The influence of substrate and cap layer on magnetic characteristics in some multilayers

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We consider the influence of non-symmetrical boundary conditions caused by different materials of the substrate and covering on some properties of the systems consisting of magnetic layers separated by nonmagnetic spacer. Magnetic properties like spin waves patterns, FMR spectra, Curie temperature, magnetization and spin wave parameter B have been investigated for symmetrical and non-symmetrical structures like: Cu(111)/(Fe/Cu)$_n$/Fe/Cu/Si(111), vacuum/(Fe/Cu(111))$_n$/Fe/vacuum, vacuum/(Fe/Cu)$_n$/Si(111) and Cu/(Fe/Cu)$_n$/Fe/GaAs, vacuum/(Fe/Cu)$_n$/Fe/GaAs, where n is equal 1 or 2. Boundary conditions in our model [1] are connected with surface anisotropy parameters, known from literature [2-4]. In FMR spectra we observe the change of intensity and positions of peaks for different bottom and capping layers in comparison to the sample with symmetrical boundary conditions. Curie temperature and magnetization were also found to be dependent on anisotropy parameters in external surfaces.

Influence of roughness on chosen characteristic of magnetic systems with non-symmetrical conditions on external surfaces is also investigated. Roughness is introduced in our model on the basis of discrete Gaussian and solid-on-solid model [5-7] and modifies both interlayer exchange coupling (similar as in [8]) and anisotropy parameters [9]. Results obtained show that the presence of roughness is less important from the point of view of modification of magnetic properties of the systems under consideration than the effect of asymmetry of boundary conditions due to different structure of substrate and overlayer.

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