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Conversion of cellulose and lingo-cellulosic based feedstock over heterogeneous catalysts into liquid polyols

Katarina Fabicovicova, Martin Lucas and **Peter Claus**
University of Technology Darmstadt, Germany

Cellulose is the most abundant and non-edible biopolymer of the world. Therefore, the utilization of this macromolecule and its integration in a bio-refinery concept is essential even in the near future of growing global shortage of crude oil. Herein, we present results of the one-pot hydrogenolysis of cellulose to valuable chemicals, especially polyols, using supported bifunctional catalysts. The hydrogenolysis of cellulose under hydrothermal conditions in the presence of solid catalysts yields ethylene glycol and other valuable polyols such as propylene glycol, butanediol, and sorbitol. Besides our highly active nickel-tungsten catalysts, our ongoing research is focused on the development of stable catalyst systems and reaction engineering aspects of biomass conversion to chemicals. Optimization of reaction conditions, recycling tests for catalysts and different cellulose-pretreatment methods such as ball-milling gave a very promising catalyst, namely Ru-W on Activated Carbon (AC). Over the Ru-W/AC catalyst, which was ball-milled with cellulose for a very short time of about 4 minutes, the cellulose conversion of 100 % and overall polyols yield of 84 % within 3 hours reaction time could be achieved under the conditions of 493 K temperature, hydrogen pressure of 65 bar, low catalyst/cellulose ratio (1/10). The catalyst was also tested for its re-usability in a recycling test which showed a very good stability in six runs. Characterization of catalysts was undertaken for a better understanding of structure and performance of the catalyst. Finally, first experiments showed that the optimized conditions can be successfully applied to the hydrogenolysis of real biomass. At very high conversions, the product distribution depends on the individual biomass type. With application of a pretreatment method, we can influence the product distribution and increase the overall polyols yield by the hydrogenolysis of raw biomass.

Biography

Katarina Fabicovicova is a PhD candidate in the field of technical chemistry, heterogeneous catalysis and reaction engineering on University of Technology Darmstadt in Germany. She is working under the supervision of Professor Peter Claus on the utilization of biomass, especially cellulose into valuable chemicals. She has completed her Master's degree in chemical engineering at the University of Technology in Bratislava, Slovakia.

fabicovicova@tc2.tu-darmstadt.de