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Magnetic Properties of the Crystalline Phase Transition Included Fe Doped Nickel Chromite

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The chromite system (ACr_2O_4 ; A = Co, Ni etc.) of spinel structure has been studied with many researchers by reason of its multiferroic properties. [1, 2] The $NiCr_{1.7}Fe_{0.3}O_4$ sample was prepared by the sol-gel method. The ultimate single phase samples were obtained for annealed 12 hr in atmosphere at 1000 ℃. The Fe doped nickel chromite system there is a cubic to tetragonal transition below the room temperature. [3] The Crystalline structure of $NiCr1.7Fe_{0.3}O_4$ was spinel cubic (*Fd-3m*) structure with a lattice constant a_0 = 8.317 Å at room temperature. The magnetic Néel temperature (T_N) of the Fe doped nickel chromite sample is determined to be 230 K by zero field cold magnetization curves under the 100 Oe applied field. Mössbauer spectra were measured at various temperatures ranging from 4.2 to 295 K. The Mössbauer spectra exhibit that there are two magnetic phases with the two different sites of the Cr^{3+} ions. [1] The spectrum at 4.2 K was fitted to two magnetic components of the magnetic hyperfine fields H_{hf} = 496 and 486 kOe. The average value curve for temperature dependence of magnetic hyperfine fields agrees with spin 1/2 curve obtained by the Brillouin function with molecular field theory, respectively. The electric quadrupole splittings (ΔE_Q) were found to be nearly zero values below the T_N =230 K. However, as the 295 K, the ΔE_Q are observed with large values. The values of the isomer shifts show that of all temperature ranges the states are ferric. The Mössbauer spectra below the T_N show that the line broadening with the accompanying relaxation effects and the Jahn-Teller distortion due to the crystalline phase transition.

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SB01

Magnetization Reversal Study in a Permalloy Wire with 3 Dissimilar Trenches by Using a Real-time Magnetic Force Microscopy

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The patterned magnetic wires have been attracting much scientific and technological interest for storage media. Magnetic Force Microscope is a powerful tool to investigate the domain structure of submicron patterned wires, especially when the external field applied during the scanning. We used real-time MFM to study the magnetization reversal process of permalloy wires. Three different depth trenches, as shown in Fig.1, were fabricated using electron beam lithography technique. Ar ion was used to make the trenches. The pattern thickness is 30 nm, the depth of these trenches from left to right are 15nm, 10nm and 5nm. By means of the real-time MFM scanning, the hysteresis loops determined by phase versus external magnetic fields could be obtained for the scanned regions at the trenches. [1] Thus, from the method of MFM phase analysis, the switching field in the three trenches is 20, 15, and 5 Oe. Switching field also represent the force of pinning ability. We observed the deeper trench has a bigger switching field. Simultaneously, we can compare with the different depths and the relative phase values. The relative phase value was found proportionally to the depth of the trench. In this study, we have investigated the magnetization reversal behavior in a permally wire as shown in Fig. 1 with an applied magnetic field up to ± 300 Oe.

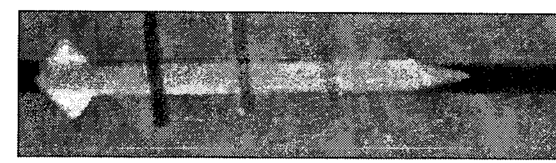

Fig. 1. The AFM image of trenches line.

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