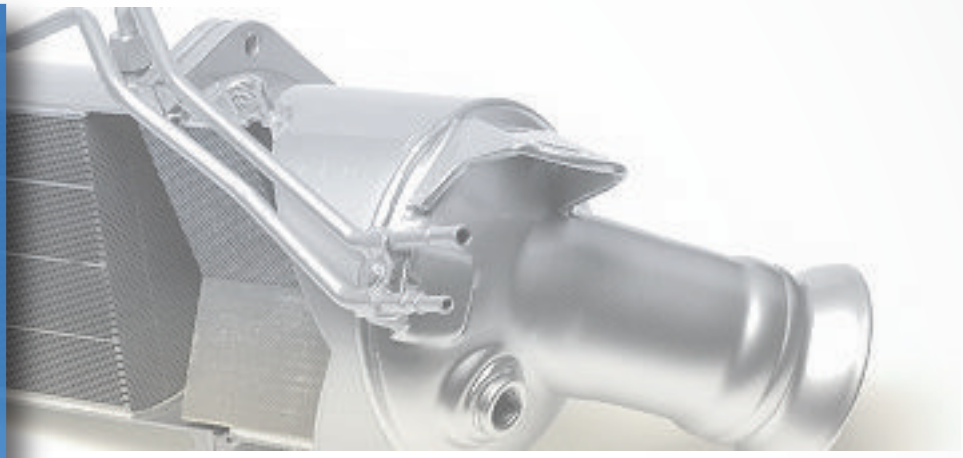
Porous Silicon Carbide as a support for Co metal nanoparticles in Fischer Tropsch synthesis



PROJECT DETAILS

Funding Programme:
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People
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PROJECT DESCRIPTION

Searching for the alternative energy sources and particularly for liquid fuel is strategic task for the nearest future. Renewable biomass, large deposits of natural gas and coal can be such sources. A major challenge for this direction is to develop efficient the gas-to-liquid process. The heart of such process is Fischer-Tropsch (FT) synthesis (CO hydrogenation by hydrogen) that takes place on Co or Fe catalysts supported on Al2O3 or SiO2. The FT reaction is usually carried out at 200 - 350 °C and at elevated pressures (up to 40 bars). At these stress conditions the chemical nature of the support material plays an important role. Significant support interaction is observed for Al2O3 and TiO2 leading to the formation of inactive compounds (so-called SMSI effect). SiO2 support exhibits a weaker interaction. However, its low thermal conductivity provokes overheating of the metals due to a high exothermic nature of the FT reaction. It leads to sintering of the active compounds. Consequently, these effects cause irreversible deactivation of the catalyst.

The main objective of the proposed project is the development of new catalysts which demonstrate high activity/selectivity with improved stability towards extreme hydrothermal conditions in FT reaction. To do so, we propose to apply porous silicon carbide (pSiC) as a support in the catalyst. The use of pSiC prevents sintering and chemical reaction of cobalt metal with a support thanks to its high thermal conductivity, outstanding chemical inertness and mechanical strength. Moreover, silicon carbide demonstrates mesoporous framework enabling its impregnation with cobalt particles. This will lead to higher activity/selectivity in comparison to nonporous supports in terms of mass unit of the catalyst. For more benefit concepts of nanotechnology in catalyst preparation will be introduced to control the size and shape of cobalt nanoparticles, known as hot injection method.

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