Biphasic Catalysis with *d*-block metal nanoparticles confined in triphenylphosphine oxide-functionalized polymeric nanoreactors

Chantal J. Abou-Fayssal[1], Leonhard Schill[2], Rinaldo Poli[3,4], Eric Manoury[3], Karine Philippot[3], Anders Riisager[2], Cyril Godard[1]

[1] Departament de Química Física i Inorgànica,Universitat Rovira i Virgili,Marcel.li Domingo s/n, 43007 Tarragona, Spain.
[2] Centre for Catalysis and Sustainable Chemistry, Department of Chemistry, Technical University of Denmark, Kemitorvet, Building 207, 2800 Kgs. Lyngby, Denmark.
[3] CNRS, LCC (Laboratoire de Chimie de Coordination), Université de Toulouse, UPS, INPT, 205 route de Narbonne, BP 44099, F-31077 Toulouse Cedex 4, France.
[4] Institut Universitaire de France, 1, rue Descartes, 75231 Paris Cedex 05, France.
Email of the presenting author: chantal.abou@fundacio.urv.cat

Metallic nanoparticles (MNPs) have garnered significant attention in catalysis due to their exceptionally high surface-to-volume ratio, which provides numerous potential active sites. The confinement of MNPs profoundly affects their stability and catalytic performance. Biphasic applications are particularly appealing because they enable easy catalyst recovery and recycling through simple phase separation. Micellar catalysis, where the catalyst is attached to the hydrophobic core of a surfactant that self-assembles into micellar nanoreactors, is of particular interest. Drawing inspiration from previous research [1], this project concentrates on synthesizing unimolecular nanosized polymeric reactors and confining block *d*-metal nanoparticles within their cores for use in aqueous biphasic hydrogenation. To address issues encountered during recycling, such as NP extraction, the use of triphenylphosphine oxide (TPPO) as a core-anchor was developed. Previously, we reported the synthesis and application of RhNP-TPPO@CCM-C latex in the aqueous biphasic hydrogenation of styrene, which demonstrated superior catalytic efficiency compared to a previously reported catalyst [2] (average cTOF 6400 h^{-1}). Moreover, it exhibited reusability across multiple catalytic cycles. Recent endeavors have expanded the utility of these polymers to anchor cobalt nanoparticles (CoNPs), denoted as CoNP-TPPO@CCM-C, as a cost-effective alternative to RhNP in hydrogenation applications. This study encompasses the synthesis, characterization, and comparison of Co versus Rh activity, evaluating catalytic efficiency, selectivity, recyclability, leaching, and other relevant factors.