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POROUS POLYMERS AND METALLIC NANOPARTICLES: A HYBRID WEDDING TOWARD INNOVATIVE SUPPORTED CATALYSTS

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Over the last decade, the generation of organic porous (nano) materials with tunable pore sizes and desired functionalities has been the subject of increasing attention in materials science. Interest in such porous frameworks originates from the large variety of applications in which they are involved, e.g. size/shape-selective nanoreactors, monoliths for advanced chromatographic techniques, nanofiltration membranes, high specific area catalytic supports, as well as 3-D scaffolds for tissue engineering. Porous monolithic polymers may represent suitable supports for the immobilization of metallic nanoparticles, thus allowing for the generation of hybrid materials having particularly interesting features for heterogeneous supported catalysis. Such porous materials indeed present some undeniable advantages over their inorganic counterparts, namely their synthesis is cost-effective and their mechanical properties as well as the chemical nature of the pore interface can be finely tuned. In this context, we have developed different polymer-based hybrid systems based on porous polymers that were suitably functionalized so as to successively immobilize gold nanoparticles. This presentation will particularly emphasize on recent studies developed in our laboratory on this topic. It will focus on hybrid systems based on three main types of porous polymers: Nanoporous polystyrene frameworks arising from polystyrene-block-poly(D,L-lactide) diblock copolymers with a cleavable functional group at the junction between both blocks; bulky macroporous monoliths prepared from a selectively cleavable disulfide dimethacrylate monomer; functionalized doubly porous poly(2-hydroxyethyl methacrylate)-based networks. Such functional hybrid materials have been successfully applied as efficient and versatile heterogeneous supported catalysts in miscellaneous model organic reactions, including hydride-mediated reduction of nitroaromatic compounds, C-C homocoupling of benezeneboronic acid derivatives and reduction of dyes. We have notably demonstrated that cascade reaction processes consisting of two successive nanogold-catalyzed reactions are efficiently implemented with these novel porous polymer-supported catalysts.

BIOGRAPHY

Daniel Grande is currently working as a CNRS Research Director at the East-Paris Institute of Chemistry and Materials Science (ICMPE) in France. He received his PhD degree in Polymer Chemistry from the University of Bordeaux, France and the University of Coahuila, Mexico in 1998 and then he spent about two years at Emory University, USA as a NIH post-doctoral fellow. His research interests include the development of functional polymer materials with a broad range of porosity scales and the whole spectrum from their design to their potential applications is investigated. He is the co-author of about 110 peer-reviewed publications in international journals, 40 proceedings, 14 book chapters and 11 patents.

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