Smart Reactors
Responsive Polymer-Based Smart Particles for Autonomous *in-situ* Reaction Process Control
Master Thesis

Introduction
Classical process control in reaction engineering require three components for the control loop: an indicator to detect a process parameter, a controller to convert the signal and an actor, which the signal is send to in order to adjust the parameter. In industrial plants, the detection of process state deviations and the localization thereof becomes more expensive and difficult with increasing size of the plant and higher numbers of process steps. Therefore, a delocalized and autonomous control system would be an innovative way to manage process interferences, such as run-away reactions. For this purpose, stimuli-responsive polymers can be applied. These types of polymers undergo a significant phase reconfiguration, due to change in thermodynamic equilibrium with the surrounding medium. Engineered into particles and introduced into the process stream, these polymers can act as delivery systems for catalysts or reaction compounds at the sites where it is required. In a way, these particles can be considered as smart as they possess a chemical-inherent ability for decision making.

Tasks
This experimental research project deals with the development and application of the stimuli-responsive smart particles. Two different types of particles will be investigated. Firstly, an established approach with immobilized responsive polymer brushes onto a catalytic particle surface will be pursued and tested with a bio-catalyzed reaction system. Different synthesis routes of the brush particles will be evaluated. In the second approach, novel hollow particles from the responsive polymer will be prepared for the transport of reaction compounds. Once the smart particles have been developed, the thesis will be concluded with the application of both types of smart particles with a suitable reaction system.

Thesis can be also conducted in German.

Supervision
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