DGMK-Fachbereichstagung: Thermochemische Konversion – Schlüsselbaustein für zukünftige Energie- und Rohstoffsysteme
Dresden, 23. und 24. Mai 2019

Optimization of Selectivity Towards Higher Alcohols for Iron-based Fischer-Tropsch Catalysts

F. Wolke, M. Schaller, E. Reichelt, M. Jahn
Fraunhofer-Institut für keramische Technologien und Systeme (IKTS), Dresden

Abstract

Recently, conversion of syngas into high-value chemicals via *Fischer-Tropsch* synthesis (FTS) gained increasing interest in the scientific community as well as in industry in the course of establishing Power-to-chemicals (PtC) technologies. So-called higher alcohols (HA), more precisely primary alcohols exhibiting atomic backbones with more than 2 carbon atoms, are considered to be a promising target compound group since they can be used as fuel additives but also as precursors for the production of several chemical products on industrial scale. In contrast to established hydroformylation routes, FTS enables a direct access to HA within one step and is therefore considered to be a key technology for a direct conversion of power to higher-value chemicals via syngas.
Despite its favorable characteristics in terms of price-level and eco-friendliness, iron-based FT-catalysts tend to exhibit lacking conversion level and selectivity towards higher alcohols. In order to overcome those drawbacks of iron catalysts, several strategies like combination with promoting elements or an aimed adjustment of the reaction conditions were performed in recent efforts and both conversion level and selectivity were improved.
However, since multiple interdependencies of reaction parameters or promotor content, respectively, and the corresponding performance of the catalytic material, a systematic determination of the structure-activity-relationships was not conducted so far.
In this work, a systematic study on the catalytic performance of iron catalysts is presented. Based on a tailored *Design-of-experiments* schedule, the correlation between promoting elements potassium, copper and molybdenum and the catalytic performance is studied. The contribution displays the experimental procedure and summarizes the obtained results together with related analyses like temperature-programmed hydrogen-reduction (TPR). The results will be discussed in the context of the state of the art in higher alcohol synthesis in order to allow for an assessment of the performance as well as of the prospects for further improvement.