SINCHEM PhD subject

Waterborne CATalytic materials with original DEsign *(acronym: DECAT)*

HOME INSTITUTION: **Ecole Nationale Supérieure de Chimie de Montpellier**, Charles Gerhardt Institute (Institut Charles Gerhardt, ICG), Montpellier, France ; team "Engineering of Macromolecular Architectures" (Ingénierie et Architectures Macromoléculaires, IAM). Supervisor of the PhD student in Montpellier: Dr. Patrick LACROIX-DESMAZES (polymers, emulsion polymerization). Other teams of Pole Chimie Balard would interact in the project: Dr. Tony CHAVE (ICSM, sonochemistry) would be co-supervisor of the PhD student; Prof. André AYRAL (IEM) (sol-gel); Prof. Vasile HULEA (ICG-MACS) (catalysis).

HOST INSTITUTION 1: University of Messina (Prof. Gabriele CENTI, Prof. Siglinda PERATHONER).

HOST INSTITUTION 2: Delft University of Technology (Dr. Patricia KOOYMAN).

PROJECT DETAILS: The PhD work will deal with the combination of innovative methods of synthesis for the elaboration of catalytic materials with original designs. The objective of the work is to synthesize and characterize porous matrices decorated with nanoparticles in view of applications in heterogeneous catalysis. Some hybrid particles composed of latex particles (polymer) and inorganic nanoparticles will be elaborated by various techniques, especially by aqueous emulsion polymerization and by sonochemistry. Thus, inorganic particles will decorate the surface of the latex particles. These hybrid particles will then be used as both transfer agents and porogens in oxide matrices prepared by sol-gel. It will give access to different types of catalytic materials with a homogeneous distribution and controlled surface density of active sites on the walls of the pores. Different types of nanoparticles could be deposited in a given pore to enhance the catalytic efficiency by specific adsorption for instance. The catalytic performances of these new materials will be tested on specific reactions and compared to those of reference materials. ICG-IAM will bring its expertise in latex synthesis. ICSM (Marcoule, France) will bring its expertise in sonochemistry. IEM (Montpellier, France) will bring its expertise in sol-gel chemistry. ICG-MACS and University of Messina will bring their complementary expertise in catalysis, for instance for the selective oxidation of carbon monoxide CO in the presence of hydrogen H_2 (ICG-MACS) and the synthesis of hydrogen peroxide H_2O_2 (Univ. Messina). Delft University will bring its expertise for the advanced characterization of the catalytic materials (e.g. by transmission electron microscopy, TEM) to establish structure-activity relationships. The PhD student is expected to spend 21 months in Montpellier, 12 months in Messina and 3 months in Delft.