UNITÉ DE CATALYSE ET CHIMIE DU SOLIDE

NEW TECHNOLOGY DEVELOPMENTS FOR ADVANCED "CLEAN" SOLID CATALYSTS. *APPLICATION:* CONVERSION OF SYNGAS TO ULTRACLEAN HYDROCARBON FUELS

Scientific field: MATERIALS SCIENCE, PROCESS, CATALYSIS

Key words: NANOCOMPOSITES, PARTICLE DESIGN, MECANOCHEMISTRY, CATALYSIS

Details for the subject:

Background, Context:

The design of novel nanocomposite materials by mechanical action has demonstrated its potential and its interest in numerous branches of industry [1,2,3,4]. Currently a lot of materials are prepared using synthesis routes which involve solvents, e.g impregnation, precipitation, liquid phase deposition etc. In the current socio-economic context, large amounts of solvents should be avoided because of their cost and contribution to the environmental pollution. In addition, because of higher cost and important energy consumption, drying step in material synthesis should be optimized. Novel materials with unique properties for a large number of applications can be efficiently prepared using environmental friendly and efficient mechanofusion/chemistry synthetic methods.

Development of particle design with controlled solid properties poses significant challenges. Apart from the physic-chemical properties of the solids, other properties, like the mechanical strength, thermal resistance, flowability [5] of powders and surface energy of very cohesive powders [6], play a crucial part in the preparation of solid catalyst. This requirement is further coupled with the urge for the reduction in the total number of discrete synthesis steps and net consumption of the solvent. Such requirements render the process development difficult in most case.

Research subject,

The goal of this study is development and optimization of advanced mechanofusion processes for synthesis of novel

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materials applied for heterogeneous catalysis. In particular our objective is design of novel nanocomposite catalysts for valorization for syngas produced from coal, natural gas and biomass into ultraclean hydrocarbon fuels (gasoline, kerosene, diesel fuels) [7]. The process of synthesis of solid catalyst through mechanofusion seems to be very promising for the preparation of new materials with good functional and mechanical properties, controlled flowability characteristics and without fragmentation. This synthesis technique is of technological interest since the process involves only a few operation parameters and is suitable for large quantity production at commercial scale.

Work plan:

The program of this study is structured around the following items:

- Development and modification of the mechanofusion process to synthesize the new catalyst
- Identification of the operating conditions for the control of the coating technique
- Understanding the basic mechanisms behind deposition of particles on the interface, their interaction and subsequent fusion
- Control of the dispersion of active and functional sites on the catalyst
- Modeling the phenomena of physicochemical/fusion adhesion
-Optimisation of catalytic performance of these novel materials for conversion of syngas to ultraclean hydrocarbons fuels.
- Consolidation of data from the laboratory studies to further scale up the process for industrial production

The project has a minimum duration of 5 months. There is no remuneration.

References:

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