'Physique et Chimie des Matériaux' – ED 397 – année 2020

PhD project for funding (max 1p), to send to

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Research unit (full name + acronym) : Laboratoire Chimie de la Matière Condensée de Paris (LCMCP)
Team if applicable : Matériaux Hybrides et Procédés
Address : Sorbonne Université, place Jussieu T44 E4, 75005 PARIS

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Number of phD under supervision : 0 Participation to supervisor training? no Year
Co-supervisor name : C Chanéac HDR ? yes
Research unit : LCMCP International co-supervision ? No
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Keyword 1 : Catalysis Keyword 2 : extrusion
Keyword 3 : Green Chemistry Keyword 4 : synthesis
Select co-funding programme if applicable : select

Project title : Green synthesis of heterogeneous catalysts via reactive extrusion

Project Description (~4000 characters, font 11 min):

Improving the performance of catalysts in the field of refining and petrochemicals, but also the development of innovative solids for breakthrough applications oriented towards the upgrading of bio-based chemicals and new energy technologies are major challenges for tackling the energy and environmental issues of tomorrow. In this context, the transition from laboratory studies to a larger scale, close to industrial development, is a key step.

The study consists in using the principle of reactive extrusion as a method of simultaneous synthesis and shaping of oxide type solids used as catalysts or catalyst supports for the applications mentioned above. Reactive extrusion is a known process for the synthesis and shaping of polymer-type materials which combines the carrying out of chemical reactions with conventional steps of shaping by mixing and extrusion. The objective of the PhD is therefore the study of the transposition of the use of this tool from the field of polymers (mastered by the Engineering Laboratory of Polymer Materials) to the field of inorganic nanoporous solids specially designed for heterogeneous catalysis. A key point will be to develop and explore extensively new “solvent-free” sol-gel chemistry approaches allowing a huge gain of atom and energy economy if compared with usual industrial production processes. Various catalytic tests (Bio-alcohol dehydration to olefins, CO2 hydrogenation, upgrading of short bio-based carboxylic acids towards green solvents and fuel additives) will be performed in collaboration with the Institute of Condensed Matter and Nanosciences of UCLouvain (Belgium) for characterizing mono-functional and bi-functional alumina-based mesoporous materials.

This work allows the acquisition of skills in the field of sol-gel chemistry, solvent-free green processes, shaping characterization of porous solids and heterogeneous catalysis.