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Effect of the metal M (M: Au, AuAg, AuCu, Ag and Cu) in CeO2 catalysts, effective in the reduction of toxic 4-NP and MO

CeO2 catalysts have been widely explored in oxidative reactions [1] however, in reductive reactions they have also been attractive for their redox properties. The synthesis of compound catalysts is usually long and multi-stage, resulting in core-shell or yolk-shell morphologies. In the present work, the microwave radiation-assisted one-pot synthesis of M@CeO2 catalysts is presented. The effects of the metal on the structure of the hollow and porous spheres of CeO2 were studied by XRD, TEM and N2 physisorption techniques, as well as the optical properties by UV-Vis spectroscopy where the presence of the metal was confirmed by the appearance of the plasmon peak. It was also evidenced that the catalytic performance is affected by the metal in question both in the reduction of 4-nitrophenol (4-NP) and in methyl orange (MO) of which, the bimetals were more active due to the synergistic effect between metals. Regarding catalytic stability, catalysts were found to be effective in at least 10 consecutive reaction runs (4-NP reduction) with a decrease in activity. This loss of activity was attributed to a transformation in CeO2 induced by the reductive environment of NaBH4 which was evidenced by Raman spectroscopy, it was found that both the incorporation of the metal and the rich environment of H2 induce oxygen vacancies in CeO2 as well as the agglomeration of the metal to nanoparticles of larger diameters which are less active.

Keywords

One-step, Nanoreactors, bimetal, Oxygen-vacancies, nitrophenol-reduction

Reference

[1] sun, xuan; Wang, Xiuxiu; Chen, Beibei; Chen, Guozhu (2016). Oxygen vacancies dependent Au nanoparticle deposition and CO oxidation RSC Adv., 2016, 6, 87978–87987

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