Ar および Xe ガスを用いて製膜された Pt/NiO/Co 構造における スピン軌道トルク

Spin-orbit torque in Pt/NiO/Co structures deposited using Ar and Xe process gases for NiO layer

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For improvement of spin-orbit torque (SOT) efficiency, suppression of spin current loss at the interface between heavy-metal (HM) and ferromagnet (FM) often comes to an issue. Recently, antiferromagnetic (AFM) insulator, such as NiO layer can be good spin current transmitter in HM/NiO/FM structure [1-3]. However, the enhancement of the spin current transmittance by inserting AFM insulator is not always observed. In order to clarify the mechanism of the NiO insertion effect, we focus on deposition condition of the NiO layer.

In this study, we deposited a Pt/NiO/Co multilayer on Si/SiO_x substrates by using RF sputtering using Ar and Xe gases (named Ar type and Xe type, respectively). Quality of the NiO layer is expected to be different between the Ar and Xe types. Harmonic Hall measurements were performed to evaluate the SOT. Figure 1 shows the NiO thickness (t_{NiO}) dependence of damping-like (DL) torque efficiencies (ξ_{DL}) for two types of samples. In the Ar type, ξ_{DL} slightly increases around t_{NiO} = 1.0 nm and exponentially decreases for t_{NiO} > 1.0 nm. On the other hand, in the Xe type, ξ_{DL} decreases with t_{NiO} insertion. The present results shows that the NiO insertion effect is significantly different between the Ar and Xe type samples even though the similar Pt/NiO/Co structure was formed.

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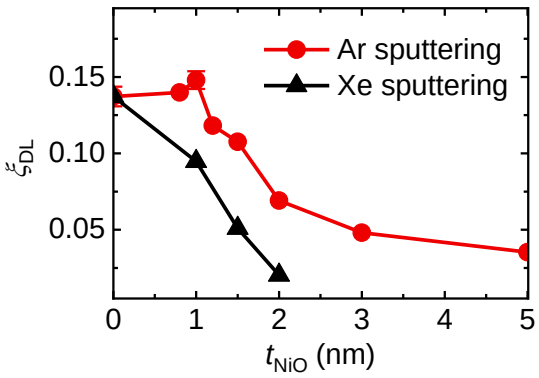

Figure 1: t_{NiO} dependence of the DL torque efficiencies for Ar type and Xe type samples.

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