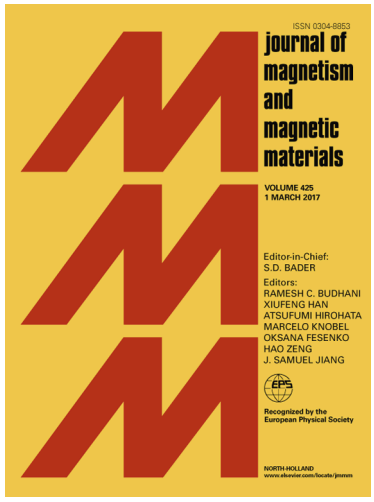

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Growth of magnetite films by a hydrogel method

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Abstract

Magnetite (Fe_3O_4) films were grown on glass substrates by formation and condensation of complex of iron oxides in an agarose hydrogel. The obtained films were characterized by Fourier Transform Infrared Spectroscopy (FTIR), Thermogravimetric Analysis (TGA), Scanning Electron Microscopy (SEM), Room Temperature Mössbauer Spectroscopy (TMS), Vibrating Sample Magnetometry (VSM), Atomic Force Microscopy (AFM) and Voltage vs. Current measurements by the four-point method. FTIR and TGA measurements showed that some polymer chains of agarose remain linked to the surface of the magnetic particles of the films after heat treatment. SEM measurements showed that the films are composed by quasi spherical particles with sizes around 55 nm. Mössbauer spectroscopy measurements showed two sextets with broaden lines, which were assigned to magnetite with a distributed particle size, and two doublets, which were assigned to superparamagnetic phases of magnetite. For the specific dimensions of the films prepared, measurements of Voltage vs. Current showed an ohmic behavior for currents between 0 and 200 nA, with a resistance of 355 kΩ.

Keywords: magnetite films, hydrogel method, Mössbauer spectroscopy, Vibrating Sample Magnetometry.

1. Introduction

Thin films of iron oxides are materials that have attracted increasing attention due to their broad number of technological applications, such as magneto-resistive systems, magneto-optical systems, Hall effect sensors, among others [1]. Many magnetic materials have been investigated for this kind of applications, but magnetite (Fe_3O_4) and maghemite (γ-Fe_2O_3) are between most studied compounds because their high magnetic response, half-metallic