

Two summer jobs at the Catalysis group

Project 1: Low-Cost Drill Bit for Geothermal Applications

Tungsten carbide (WC) is the base material in commercial drill bits today. Tungsten is heavy, very expensive, with limited resources on earth and on the list of critical raw materials. Attempts were made to apply SiC, in place of WC in order to significantly reduce cost (and weight) of final drill bits while keeping high mechanical strength. The basic idea is to coat SiC with WC using chemical method. The primary results from previous studies showed that uniform coating of WC on SiC is achievable, the powder has good wettability with typical binder materials (CuNiMn based alloys). However, test bar prepared from the coated powder has poor mechanical strength.

The summer job deals with first a literature study on WC coating on SiC and what influence the mechanical strength of a cermet. The summer job is 6 weeks followed by project in the autumn and Master thesis project in spring. The summer job will be carried out at the Catalysis group at the Department of Chemical Engineering.

Supervisor: Prof. Jia Yang Co-supervisor: Prof. De Chen, Dr We He (Lyng Drilling AS)

The candidate should have background in nanotechnology or material chemistry and familiar with material synthesis and characterization. For those who are interested, please send your CV and grades to Prof. Yang through email: jia.yang@ntnu.no Deadline: 25 March 2021.

Project 2: Novel Fe based catalyst for Fischer-Tropsch synthesis

The depletion of oil reserves has increased the interest in developing and improving processes that can replace the use of crude oil. An alternative is the Fischer Tropsch synthesis (FTS), a catalytic process where syngas (CO+H₂) reacts to form a range of hydrocarbons, such as light olefins, gasoline, diesel, and waxes. The lower olefins (C₂-C₄) and their derivatives are important building blocks in the chemical industry, used to produce many high-performance materials and chemical products, i.e. plastic and engineering resins, lubricants, coatings, and paints. To increase the renewability of the process, the syngas feedstock should derive from biomass, however, syngas from biomass is lean in hydrogen. This makes iron an attractive catalyst, as it can manage syngas with a

relatively wide range of hydrogen content ($H_2/CO = 0.5-2.5$), due to water-gas-shift activity.

This project focuses on the synthesis of novel Fe-based catalysts. By pyrolysis of Fe-containing polymers, well-dispersed Fe nanoparticles supported on porous carbon are formed. In order to understand how to produce and tailor the best catalysts, an array of synthesis conditions will be explored. The resulting materials will be investigated with a wide range of characterization techniques to understand how synthesis conditions affect Fe species, particle size and the porosity of the carbon support. In addition to material properties, we will investigate the effect different promoters and activation methods have on the stability, activity, and selectivity during FTS.

The summer job is 6 weeks followed by project in the autumn. The summer job will be carried out at the Catalysis group at the Department of Chemical Engineering.

Supervisor: Prof. Jia Yang Co-supervisor: Prof. Anders Holmen, Research scientist: Rune Myrstad (SINTEF)

The candidate should have background in chemistry, chemical engineering, or material chemistry and familiar with material synthesis and characterization. For more information, do not hesitate to contact Associate Professor Jia Yang, email: jia.yang@ntnu.no. You can apply the summer job by sending your CV and grades to Prof. Yang through email: jia.yang@ntnu.no Deadline: 25 March 2021.