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Catalytic activity and recyclability of polymer supported palladium or nickel nanoparticles in organic reactions in water

Maria Michela Dell'Anna[1], Matilda Mali[1], Giuseppe Romanazzi[1], Antonino Rizzuti[1], Cristina Leonelli[2] and **Piero Mastrorilli[1]**
[1]Polytechnic University of Bari, Italy
[2]University of Modena and Reggio Emilia, Italy

An insoluble palladium catalyst (*Pd-pol*) was obtained by copolymerization of the metal containing monomer Pd(AAEMA)2 [AAEMA– = deprotonated form of 2-(acetoacetoxy)ethyl methacrylate] with ethyl methacrylate (co-monomer) and ethylene glycol dimethacrylate (cross-linker), followed by *in situ* reduction of Pd(II) to Pd(0), to give polymer stabilized metal nanoparticles. The good swellability in water exhibited by *Pd-pol* rendered it an ideal potential catalyst for reactions carried out in a green solvent, such as water, since the migration of the reagents to the active sites would not be hampered by the solid support. With the aim to develop innovative catalytic processes that enable chemical transformations to be performed under mild and sustainable conditions with high efficiency, we decided to evaluate the catalytic activity of *Pd-pol* for several important organic reactions using water as solvent. *Pd-pol* resulted highly active and selective in catalyzing (figure 1): the Suzuki-Miyaura coupling between aryl bromides or activated aryl chlorides and phenylboronic acid; the oxidation of benzyl alcohols to aldehydes; the reduction of quinolines and nitroarenes by H_2 or $NaBH_4$. *Pd-pol* was recyclable for several consecutive runs (for example, at least 12 times in the nitroarene reduction). TEM analyses carried out on the catalyst showed that the active species were supported palladium nanoparticles having a mean size of 4 nm, which did not aggregate with the recycles. Recently, due to their low cost, Ni catalysts have been employed in several organic reactions (mainly hydrogenations). In this context, we synthetized a Ni catalyst similar to *Pd-pol*, starting from $Ni(AAEMA)_2$ and we employed it as active and recyclable, insoluble catalyst for the reduction of different nitroarenes to give the corresponding anilines, under sustainable conditions. All these results proved that the proposed Pd or Ni based composite materials are excellent hybrid structures as efficient and reusable catalysts.

Biography

Maria Michela Dell'Anna completed her PhD in "Chemistry of materials for special uses" at University of Reggio Calabria (Italy), giving a dissertation on "Synthesis and characterization of new transition metal complexes: Aerobic oxidation of organic substrates and C-C bond forming reactions". During her PhD studies, she joined for one year the research group of Prof. M Cowie in the Chemistry Department of University of Alberta (Canada), where she worked on the synthesis and characterization of bimetallic complexes. Since 2000, she has been Assistant Professor in Chemistry at Polytechnic of Bari. Since 2012 she has been the Editor of the journal *Recyclable Catalysis*, merged with the journal *Catalysis for Sustainable Energy*. Her research interests are focused on: i) polymer supported metal catalysts; ii) green nanocatalysis; iii) platinum complexes and iv) risk assessment. She is co-author of almost 45 publications in major journals and more than 20 communications in congresses.

mariamichela.dellanna@poliba.it

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