Inorganic Materials & catalysis

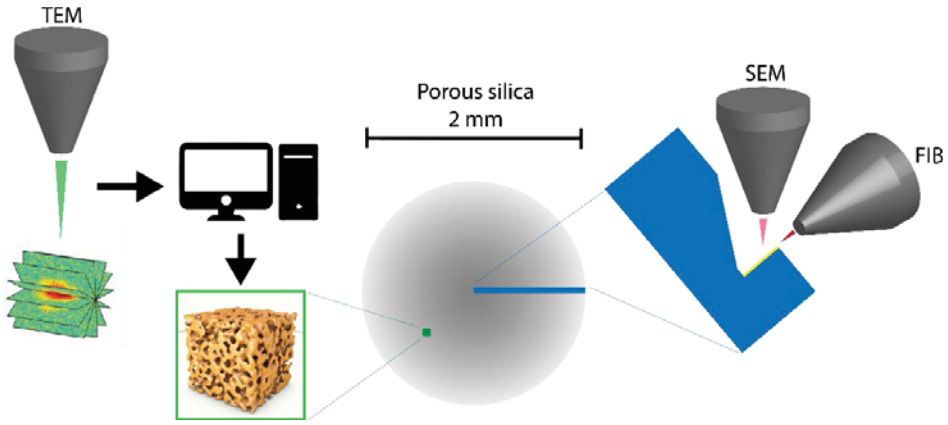
Research Project

Emiel Hensen/Heiner Friedrich/Rim van de Poll

Developing silica pore model spanning multiple length scales

In the field of catalysis there has been an increased effort to develop models that can accurately make predictions about the catalyst synthesis process. This is however, a complicated process, as synthesizing an industrially relevant heterogeneous catalyst has processes on different length scales. On the smallest Ångstrom scale, single metal precursor molecules are deposited. This process takes place in pores with a diameter and length of several nanometres. On the slightly bigger scale, the receding fluid phase can have an impact on the local concentration of the precursor molecules during drying. On the even larger scale of a support particle of several mm, there can be a significant radial difference in pore size or metal distribution. To accurately model how to control this during synthesis, a realistic pore model is needed.

In this project a silica pore model will be developed using a combination of TEM tomography and FIB-SEM. In tomography, TEM images of a sample are taken at different tilt angles and reconstructed into a 3D structure. This reconstruction will be of the nanoscale of the silica support. In order to map the macro structure, the silica will be mapped using 2D FIB-SEM. This technique allows a single support particle to be cut open and scanned in the radial direction. The combination of these two techniques will results in a silica pore model that will span multiple length scales, ranging from 1-2 mm to 5-10 nm. This project will focus heavily on acquiring and processing 2D & 3D and combining the two. A collaboration with a master project in the group of Hans Kuipers will be established to carry out the integration into catalyst synthesis models. Once the silica model has been established, the system can be further expanded by impregnation with a metal salt and monitoring where the metal deposits.



Learning goals:

- Learn how to operate advanced analysis instruments and how to process their data.
- Formulating your own research questions and experiments to validate your hypotheses.
- Reporting you findings in a scientific report and presenting it to the research group.

For further information:

Emiel Hensen
Helix, STW 3.33
e.j.m.hensen@tue.nl

Heiner Friedrich
Helix, STO 2.25
h.friedrich@tue.nl

Rim van de Poll
Helix STW 3.34
r.c.j.v.d.poll@tue.nl