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AN EXPLANATION TO SPIN REORIENTATION OF *CoPt/AlN* MULTILAYERS USING HEISENBERG HAMILTONIAN WITH THIRD-ORDER PERTURBATION

P. Rajakaruna* and P. Samarasekara

Department of Physics, Faculty of Science, University of Peradeniya, Sri Lanka
**prabhanimr88@gmail.com*

Thin film magnetism has become a dominant research area in present science and technology. This field received further attentions with the present competitiveness. *CoPt* is one common member of the family of ferromagnetic thin film researching. In our project, easy axis orientation of *CoPt-AlN* multilayer thin films was investigated using Heisenberg Hamiltonian with third-order perturbation. The experimental data of out-plane spin reorientation temperatures (SRT) for thicknesses of 4 nm, 6 nm and 8 nm which contained ~11, 16 and 21 layers respectively and each of ~3.784 Å individual thickness were found as 484 K, 453 K and 584 K respectively. There are seven unknown parameters in the currently considering Hamiltonian equation. Explicitly, they are J, ω, $D_m^{(2)}$, $D_m^{(4)}$, H_{in} , H_{out} and K_s which denote exchange interaction, strength of long range dipole interaction, second order and fourth order anisotropy, in-plane internal field, out-of-plane internal field and stress induced anisotropy factor. $J = 10^{-30}$ J, $\omega = 10^{-35}$ J, $D_m^{(2)} = 10^{-27}$ J, $D_m^{(4)} = 10^{-25}$ J, $H_{in} = 10^{-27}$ A m^{-1} , $H_{out} = 10^{-30}$ Am^{-1} and $K_s = 10^{-28}$ J were found to be the values corresponding to the SRT of 484 K for film with 11 layers. The values obtained were $J = 10^{-44}$ J, $\omega = 10^{-34}$ J, $D_m^{(2)} = 10^{-26}$ J, $D_m^{(4)} = 10^{-25}$ J, $H_{in} = 10^{-26}$ A m^{-1} , $H_{out} = 10^{-32}$ A m^{-1} and $K_s = 10^{-28}$ J in order to get SRT of 453 K for film with 16 layers. Later $J = 10^{-44}$ J, $\omega = 10^{-34}$ J, $D_m^{(2)} = 10^{-26}$ J, $D_m^{(4)} = 10^{-25}$ J, $H_{in} = 10^{-54}$ A m^{-1} , $H_{out} = 10^{-30}$ A m^{-1} and $K_s = 10^{-80}$ J were the resulted values corresponding to SRT of 584 K for film with 21 layers. As the next part, characteristics of each of seven parameters for *CoPt* layers were studied using the Heisenberg Hamiltonian. What mainly identified was that the SRT did not respond to the parameters J, $D_m^{(4)}$ and H_{in}; but all the others responded in unique proportions. Among varying parameters, SRT decreased with ω, H_{out} and K_s. However, $D_m^{(2)}$ responded in the opposite way, *i.e.* SRT showed an apparent increment with increasing $D_m^{(2)}$ values.