

IBN SEMINAR SERIES

Non-Conventional Eco-Friendly Routes for the Preparation of Ordered Porous Materials for Catalysis and Biocatalysis

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Aspiration Theatrette, Level 2M • The Matrix, 30 Biopolis Street, Biopolis

ABSTRACT

Phospholipid-templated mesoporous supports for enzyme encapsulation

A new method of enzymes encapsulation involving sol-gel precipitation templated by bilayers of phospholipids is presented. It provides an organized network of phospholipids embedded in silica and allows protection of entrapped enzymes, as if they were entrapped in a biological membrane. The formation of a negative curvature in the rigid phospholipid bilayers is induced by adding ethanol to the aqueous medium. Dodecylamine stabilizes the structure and acts as a catalyst for silica condensation. Lactose avoids direct interaction of the enzymes with the silica walls at the interface of the lipids bilayer. Encapsulated enzymes show higher activities compared to traditional and commercial immobilized-enzymes. This new type of biological nanoreactor has been used to encapsulate simultaneously several enzymes. Examples showing the degradation of carcinogenic aromatics from aqueous and organic effluents and the conversion of carbon dioxide into methanol will be presented.

Stimuli-responsive micelles of hydrosoluble copolymers for the eco-synthesis of functional mesoporous materials

An original method for the preparation of functional mesoporous materials relies on the use of Polyion Complex (PIC) micelles, whose role is double : they can direct the structure of the inorganic framework and confer a functionality to the final hybrid mesoporous material. PIC micelles are reversible dynamic assemblies of hydrosoluble polymers that result from electrostatic interactions between two polyions of opposite charge, one of them belonging to a double-hydrophilic block copolymer (DHBC). The micelle formation is reversible in water as a function of pH, which allows dissociating the micelles within the material, generating the ordered porosity at room temperature and neutral pH. A second advantage of using polyelectrolytes as structuring agents is the possibility to functionalize the silica pore surface. We will describe several possible preparation routes of functional hybrid silica-based mesoporous materials using complex micelles between different polyacids and polybases.

Conversion of polysaccharides into functional materials

Natural polysaccharides are gelling agents in the aqueous phase, due to the high level of dispersion of hydrocolloids. An effective method to prepare dry materials which retain the dispersion of the polymer hydrogel, namely polysaccharide aerogels, will be introduced. The diverse surface functionalities like hydroxy, carboxy or amino groups of the polysaccharide aerogels are accessible to catalysts and reactants and can be easily modified to tune the functionality of the materials.

ABOUT THE SPEAKER

François Fajula graduated in Physical Chemistry and obtained his PhD and Doctorate ès Sciences in Catalysis in 1978 from the University of Strasbourg (France). After a post-doc at Texas A&M (College Station, TX, USA) he settled at Montpellier (Ecole Nationale Supérieure de Chimie) as a CNRS researcher in 1981, where he established a group working in the fields of zeolite synthesis and catalysis in close cooperation with major refining and chemical companies. Since 2007, he is the director of the Institute for Molecular and Materials Chemistry in Montpellier, France, a CNRS-associated laboratory with 220 permanent staff covering a broad range of expertises, including catalysis, quantum and bio-chemistry, organic and inorganic synthesis, polymer and materials sciences, spectroscopy and life sciences. François Fajula has authored over 270 scientific papers (h= 44) and holds 34 original patents. He has been the chairman of the 13th International Zeolite Conference in 2001 and the president of the International Zeolite Association from 2004 till 2010. His work has been recognized with the CNRS bronze medal, the French Chemical Society award and the 2013 IZA Award.

This seminar is free and no pre-registration is required.

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