Editorial

Nanoscale Catalysts as Tools for Synthesis

This thematic issue covers principles from areas of green chemistry and catalysis, in particular nanoscale catalysts as synthetic tools. Today almost all reactions may be carried out with environmentally benign catalysts and solvents. Indeed, this rise was demonstrated by the design and application of tunable nanoscale catalysts modified by ligands functional supports or ionic liquids. Nanoscale catalysts such as metal nanoparticles have emerged because of their easy preparation, high catalytic activity and long-term stability. They are used in a series of reactions, such as hydrogenation, dehydrogenation, hydrogenolysis, aminolysis, defunctionalisation, hydrogen storage, GtL, Fischer-Tropsch, cross-coupling reactions, C-H activation and many more. In the last decades, many research groups have made great efforts in this area. The nanocatalysts are combined with several support materials, such as ionic liquids, nanotubes, magnetic supports, silicates, zeolithes. In this manner the selectivity and stability for catalyst recycling can be tuned and their application in the synthesis of fine and bulk chemicals, pharmaceuticals and biomass conversion for example is enhanced. Moreover, nanoscale materials have also many useful applications in other fields, the advantages of these materials will be enhanced in the near future. I believe that the future research in the area of nanocatalysts will provide new opportunities for the breakthrough in fundamental research and industrial applications. The literature about catalysis envolving nanoparticles and nanomaterials is wide spread, and these six reviews in this issue will supply new and relevant information for many chemists working in the field of nanocatalysts, organic and inorganic synthesis, green chemistry and related areas.

The first review was written by A. Welther and A. Jacobi v. Wangelin, (University of Regensburg, Germany), they presented an overview with more than 50 references discussing recent developments in the synthesis of iron(0) nanoparticles and their applications as catalysts to organic reactions including cross-coupling reactions and hydrogenation reactions in multiphase systems and homogeneous systems.

The second review came from China, it was written by Y. Yu and Z. Hou (East China University of Science and Technology, Shanghai, China). This review discusses synthetic approaches for soluble nickel nanoparticles and their application in selective hydrogenation reactions. The current review includes more than 80 references.

The third review was written by J. D. Scholten (Federal University of Rio Grande do Sul, Porto Alegre, Brazil). The author discusses details about the application of soluble and supported iridium nanoparticle catalyzed hydrogenation reactions in water, organic solvents and ionic liquids. This review includes over 90 references.

The fourth review was written by M. Guerrero, N. T. Than Chau, S. Noël, A. Denicourt-Nowicki, F. Hapiot, A. Roucoux, E. Monflier and K. Philippot (CNRS-LCC and University of Toulouse, Toulouse, France; University d´Artois, Lens, France; CNRS-Rennes, Rennes, France; European University of Bretagne, France). The authors focused on the use of rhodium nanoparticles for hydrogenation and hydroformylation reaction in different reaction media (organic solvents as well as ionic liquids) and effects of stabilizers and ligands. This review includes about 150 references.

The fifth review was written by Y. Yuan, S. Yao, M. Wang, S. Lou and N. Yan (National University of Singapore, Singapore; Peking University, Beijing, China). This review provides details about the usage of nanomaterials for the chemoselective hydrogenation of unsaturated aldehydes to their corresponding alcohols. This overview provides almost 120 references about the mentioned topic discussing the application of metal nanoparticles, new nanosupports and designer solvents such as ionic liquids.

The last review by Paul S. Campbell, M. H. G. Prechtl (guest editor), C. C. Santini, P.-H. Haumesser (University of Bochum, Bochum, Germany; University of Cologne, Cologne, Germany; University of Lyon and CNRS-Lyon, Lyon, France; CEA/LETI/MINATEC, Grenoble, France) provides an overview of the synthesis and application of ruthenium nanoparticles in ionic liquids. Besides the application for hydrogenation, hydrogenolysis, gas-to-liquid processes, biomass refinery and isotope labeling, also their application in electronic devices is discussed and about 120 articles are cited.

In summary, from this special issue, it shows that tunable nanocatalysts are attractive as alternatives to classical homogeneous and heterogeneous catalytic systems. Especially in terms of long-term stability, recyclability and activity nanocatalysts are competitive with molecular and solid-supported catalysts in certain cases.

Finally, I gratefully acknowledge all the authors from different parts of the world for their contributions and critical and in-depth analysis, as well as their insights into the current state-of-the-art of nanocatalysts to make this issue special. I would also like to thank the journal (COC) for the kind invitation and the trust in me to take on this project.

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