Developement of a spraying process in supercritical CO$_2$ for the production of aerogel particles

Fynn Mißfeldt

Aerogels are nano porous solids with extremely low densities and high porosities up to 99%. They possess an open pore structure, a high specific pore volume, a high internal surface area and low thermal conductivities. Their special properties make aerogels suitable for a wide range of applications like thermal insulation or as carrier for active substances in pharmaceutical industry or food industry.

A vast variety of different inorganic and organic precursors, like metal alkoxides or biopolymers can be used for the production of aerogels. In general aerogels are produced from a sol, which is gelled by inducing a reaction or physical aggregation of the precursor molecules. The solvent has to be replaced by a solvent, that is well miscible with CO$_2$, e.g. ethanol. The aerogel is then formed by extraction of the ethanol with CO$_2$ at pressures above the mixture’s critical point.

In case of silica-based aerogels from tetraethyl orthosilicate (TEOS) gels can be directly formed in organic solvents. By pressurization with CO$_2$ the reaction kinetics of the gelation can be enhanced. In this project the production of silica aerogel particles by spraying into supercritical CO$_2$ and by supercritical drying is investigated and the effects of process parameters on the aerogel properties as well as potentials for process integration are evaluated.

Figure 1: Spray drying of silica aerogel particles in scCO$_2$. 