Magnetic properties of thin film Ni-Fe-Co alloy

Lytvynenko Ia.M., *PhD stud.*
Sumy State University, Sumy

In recent years, considerable attention has been devoted to the investigation of the physical properties of ultrathin magnetic films of 3*d* transition metals and thin film structures based on its because of their application in nanoelectronics [1, 2]. Frequent use of ferromagnetic alloys as elements of structures that exhibit AMR, GMR or TMR making them of the relevant object of research.

The goal of our work was to detect the magnetic characteristics (coercivity B_C, saturation field B_S and remanent magnetization M_r) dependence on the annealing temperature of the thin film Ni-Fe-Co alloy with concentration of components $c_{Ni} = 40$, $c_{Fe} = 10$ and $c_{Co} = 50$ at.%. The films of 37 nm thickness were deposited on the amorphous substrates in an oil vapor-free vacuum of $\sim 10^{-4}$ Pa by thermoresistive co-evaporation technique using permalloy with concentration of components $c_{Ni} = 79\text{-}80$, $c_{Fe} = 13\text{-}16$, $c_{Mo} = 2\text{-}5$ wt.% and Co independent sources and were annealed to 500, 700 and 900 K for 20 min. The magnetic properties were measured by vibrating sample magnetometer VSM Lake Shore with magnetic field orientation "out of plane" and "in plane" of sample. For as-deposited films was observed a slight anisotropy in the plane of sample and which disappeared after annealing to 900 K.

Hysteresis loops measured under applied field “in plane” are nearly rectangular shape with a sharp magnetic reversal that is typical for easy axis of magnetization. With the sample rotation by an angle from 0º (magnetic field is in plane) to 85º the coercivity increases by 67 % for as-deposited thin films and by 81-82 % for annealed samples and stay independent of the annealing temperature. Established that B_C, B_S and M_r increase with increasing of annealing temperature. Relative change of B_C and B_S in the range of heat treatment temperatures 300-900 K composes 154 % and 88 %, respectively.

Supervisor: Bibyk V.V., *senior lecturer*

1. P. Ciureanu, *Thin-Film Resistive Sensors* (IOP: London: 1992).
2. C. S. Roumenin, *Solid State Magnetic Sensors* (Elsevier: Amsterdam: 1994).