Influence of the addition of surfactants in iron oxide microwave synthesis

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Abstract

Microwave-assisted hydrothermal synthesis is a method that has been increasingly used in the last decade, mainly because of the reduction in synthesis time, repeatability, and the ability to control the main parameters for iron oxide synthesis. Since nanoparticles of iron oxides are widely used in many scientific and industrial fields such as medicine, industry and biotechnology as inorganic pigments, adsorbents for wastewater treatment, catalysts, electrochemical sensors and medical diagnostics or therapy, there is a growing interest in the preparation of iron oxide nanoparticles with different properties required for various applications. This method was used for the synthesis of hematite (α-Fe_2O_3) and goethite (α-FeOOH) in highly alkaline media with iron(III) chloride ($FeCl_3$) as precursor under continuous microwave emission of 850 W at 200 °C for 20 min. The main goal of this research was to investigate the influence of different types of surfactants, such as polyethylene glycol (PEG), N-guanylurea sulfate (NGS) and sodium dodecyl sulfate (SDS) on the shape, size and composition of the final product. Also, addition of different percentages of mentioned surfactants in the reaction mixture were investigated. The nanoparticles were characterized by Fourier Transform Infrared Spectroscopy (FTIR), Powder X-ray Diffraction (PXRD) followed by Rietveld analysis and a Field Emission Scanning Electron Microscope (FE - SEM) was used to determine the size and shape of the nanoparticles. It was found that the samples precipitated without surfactants were pure hematite, while the samples to which surfactants were added gave a different final product and nanoparticle size and shape.

Image

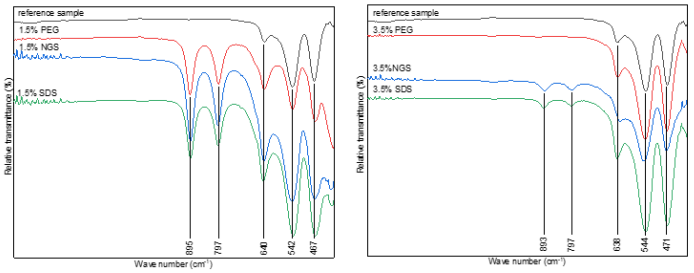


Figure 1. FTIR characterization of samples

Recent Publications

[1] I. Mitar, L. Guć, Ž. Soldin, M. Vrankić, A. Paut, A. Prkić, S. Krehula, Rapid Microwave Method for Synthesis of Iron Oxide Particles under Specific Conditions, Crystals, 11 (2021) 383.

[2] A. Paut, A. Prkić, I. Mitar, P. Bošković, D. Jozić, M. Jakić, T. Vukušić, Potentiometric Response of Solid-State Sensors Based on Ferric Phosphate for Iron(III) Determination, Sensors (Basel), 21 (2021) 1612.

[3] J. Radić, M. Bralić, M. Kolar, B. Genorio, A. Prkić, I. Mitar, Development of the New Fluoride Ion-Selective Electrode Modified with Fe(x)O(y) Nanoparticles, Molecules (Basel, Switzerland), 25 (2020) 5213.

[4] S. Krehula, M. Ristic, Z. Petrovic, L.K. Krehula, I. Mitar, S. Music, Effects of Cu doping on the microstructural, thermal, optical and photocatalytic properties of alpha-FeOOH and alpha-Fe2O3 1D nanoparticles, Journal of Alloys and Compounds, 802 (2019) 290-300.

[5] M. Ristic, I. Mitar, S. Music, Forced hydrolysis of FeCl3 solutions in the presence of sodium dextran sulphate, Colloid and Polymer Science, 297 (2019) 177-182.

Photograph



Biography

Dr has her expertise in structural, spectroscopic and microscopic analysis (FT-IR, Mossbauer, UV-Vis-NIR, EDX spectroscopies, FE-SEM). The scientific field of her work is analytical chemistry and scientific interests are chemical synthesis, material characterization and heat treatment.

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Notes/Comments:

Figures for Powder X-ray Diffraction (PXRD) followed by Rietveld analysis and a Field Emission Scanning Electron Microscope (FE - SEM) is going to be on the poster.