OTTO VON GUERICKE UNIVERSITÄT MAGDEBURG | VST | FAKULTÄT FÜR VERFAHRENS- UND SYSTEMTECHNIK

Topic for a Master Thesis (or Bachelor Thesis)
for students enrolled in CiW, VT, WVET, UEPT, BSYT, CEE

CHEMISCHES INSTITUT
Lehrstuhl für Technische Chemie
FRAUNHOFER-INSTITUT IKTS
Hermsdorf
Abteilung Nanoporöse Membranen

Dr. Alexandra Lieb, OVGU
Dr. Adrian Simon, IKTS

joint project
of the **Chair of Industrial Chemistry** of the OVGU (supervisor Dr. Alexandra Lieb) and
of the **Fraunhofer Institute IKTS** Hermsdorf (supervisor Dr. Adrian Simon)

Topic: „Synthesis of defect free membranes of ZSM-5 zeolite material on porous ceramic substrates in single tube geometry“

Zeolites, as ZSM-5, are porous crystalline alumosilicates, which can show interesting properties for industrial applications. The range of applications stretches from additives in detergents, over sorptive gas separation processes, drying of solvents, molecular sieves, sorptive heat storage and heterogeneous catalysis. By the adjustment of structure and composition of the respective zeolite material, it is tailored to the targeted application. This takes place e.g. by changing the Si/Al ratio within the framework or by ion exchange within the pores. The synthesis of zeolites is often performed under hydrothermal conditions (in water under autogenous pressure), using different Si and Al sources and implementing structure-directing molecules (very often these are organic ammonium salts).

In order to make use of zeolite materials they are often shaped into granules or immobilised on supports. At the Fraunhofer institute IKTS, ceramic materials with an asymmetric pore distribution are coated with microporous, functional materials in order to create mechanically stable membranes.

An especially interesting material for the fabrication of membranes is ZSM-5, which is normally synthesised using a template. The removal of such templates from deposited zeolite crystals is challenging in the case of compact layers. The volume change of the material during heating and calcination can cause cracks, which destroys the sieving capability of the membrane.

During the Thesis work you should synthesise and deposit ZSM-5 on a porous ceramic support using a template free synthesis route. The support will have a single tube geometry. This procedure, which lacks the calcination step, will avoid cracks caused by tension and defects in the membrane. In case of a successful coating procedure, the topic can be expanded by controlling the layer thickness or changing the Si/Al ratio of the ZSM-5.

The coated ceramic tubes shall be characterised using the following methods: Raman and IR spectroscopy, SEM/EDX, nitrogen sorption measurements and powder X-ray diffraction. Additionally, the gas separation capability could be investigated at the Fraunhofer IKTS at Hermsdorf.

Furthermore, an extensive literature research and discussion of its results is part of the Thesis project.

Target of the Thesis work is the manufacturing and characterisation of a dense layer of ZSM-5, which can be suitable for gas separation applications.

Possible start of the work: now

If you are interested, please contact: alexandra.lieb@ovgu.de