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Magnetic Resonance Investigations of NiFe/Bi/NiFe Trylayer Films

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Multilayer magnetic films with a nonmetal spacer, in particular, those belonging to the system *ferromagnetic metal/semiconductor*, or with a *semimetal* spacer attract close attention by virtue of a great variety of effects observed in these films. When the semiconductor material is used as an interlayer, it is arose the possibility for controlling of properties of spacers and interlayer coupling (J) by means of external influence (impurities, different kind of radiation, temperature, fields, etc). Inasmuch as the electron magnetic resonance (EMR) parameters are sensitive to coupling factors that are responsible for the formation of a magnetic state, this method turns out informative to establish detail information in multilayer films. Early [1], for the first time the NiFe/Bi/NiFe trilayer films were synthesized and investigated by us. Measurements of magnetic field and temperature dependences of magnetization have shown that the interlayer coupling depends on bismuth spacer thickness. The dependence of saturation magnetization of the system on semimetal thickness has been found.

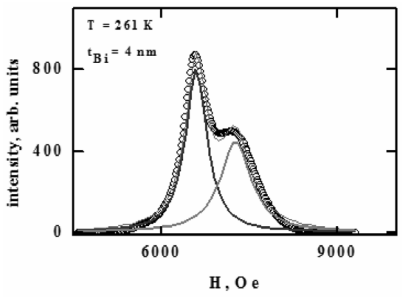

Fig. 1

In given report the results of investigations of interlayer interactions in *permalloy/bismuth/permalloy* films via magnetic resonance method at different bismuth thickness (t_{Bi}) are represented. It was established that in the bismuth thickness interval t_{Bi} = 2 - 12 nm magnetic resonance spectrum consists of two lines, which is in agreement with antiferromagnetic interlayer coupling between magnetic layers. In Fig. 1 the shape of resonance curve is shown for films cited above. For control film with t_{Bi} = 0 nm and films with $t_{Bi} \geq$ 15 nm the solitary line is observed. Processing of the temperature dependences of resonance field revealed to determine the temperature dependences of interlayer interactions. Also the dependence J on bismuth spacer thickness is established. Mechanisms responsible for effects observed are discussed.

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Novel Nitrogen-doped CoFe Ferromagnetic Electrode for High Performance of Spin-Dependent Tunneling in Magnetic Tunnel Junction

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A new ferromagnetic electrode with amorphous or nanocrystalline structure was developed to enhance magnetoresistance (MR) ratio of magnetic tunneling junctions (MTJs) since structural and electrical properties of ferromagnetic electrodes strongly affect the MTJ device performance. The bottom electrode roughness controls the ferromagnetic coupling thus the switching fields and induces defects on the barrier growth, leading to low breakdown voltages [1]. The MTJs with different barriers and ferromagnetic electrodes (nitrogen-doped CoFe / AlOx or MgO / nitrogen-doped CoFe) were fabricated by using multi-target magnetron sputtering at room temperature. Various nitrogen-doped CoFe films were prepared on thermally oxidized Si substrates in an Ar and N2 mixture by using a dc magnetron sputtering system. A base pressure was 10^{-8} Torr. Critical deposition parameters in a preparation of ferromagnetic electrodes were nitrogen partial pressure (defined as $R_{N2} = P_{N2} / (P_{N2} + P_{Ar}) \times 100$ %), DC Power, and film thickness. The analysis for the resistance area (RA) and temperature dependence of MR ratio was in detail discussed to determine the effects of the magnetic behavior at interface between the new ferromagnetic electrode and the barrier.

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