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ABSTRACTS

4R-29. MICROWAVE ABSORPTION IN MAGNETIC BILAYERS. Yark Yeon Kim (Chungbuk Nat'l Univ., Institue for Basic Sciences, 48, Gaeshin-dong, Chungju, Chungbuk, 361-763, South Korea) and Seong-Gi Min, Seong-Cho Yu (Chungbuk Nat'l Univ., Physics, 48, Gaeshin-dong, Chungju, Chungbuk, 361-763, South Korea) and Jang Roh Rhee (Sookmyung Women's Univ., Physics, Seoul, 140-742, South Korea)

The simulation of ferromagnetic resonance spectra was performed on the exchange coupled bilayer thin films within the classical electromagnetic model at the perpendicular configuration. Material parameters considered in Poynting vector calculation were the interfacial exchange constants per unit area (boundary conditions of the dynamic magnetization at the interface), the layers thickness, the spectroscopic splitting factor, the electric resistivity, Gilbert damping factor and the surface anisotropy constants (boundary conditions of the dynamic magnetization at the surfaces). The interfacial exchange interaction and the surface anisotropy were assumed to be bilinear and uniaxial respectively. From the calculated results, we described the resonance field, intensity, and linewidth of the spectra as a function of exchange constant, layers thickness, and surface anisotropy. The intensity and the resonance field of ferromagnetic resonance spectra were very sensitive to the surface anisotropy constant as well as the exchange constant. Also, absorption mode shapes excited in the bilayers were investigated using the microwave dynamic magnetization which has in phase and out of phase components. The variation of absorption modes consisting of an acoustic mode and an optic mode was studied in terms with the exchange interaction, the film thickness and the surface anisotropy.

4R-30. MAGNETIC PROPERTIES AND ELECTRON-TRANSPORT PROPERTIES IN $Fe_{0.92}Cr_2S_4$. Sam Jin Kim, Woo Chul Kim, Chul Sung Kim (Kookmin University, Dept. of Physics, 861-1, Songbu-ku, Seoul, 136-702, South Korea) and Bo Wha Lee (Hankuk University of Foreign Studies, Dept. of Physics, Yongin, Kyungkido, 449-701, South Korea) and Jung Chul Sur (Wonkwang University, Dept. of Physics, Iksan, Jeonbuk, 570-749, South Korea)

Sample of $Fe_{0.92}Cr_2S_4$ has been studied with Mössbauer spectroscopy, x-ray photoelectron spectroscopy(XPS), SQUID magnetometer and magnetoresistance(MR). The sample was synthesized by the usual ceramic method sealed in evacuated quartz tube and the crystal structure was examined by powder x-ray diffraction. The crystal structure was determined to be cubic spinel with its lattice constant a_0=9.983 Å. In order to study charge carrier and magnetic property, the Mössbauer spectra were recorded from 4.2 K to room temperature. From the temperature range 13 to 100 K the asymmetric line broadening is observed and considered to be dynamic Jahn-Teller distortion. Isomer shift value of the sample at room temperature was 0.52 mm/s, which means that charge state of Fe ions is ferrous in character. The ferrous character of iron ion was also convinced by XPS spectrum. The electrical resistance and magnetoresistance (MR) of the samples have been measured 80-300 K range in magnetic fields up to 2 T. The magnetization has been measured from 4 to 300 K. The Curie temperature was 170 K. While the maximum MR was observed at 184 K about 10 %. The activation energy above the Curie temperature was calculated to be 65 meV. From the above results, it is concluded that the conduction mechanism in this sample is different from the double exchange mechanism in a point that there were no mixed charge valences.

4R-31. DYNAMIC COUPLING OF CO-FENI BASED SPIN-VALVES INVESTIGATED BY TIME-RESOLVED XMCD. Marlio Bonfim, Stefania Pizzini, Alain Fontaine (CNRS, Laboratoire Louis Nèel, 25, Av des Martyrs, Grenoble, 38042, France) and Giacomo Ghiringhelli, Nick Brookes (ESRF, ID12-B, BP 220, Grenoble, 38043, France) and Frederic Petroff, Francois Montagne (CNRS/Thomson, Unite mixte, Domaine de Corbeville, Orsay, 91404, France)

