

Synthesis of talc/Fe₃O₄ magnetic nanocomposites using chemical co-precipitation method.

ABSTRACT

The aim of this research was to synthesize and develop a new method for the preparation of iron oxide (Fe₃O₄) nanoparticles on talc layers using an environmentally friendly process. The Fe₃O₄ magnetic nanoparticles were synthesized using the chemical co-precipitation method on the exterior surface layer of talc mineral as a solid substrate. Ferric chloride, ferrous chloride, and sodium hydroxide were used as the Fe₃O₄ precursor and reducing agent in talc. The talc was suspended in deionized water, and then ferrous and ferric ions were added to this solution and stirred. After the absorption of ions on the exterior surface of talc layers, the ions were reduced with sodium hydroxide. The reaction was carried out under a nonoxidizing oxygen-free environment. There were not many changes in the interlamellar space limits (d-spacing=0.94-0.93nm); therefore, Fe₃O₄ nanoparticles formed on the exterior surface of talc, with an average size of 1.95-2.59nm in diameter. Nanoparticles were characterized using different methods, including powder X-ray diffraction, transmission electron microscopy, emission scanning electron microscopy, energy dispersive X-ray spectroscopy, and Fourier transform infrared spectroscopy. These talc/Fe₃O₄ nanocomposites may have potential applications in the chemical and biological industries.

Keyword: Fe₃O₄ nanoparticles; Nanocomposites; Powder X-ray diffraction; Scanning electron microscopy; Talc.