



INFLUENCE OF THE PRECIPITATION CONDITIONS ON THE MORPHOLOGY, PHASE PURITY AND PHYSICAL PROPERTIES OF MAGNETITE NANOMATERIALS

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ABSTRACT

In the present investigation, influence of the synthesis conditions on the morphology, phase purity and physical properties of the magnetite (Fe_3O_4) nanosized particles obtained from only ferrous salt solutions were investigated. It was found, that particle size, its distribution and phase composition is strongly influenced by different reaction conditions such as cation salt/precipitation agent molar ratio and temperature. Obtained powder products were characterized by X-ray diffraction (XRD) and scanning electron microscopy (SEM) analysis. By regulating synthesis conditions it is possible to obtain monophasic magnetite nanoparticles with spinel type structure and size <30 nm, as well as admixture containing different crystal phases such as maghemite ($\gamma\text{-Fe}_2\text{O}_3$), hematite ($\alpha\text{-Fe}_2\text{O}_3$) or goethite (FeOOH). For synthesized compounds different physical characteristics such as magnetic, optical, photoelectrochemical and photocatalytic properties were studied. Saturation magnetization of magnetite nanopowders was close to that of bulk value, thus showing that synthesized Fe_3O_4 is close to its stoichiometric composition. Also, obtained magnetite nanosized particles show some photoelectrochemical and photocatalytic activity for water splitting under visible light for hydrogen production. Several factors like photocatalyst dose, illumination intensity, irradiation time, sacrificial donor and presence of co-catalyst were investigated to find out optimal reaction conditions what could lead to remarkable hydrogen evolution activity under visible light.

Keywords: Magnetite, nanoparticles, precipitation, photoelectrochemical properties, photocatalytic activity