Improving Brillouin light scattering intensity with MgO anti-reflective coating at the Pt/Co system

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In a system with inversion broken symmetry such as Oxide layer/Ferro-magnet or Heavy metal/Ferro-magnet structures [1,2], spin-orbit coupling brings some new term on the interfacial Dzyaloshinskii-Moriya interaction (iDMI) at their interfaces. Recently, the iDMI has caught much attention as it could open new paths to manipulate information based on spintronic devices. Furthermore, Brillouin light scattering system is powerful tool which can directly determine the iDMI energy density [3,4]. However, measured the BLS signal is not large enough due to its physical origin, and the small signal to nose ratio make it difficult to determine iDMI in the moderate interface quality samples. In order to obtain the iDMI energy density more exactly and reliably, the better BLS signal is required. Since the BLS is based on magneto-optical Kerr effect (MOKE), we introduce optical anti-reflection (AR) layer. It is well-known that the MOKE signal is improved with AR layer [5,6,7]. Due to the multiple reflections, the incident beam has more chances to interact with the magnetic layer, which enhanced magneto-optical effect.

In this study, we investigate the intensity of spin-wave resonance frequency signal with additional MgO-AR coating layer. To observation of iDMI, we fabricated Ta(4 nm)/Pt(4 nm)/Co(2 nm)/MgO(t_{MgO} nm)/Ta(4 nm) structures on Si/SiO_2 substrate using DC magnetron sputtering system. Here, thickness of MgO layer are 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, and 100 nm, respectively. The deposition was carried out a base pressure of 3×10^{-8} Torr or lower. From the MgO thickness dependence measurement, we found the changes of BLS signal strength as a function of MgO layer thickness. Fig. 1 shows BLS intensity as a function of MgO thickness. When we used the 80 nm of MgO thickness, BLS and MOKE intensity have a maximum value, and we confirmed that the BLS and MOKE signals are strongly correlated as we expected.

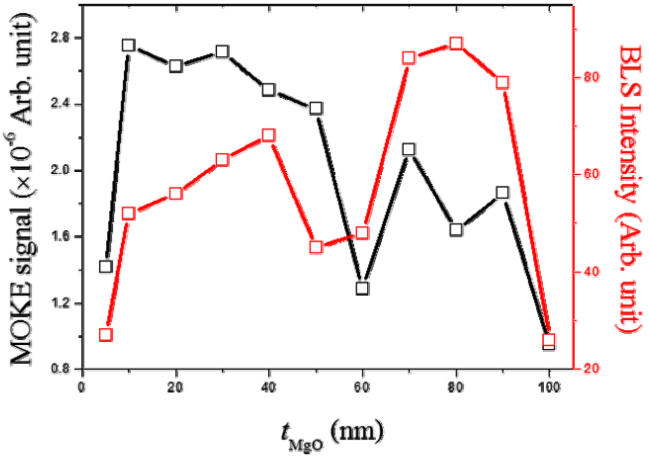

Fig. 1. BLS and MOKE signal as a function of MgO thickness.

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