

TOPIC FOR A MASTER THESIS

„Integration of Mineral Oil Refineries into the Energy Transformation: Experimental Study on the Potential of Co-Hydroprocessing a Bio-Derived Heavy Gasoline“

The Work is conducted abroad at Technical University of Denmark (DTU, Copenhagen) for 5 – 6 month

Background and Motivation

Heavy traffic as well as private transport driven by fossil fuels contribute significantly to the climate change by emitting large amounts of greenhouse gas emissions. With the bioliq[®] plant, KIT runs a DtG-process for the production of CO₂-neutral synthetic gasoline from straw or other bio-derived organic “waste” on a large scale (approx. 50 l/h). In order to test the produced synthetic fuels in realistic scenarios, the project "reFuels - rethinking fuels" was launched. Part of the project is to investigate the influence of synthetic fuels on existing engines as well as the entire vehicle. Furthermore, the project aims to investigate how synthetic fuels can be integrated into modern refineries. A key difference between synthetic bioliq[®] gasoline and conventional fuel lies in the high aromatics content (>70 vol.-%). In addition to clear advantages such as high antiknock properties, these aromatics also hold disadvantages. The main ones are increased emissions during engine combustion (caused by >C₉ aromatics) and high crystallization temperatures for heavy and symmetric aromatics such as 1,2,4,5-tetramethylbenzene (durene). To counter these disadvantages the heavy aromatics are modified in a subsequent hydroprocessing. Such processes are well understood on a laboratory scale. Relating to the urgency of the energy transformation, solutions for implementing synthetic fuels in existing refinery hydroprocessing units need to be developed.



bioliq[®]-plant at KIT, Campus North

Assignment

The topic for the master thesis is the experimental study on co-hydroprocessing heavy gasoline (bioliq[®]) and fossil middle distillate (Mineralölraffinerie Oberrhein – MiRO) utilizing existing refinery-processes and related parameters. For the experimental work a reactor at Technical University of Denmark (DTU) is provided, which makes a 5 – 6 month stay abroad mandatory for this thesis. Several mixtures of heavy gasoline and middle distillate are used as feedstock. An industrially widely utilized CoMo catalyst will be provided for the hydroprocessing experiments. The following tasks are to be carried out in the course of the work:

- Literature research on the (co-)hydroprocessing of bio-derived and fossil fuels
- Planning and execution of experiments on an existing fixed bed reactor at DTU in Denmark
- Discussion of experimental results based on established reaction engineering quantities as well as in comparison to the literature
- Evaluation of the potential for incorporating co-hydroprocessing into an existing refinery

Starting date: Depending on the schedule of DTU and the student

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