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
INSTITUT FÜR VERFAHRENSTECHNIK
Lehrstuhl für Thermische Verfahrenstechnik

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joint project of
Chair of Industrial Chemistry (supervisor Dr. Alexandra Lieb) and
Chair of Thermal Process Engineering (supervisor Dr.-Ing. Torsten Hoffmann)

Topic: „Binder-based agglomeration of a MOF material by fluidised bed methods with accurate control of the process humidity“

The class of metal organic framework materials (so-called MOFs) is currently in the focus of word wide scientific investigation. In this concern, for example gas storage and separation, catalysis, drug release, dehumidification and sorptive cooling / sorptive heat storage are interesting areas of research.

An intensively discussed MOF material is CAU-10-H (an aluminium isophthalate). In order to get such a material ready for application a shaping process is necessary. One possibility for this is the agglomeration of primary particles to form granules in a fluidised bed process.

During the Thesis work you should establish a procedure, which creates beads of CAU-10-H of about 1.5 mm in diameter. The water based binder system, which will be applied for the procedure, is already established at the Chair of Industrial Chemistry. In addition, a certain amount of MOF material of about 2-3 kg with almost monomodal particle size distribution around 5 µm is available. If necessary, you will synthesise more CAU-10-H material by a reproducible synthesis method.

CAU-10-H shows a very interesting water adsorption isotherm (at 25 °C) looking towards sorptive cooling applications. It shows a steep uptake of water of about 25 wt% at approx. 20 % relative humidity. This desired phenomenon is a challenge looking at a binder based agglomeration process, where controlled viscosity plays an important role. The humidity content of the purge gas flow must be manipulated in order to control the water content in the pores of the MOF material. This is necessary to avoid non-reproducible processes triggered by different water uptake amounts during fluidisation and agglomeration.

At the Chair of Thermal Process Engineering, we have an apparatus in a suitable size to test CAU-10-H agglomeration under full humidity control.

Within the Thesis work, you will systematically investigate and optimise the agglomeration and shaping of granules from CAU-10-H. First, a purge gas flow with controlled humidity will be established and the MOF particles will be fluidised. Then the agglomeration will take place by injecting the binder solution. You will characterise the resulting granules concerning size (sieving, light microscopy), microstructure (SEM), porosity (mercury intrusion, nitrogen adsorption) and mechanical strength. The results are compared to results obtained from granules shaped with a moulding process, which is already established at the Chair of Industrial Chemistry.

The main target of the Thesis work is the establishment of a fluidised bed process to agglomerate CAU-10-H and the characterisation of the resulting beads.

Possible start of the work: now

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