

## Magnetic properties for the Multi- and trilayer Co/Cu films by Brillouin light scattering

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**In introduction,** The among the various experimental techniques currently used for detecting spin waves. BLS has shown to be particularly suitable for application to thin film and multilayer samples. This technique has been widely employed for the determination of the magnetic parameters of Fe, Co and their alloys[1]. The purpose of the present study is to understand experimentally the magnetic properties for multi- and trilayer films with Co and Cu layers deposited constant bias field. The experimental methods of choice that allows determining the spin wave are BLS and magnetization measurements.

**In experiment,** The multi- and trilayer films with Co and Cu layers, deposited by DC magnetron sputter on Si(100) substrate at room temperature, have been investigated. Multi- and trilayers were composed of 8[Co(5nm)/Cu(x)] bilayers with Cu layers thicknesses  $x = 1, 2, 5, 10$  nm and [Co(20nm)/Cu(x)/Co(20nm)] layers with Cu layer thicknesses  $x = 4, 8, 20, 40$  nm, respectively. During deposition, magnetic field of 500 G was applied to the film parallel to the plane in order to introduce uniaxial anisotropy. The crystal orientations were confirmed by XRD in  $\theta$ - $2\theta$  configuration. The magnetic properties of the films have been studied by VSM and BLS.

**In result and discussion,** It has been found that the magnetization of Co layers decreases rapidly with increasing of Cu thickness for the range of thickness ratio  $t_{Co}/t_{Cu} < 2.5$ . The coercivity has been kept at approximately 8.7 Oe in the trilayer films, but changed from 22.6 Oe to 4.7 Oe with increasing Cu thickness in the multilayer films. Anisotropy field was evaluated by Stoner-Wohlfarth (S-W) model[2]. The anisotropy field of films with thickness ratio  $t_{Co}/t_{Cu} = 2.5$  was larger than that of the films with thickness ratios  $t_{Co}/t_{Cu} \neq 2.5$ . The values were determined to be 28.2 Oe (multilayer film) and 24.9 Oe (trilayer film), respectively. The thermally excited spin wave of the multi- and trilayer films with thickness ratios  $t_{Co}/t_{Cu} \neq 2.5$  has been observed by means of BLS[3]. Both the Damon-Eshbach surface and bulk standing modes were present in BLS spectra[4]. The spin wave frequencies dependence on the applied magnetic field was fitted using the analytic expression in the dipolar approximation[5]. These characteristics of multi- and trilayer films is discussed with the respect to the thickness ratio and the effect of bias magnetic field.

### References

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