Effect of fuel/oxidizer ratio and the calcination temperature on the preparation of microporous nanostructured tricobalt tetraoxide

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Abstract:

Microporous tricobalt tetraoxide, Co3O4, nanoparticles (NPs) clusters have been successfully fabricated using a simple but efficient controlled solution combustion route. Such a synthesis involves combustion reaction of cobalt nitrate with cetyl trimethylammonium bromide (CTAB). The combustion process has been analyzed by simultaneous thermal analysis. The resultant powders were characterized by means of X-ray diffraction technique (XRD), Fourier transform infrared spectroscopy (FTIR), Scanning electron microscopy (SEM), Transmission electron microscopy (TEM) and nitrogen adsorption at 196 °C. The morphology and specific surface area of the obtained Co3O4 nanoparticles clusters have proved to be strongly dependent on the fuel (F)/oxidizer (O) molar ratio and the calcination temperature. It was found that both the crystallite size and the lattice parameter nanocrystalline Co3O4 increase with increasing the F/O molar ratio as well as the calcination temperature. X-ray diffraction confirmed the formation of CoO phase together with spinel Co3O4 using F/O ratio of 1. The concentration of such phase increases with increasing the F/O ratio. Moreover, when the calcination is applied at 900–1000 °C traces of CoO was obtained together with Co3O4 as a major phase.

Keywords:

Cobalt oxide Nano-crystalline Co3O4 Combustion synthesis Inorganic materials Nanostructured materials

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