Subject:

Determination of a particle-property relationship for cake filtration using microstructure simulations.

Type: Master thesis (theoretical, 6 months)

**Start:** by agreement (October 2023 at the earliest)

Location: University of California, Davis (UCDavis)

Supervisor: Dr.-Ing. Marco Gleiß (KIT); Prof. Dr. Jennifer Sinclair Curtis (UCDavis)

Examiner: Prof. Dr.-Ing. habil. Hermann Nirschl (KIT)

Motivation and objective

For the design of cake filtration on an industrial scale, laboratory experiments on pressure nutsches are still used today to determine the necessary properties of the filter cake which are permeability, porosity and capillary pressure curve. The lack of knowledge of particle properties means that changes in the industrial process require re-characterization of the filter

cake properties and only a narrow range is represented by derived material properties. At the same time, secondary effects such as particle segregation or layer cake formation have a significant impact, as the filter cake properties can change drastically and do not represent the real process. Thus, it is not yet possible to develop particle property functions that link the particle to the filter cake properties and to make precise theoretical predictions of filter cake formation and mechanical deliquoring.
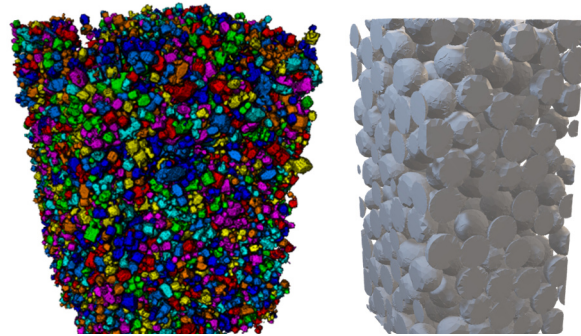
Figure 1: Reconstruction of a filter cake after measurement in the µCT and its negative for the microstructure simulation.

This master thesis investigates the microstructure simulation to derive particle property functions for cake filtration. The master thesis will be conducted at the University of California at Davis USA in the group of Prof. Dr. Jennifer Sinclair Curtis. Particle packings dependent on particle properties are formed using a DEM-Code of the UCDavis. Afterwards the microstructure simulation with the software tool OpenFOAM is used to do virtual simulation experiments to predict the necessary property function for cake filtration dependent on the particle properties. The validation of the simulation results is done by the Process Machine group at the MVM.

For the execution of this task you should be enthusiastic about simulation and like to work theoretically and have first programming skills. The intensive training in the DEM code will take place at UCDavis. For further questions please contact Dr.-Ing Marco Gleiß

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