Simulation of Thermochemical Heat Storage in the $CaO/Ca(OH)_2$-System on the Micro-Scale

Thermochemical Energy Storge (TCES) has long been under investigation for prospective applications including the capture of excess heat from industrial processes or storing energy in concentrated solar power plants. Furthermore, TCES in the $CaO/Ca(OH)_2$-System is investigated because of the low price and environmentally friendliness of the reactants. In the project THEMSE, DLR is developing models and simulations for TCES in the $CaO/Ca(OH)_2$-System on the microscopic level.

A geometrical microscale characterization of the material is done using a combination of micro computed tomography (µCT) and scanning electron microscopy (SEM). Where SEM can be used to resolve fine scale details, up to crystallites, µCT can resolve particles as well as agglomerates of numerous particles. This is complemented by kinetics, measured by thermogravimetric analysis.

The first goal in the project is to explain the measured kinetics using a spatially resolved model, which takes the three-dimensional morphology of the storage material into account. In general, this involves, thermal, hydrodynamic, mechanical, and chemical modeling. However, the first investigations involve a single particle model, where the thermal and hydrodynamic effects can be neglected, and which is solved using finite element simulations.

In this talk, we give an overview over the project and the materials involved and we will show first results from kinetic simulations and experiments.

Keywords: Thermochemical Energy Storage; Modeling; Simulation