NS02

A novel sonochemical approach for the synthesis of core/shell Fe_3O_4/SiO_2/Agnanocubesand SiO_2/Ag nanospheres with superior catalytic properties

Mohamed Abbas[1*], Sri Ramulu Torati[2], Yunji Eom[2], Cheol Gi Kim[2]

[1]Ceramics Department, National Research Centre, El-Bohous Street, 12622 Cairo, Egypt

[2]Department of Emerging Materials Science, Daegu Gyeongbuk Institute of Science and Technology (DGIST), 711-873 Daegu, South Korea

A novel sonochemical approach was developed for the synthesis of different core/shell structures of Fe_3O_4/SiO_2/Ag nanocubes and SiO_2/Ag nanospheres. The total reaction time of the three sonochemical steps for the synthesis of Fe_3O_4/SiO_2/Ag nanocubes is shorter than the previously reported methods. A proposed reaction mechanism for the sonochemical functionalization of the silica and the silver on the surface of magnetic nanocubes was discussed in details. Transmission electron microscopy revealed that small Ag nanoparticles of approximately 10-20 nm in size decorated on the surface of Fe_3O_4/SiO_2 nanocubes, and the energy dispersive spectroscopy mapping analysis confirmed the morphology of the structure. Additionally, X-ray diffraction data were used to confirm the formation of both phases of a cubic inverse spinel structure for Fe_3O_4 and bcc structures for Ag in the core/shell structure of the Fe_3O_4/SiO_2/Ag nanocubes. The as-synthesized Fe_3O_4/SiO_2/Ag nanocubes displayed a high efficiency in the catalytic reduction reaction of 4-nitroaniline to 4-phynylenediamine, and with better performance than both Ag and SiO_2/Ag nanoparticles. The grafted silver catalyst was recycled and reused at least fifteen times without a significant loss of catalytic efficiency.