Development of a Transient Catalyst Characterization Method for Methanol Synthesis

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Abstract

The collaborative research project DELTA deals with the development of a tubular steam electrolyzer with integrated hydrocarbon synthesis. The aim is to use electricity from renewable energy sources for water electrolysis and to produce methanol as a platform chemical with hydrogen thus obtained and carbon dioxide. These two processes will be combined in one reactor.

The development and characterization of the catalytic materials for electrolysis and for the synthesis reaction is an essential aspect of this cooperative project. The Chair of Technical Thermodynamics deals with this task. The activity of potential catalysts is investigated in-situ and thermodynamic properties are determined. The results of these investigations contribute to a better understanding of the processes taking place on microscopic scale. Thus, a contribution to the optimization of the overall process on macroscopic level is made.

The study of processes taking place inside the pore structure is one of the main challenges in investigation of porous materials for catalytic purposes. To gain deeper knowledge of mass transport in such catalytic materials, the frequency response method (FR) is used. In this method, a system of gas phase and bed of porous material is exposed to a periodic volume modulation. The resulting pressure response provides information about gas diffusion and sorption phenomena. In this way, important conclusions about the accessibility of the pore system of catalytic materials for the gaseous reactants of the methanol synthesis are obtained.