Magnetization dynamics of $Co/Cu/Fe_{20}Ni_{80}$ based spin-valves was studied with an element selective nanosecond resolved technique. Element selectivity is achieved by means of X-ray Magnetic Circular Dichroism (XMCD) using soft X-rays (500-1500eV) from a synchrotron light source (ESRF-France). Time resolution is obtained by a pump-probe scheme, with a magnetic field pulse (tens of nanoseconds) as the pump and a single bunch of X-ray photons (100 picoseconds width) as the probe. Samples were grown by MBE on step-bunched Si substrates and present an in-plane uniaxial magnetic anisotropy induced on each magnetic layer by the substrate topology. The dynamic coupling between soft and hard magnetic layers was studied in three samples with different copper thickness (60, 80 and 100 Å). For the dynamic measurements, a magnetic field pulse (30 ns wide, variable amplitude) was applied in the easy axis direction, superimposed to a continuous bias field of 5 mT opposite to the pulse, in order to reverse the magnetization. Quasi-static hysteresis loops (insets in figure 1) show a strong coupling between hard and soft layer for the samples with 60 and 80 Å Cu thickness (single loop), while for 100 Å the hard and soft layers have a weak coupling (two steps loop). On the contrary, dynamic measurements of the magnetization in the nanosecond time scale (figure 1) show a different coupling for the intermediate Cu thickness (80 Å), where the soft and hard layers seem to be partially uncoupled. We understand this difference as being due to the limited domain walls speed in the hard layer, which causes a different behavior of the soft and hard layers in this time scale. Moreover, a part of the signal coming from the permalloy layer has the same time dependence as the cobalt layer after the end of the field pulse. This suggests that the coupling is strong in some parts of the sample. We believe that this is due to pin holes present in the copper layer, where a direct contact exists between the soft and hard layers.

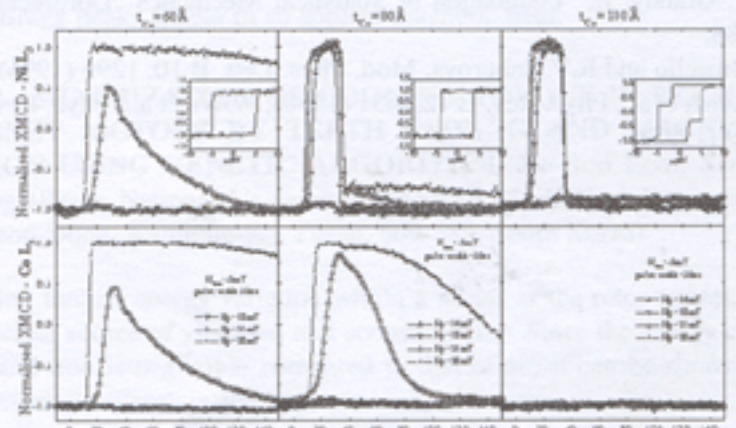

FIG. 1. XMCD dynamic response of the Co/Cu/FeNi spin valves.

4R-33. CALCULATION OF MÖSSBAUER SPECTRA OF SUPERPARAMAGNETS BASED ON A SPIN-PHONON INTERACTION LIKE MODEL. Hans-Dieter Pfannes, José Higino Dias Filho, Rogério Magalhães-Paniago, Roberto Paniago (Universidade Federal de Minas Gerais, Departamento de Física, C.P. 702, Belo Horizonte, MG, 30123-970, Brazil)

The thermally activated dynamic behavior of the magnetization of small particles (superparamagnetic relaxation) is described by a dynamic spin-Hamiltonian and the golden rule. Long-wavelength phonons stemming from the superparamagnetic particles and/or the matrix in what they are embedded are supposed to interact with the total spin S (S = 1000 - 10000) of the particle causing transitions between the spin-levels S_z analogously to paramagnetic relaxation. One-phonon processes and a Debye model are assumed and transition probabilities are calculated. The presence of an external magnetic field is admitted. From the calculation of relaxation rates at low temperatures (pseudo two-state relaxation system) and their comparison to experimental values is deduced that only transitions with $\Delta S_z = 2$ can occur. Mössbauer relaxation spectra for ^{57}Fe are calculated for diagonal hyperfine interaction (electric quadrupole interaction $\ll$ magnetic hyperfine interaction in ferro- or ferrimagnetic particles) by summing up three separately calculated two-line spectra (lines 1 and 6, 2 and 5, 3 and 4 of the six-line spectrum) according to Sack's method [1]. The influence of KV/k_BT, S and spin-transition probabilities on the spectra is demonstrated (K = magnetic anisotropy constant, V = particle volume, T = temperature). The results are compared with experimental spectra of ferrites.

[1] R.A. Sack, Mol. Phys.1 (1958) 163.