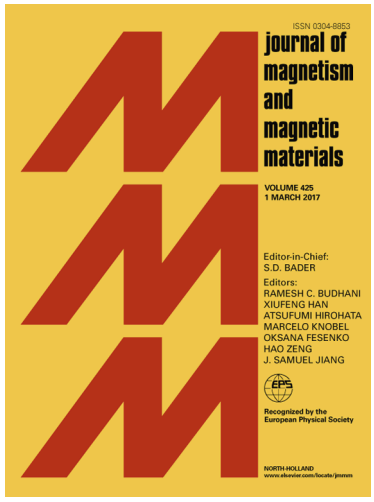

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Magnetic studies of nickel hydride nanoparticles embedded in chitosan matrix

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Abstract

In this work we present a method to produce NiH (β-NiH phase) nanoparticles from Ni-Cu solid solution. The reduction of Ni^{3+} and Cu^{2+} occurred at high temperatures and in presence of glutaraldehyde, citric acid and chitosan biopolymer. The samples are mainly composed of Ni and NiH phases with particles sizes ranging from 9 to 27 nm. DC magnetization studies reveal the presence of hydrogen-poor nickel hydride phase (α-NiH phase) which enhances the saturation magnetization at temperatures below 50 K. Stability of samples stored in air after 8 months was verified, and thermal treatment at 350 C in presence of air transformed the samples to Ni and Cu oxides.

Keywords: Chitosan, nickel hydride, nanoparticles, glutaraldehyde, citric acid

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1. Introduction

The discovery of Nickel hydride (NiH) [1] has stimulated the research of several metal hydride systems [2] which are interesting from a technological and scientific point of view [3]. Theoretical and experimental studies have provided the basis for the comprehension of chemical bonds in metals hydrides [3], thus promoting an understanding of materials that can be used for hydrogen storage [4-7].

The physical properties of many transition metals undergo drastic changes when hydrogen is introduced in the metal lattice [8-9]. Hydrogen can occupy octahedral and tetrahedral interstitial sites and promote the lattice expansion [10]. The type of interstitial position is determined by the level of local energy [10-11]. The lattice expansion strongly affects the magnetic properties of metals [12]. For instance, in Ni-Cu alloys, interstitial hydrogen can turn Ni paramagnetic [13-14]. A very low hydrogenated nickel sample ([H]/[Ni] < 0.03) exhibits a ferromagnetic α-NiH phase, a