and chemisorption experiments. FT-IR and UV/vis characterization carried out under *operando* conditions will also deliver relevant information of the material in a reactive environment.

The work will be carried out at Paul Scherrer Institut (PSI) in Villigen in affiliation with ETH Zürich.

Tasks

- Synthesis of modified zeolite catalysts
- Operating lab-based equipment for material characterization
- Perform lab-based *operando* experiments
- Deliver scientifically valuable results

Benefits

- Training in standard and advanced characterization techniques
- Gaining experience on spectroscopic *operando* techniques
- Gaining experience on writing scientific reports/presentations
- Work in international team

Type of work: Master

Nature of work: experimental

Requirements: interest in material science and applied spectroscopy, knowledge of catalysis and heterogeneous catalysis, commitment in research

Contacts

Prof. J. A. van Bokhoven (jeroen.vanbokhoven@chem.ethz.ch); Dr D. Ferri (davide.ferri@psi.ch);
 L. Maggiulli (luca.maggiulli@psi.ch)