CHALMERS
Competence Centre for Catalysis

Master thesis, 30 or 60 credit points at KCK, Chalmers

Catalytic hydrodeoxygenation of oils in the production of renewable fuels

This is a master thesis work at Chemical Engineering and Competence Center for Catalysis at Chalmers (KCK) in collaboration with Preem that deals with the selective catalytic removal of oxygen from bio-oils to produce high quality renewable fuel. One measure to limit global warming is to reduce the CO_2 emissions from the transportation sector. This can be achieved by using alternative fuels from renewable sources. Many of these fuels that are based on different kinds of fats and oils contain much higher amounts of oxygen than traditional fuels. This higher content of oxygen may shorten the time the fuel can be stored and cause material problems in the engine and before the engine. Therefore, it is beneficial to upgrade the fuel by selectively removing the oxygen.

This can be achieved by catalytic hydrodeoxygenation (HDO), where hydrogen reacts with the oil at high temperatures and mild pressures over different catalysts. One of the major problems with this process is the limited lifetime of the catalyst due to deactivation. In overall project, different catalysts will be used for hydrodeoxygenation when different compounds are added to a standard feed mixture and their activity for hydrodeoxygenation analyzed in a batch reactor. The catalysts will be placed together with dodecane as solvent and a model compound for oil e.g. oleic acid in the reactor. Then the reactor will be heated and pressurized with hydrogen. Samples will be taken regularly and analyzed in a GC. After the test, spent catalyst will be recovered and analyzed.

Two different projects available within this field are as follows:

Project-1: The feed composition i.e. type and amount of raw materials, impurities and catalyst poisons have a major impact on the deactivation the catalysts. The focus of this project is to study how different feed compositions alter the activity, selectivity and coke formation on the catalyst.

Project-2: Catalysts are key! Novel catalysts will be developed to facilitate high conversions of bio-oils. The focus of this project is to optimize catalysts systems which mitigates coking of catalyst and exhibit good tolerance to water and other poisons.

Education program: Chemical Engineering, Chemical Engineering with Physics, Physics and Material Chemistry.

Project start: Flexible, for example January 2015.

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Competence Centre for Catalysis (KCK) is a centre where three divisions (Chemical Engineering, Applied Surface Chemistry and Applied Physics) work in close collaboration with its member companies: AB Volvo, ECAPS AB, Haldor Topsøe A/S, Scania CV AB, Volvo Car Corporation AB and Wärtsilä Finland Oy.