New MicroGasic Fluidized Bed Reactor for the respect of the environment

Application: conversion of syngas to ultraclean hydrocarbon fuels

Scientific field: MICROFLUIDIC, MATERIALS SCIENCE, PROCESS, CATALYSIS,

Key words: microreactor, catalysis, Nanocomposites

Details for the subject:

Background

The design of novel microreactor (microgasic-system) has demonstrated for its potential and its interest in numerous branches of industry. Currently, lot of reactors are very large in size and use particles with low surface area which requires high gas velocity. This, leads to large quantity of waste resulting into high cost of waste and energy. In the current socio-economic context, it is necessary to reduce the size of the reactor to decrease the quantity of waste and the energy for the production of solids. Novel microreactors with unique design can be efficiently used for a large number of applications in environmentally friendly processes.

Research subject,

The microgasic reactor (microfluidic system: gas-solid) will be used for the suspension (or dispersion) of the nanometric powders (size lower than 200 nm) at a very high gas velocity in microtubes. Moreover, the dispersion of the particles and the contact between gas and the particles (reaction system) will be carried out in tubes of sizes lower than 10µm which has very complex configuration and "innovative" design. Although this process has real challenges such as complexity of the dynamics flow, the very cohesive powders in its design. It has more advantages like its ability to react gas and the active product without support, absence of attrition (fragmentation) of the particles, increase in the heat-transfer surface and thermal stability of the reactor.

However, the major and complex problems in this process are the desagglomeration and the separation of nanometric particles and the good design of MicroGasic system.

The very low size of the tubes makes it possible to obtain high

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speed of gas and a turbulent flow which allows a better shearing of the agglomerates and the dispersion of the nanometric particles. Furthermore, the design of the MicroGasic process allows good dispersion, the good gas-solid mixture and finally better separation of gases and the solid at the end of the reaction.

Work plan:

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

- Development of the microgasic reactor
- Study of nanometric powders behaviour
- Study of the Hydrodynamic and thermal behaviour (gas-solid)
- Study of the feasibility and the validity of the concept
- Identification of the operating conditions and optimisation of the microreactor
- Application: Optimisation of catalytic performance in the novel reactor for conversion of syngas to ultraclean hydrocarbons fuels.

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

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