



Synthesis and Characterization of the Magnetic Properties of Fe₃O₄/PANI Magnetic Nanocomposite

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Abstract – In this work we report the preparation and characterization of a polyaniline/magnetite (PANI)-Fe₃O₄ nanocomposite, with both magnetic and conducting properties. This report is the ⁵⁷Fe Mössbauer spectroscopic characterization of the Fe₃O₄ nanoparticles and of the PANI-Fe₃O₄ HCl magnetic nanocomposite.

The nanocomposite was synthesized by a new and in situ straightforward synthetic route polymerization method, where the aniline monomer was polymerized using the Fe₃O₄ nanoparticles assisted by UV light as an oxidizing agent only. The products were characterized by powder X-ray diffraction (XRD), Fourier transform infrared (FTIR), scanning and transmission electron microscopy (TEM and SEM), and Mossbauer spectroscopy. The X-ray diffraction analyses of the Fe₃O₄ and PANI/Fe₃O₄ composites, obtained after UV irradiation for 1, 2, 3 or 4 hours, shown the presence of the Fd3m cubic spinel phase for the Fe₃O₄, where the particle size calculated by the Debye-Scherrer equation gives a Tc of 23, 25, and 23 nm for sulfate, chloride and nitrate acid reaction medium respectively, in Figure 1. The Mossbauer spectra analysis of the polyaniline/magnetite (PANI)-Fe₃O₄ nanocomposite after 4 hour of reaction shows a superparamagnetic quadrupole doublet at room temperature. The analysis clearly shows the powerful possibilities of Mossbauer spectroscopy to analyze the surface oxidation of nano structured powders of magnetite, in Figure 2.

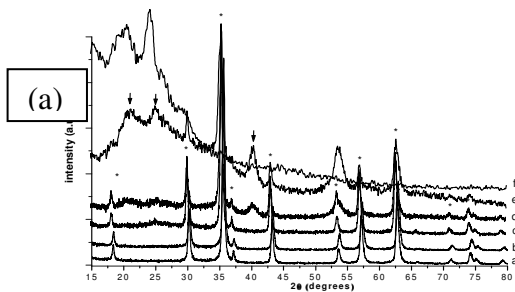


Figure 1: X-ray diffraction patterns for (a) Fe₃O₄, and for PANI/Fe₃O₄ nanocomposites as a function of the UV irradiation. (b) after 1 hour, (c) after 2 hours, (d) after 3 hours,

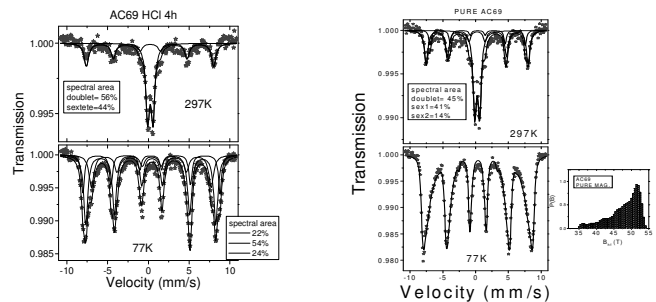


Figure 2: Mössbauer spectra of the sample Fe₃O₄ and 4C69 HCl 4h obtained at 77 K and room temperature. The circles represent the experimental data while the solid line represents the fit obtained with the several components represented by dashed lines

[1] Park J. W., Huh S. H., Jeong J. W., Lee G. H., Ri H-C., *J. Korean Phys. Soc.* 39 (2001) 387

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