

How calcination affects the morphology and the catalytic activity of polymer supported Nickel nanoparticles

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Abstract.

A nickel containing monomer, Ni(AAEMA)₂ (AAEMA⁻ = deprotonated form of 2-(acetoacetoxy) ethyl methacrylate) was co-polymerized with ethyl methacrylate (co-monomer) and ethylene glycol dimethacrylate (cross-linker) [1]. The obtained polymer was a green methacrylic resin containing Ni(II) centers homogeneously dispersed in the catalyst, which resulted insoluble in all common organic solvents and in water. The material can be described as an amphiphilic resin, air and moisture stable, with the peculiarity to swell in halogenated solvents, acetone and water and to shrink in diethyl ether and petroleum ether. The polymer was calcined under reductive conditions (dihydrogen with initial pressure of 5 bar) following two procedures, differing from each other for the cooling conditions. In the first procedure the calcined material was cooled under dihydrogen gas, while in the second one the cooling step occurred under air. After calcination, the green Ni(II) based co-polymer turned into black resins, Ni-res1 (obtained with hydrogen cooling) and Ni-res2 ((obtained with air cooling). TEM analyses showed that both Ni-res1 and Ni-res2 supported Ni nanoparticles with different morphologies, being the metal nanoparticles onto Ni-res1 smaller than the ones dispersed in Ni-res2, that had an urchin-like shape. Both Ni based co-polymers were tested as catalysts in the reduction of nitrobenzene with NaBH₄ [2]. Ni-res1 resulted more active and selective towards aniline, with respect to Ni-res2.

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