フレキシブル基板上に製膜した Pt/Co 膜の磁気異方性の機械的制御
Mechanical modulation of magnetic anisotropy in Pt/Co films deposited on a flexible substrate

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The strain-induced change in the magnetic anisotropy in ferromagnetic thin films has been reported by directly bending the substrate [1], or in the configuration where the sample was mounted on a piezo device [2]. In our previous work, we had achieved to apply larger uniaxial strain of percent order on a thin film made of TbFeCo, one of the famous magnetostriction alloys, by simply stretching a flexible substrate on which the film was deposited. As a result, a clear switching in the magnetic easy axis had been reversibly observed. In this work, we investigated the effect of strain application in Pt/Co films, where interface anisotropy yielded the perpendicular magnetic anisotropy (PMA).

Ta (4 nm)/Pt (2 nm)/Co (t_{Co})/Pt (2 nm) layers from the substrate side, where t_{Co} = 0.4-0.9 nm, were deposited on a flexible polyethylene naphthalate substrate by rf sputtering. A uniaxial tensile strain was applied to the samples and the magnetization curves were measured using the anomalous Hall effect. Increase of coercivity was observed as the strain increased (see Figure). We determined magnetic anisotropy energies from the hard axis magnetization curves obtained under applying in-plane magnetic fields along the tensile and the compressive directions. We found that the signs of the change in the anisotropy energies for both in-plane magnetic fields were opposite. The sign of the magnetostriction constant (positive) determined here was same as that in PtCo alloy. From t_{Co} dependence, however, we confirmed that the interface magnetic anisotropy was independent of the strain application, which implied interfacial alloying is not the main reason for positive magnetostriction constant.

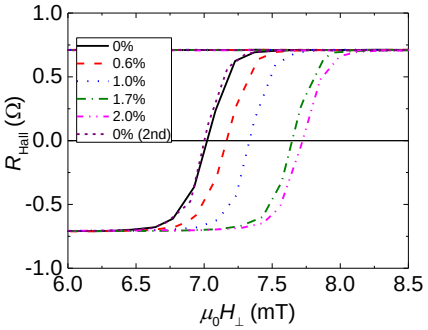

Figure: Enlargement around coercivity of the hysteresis curves for the sample (t_{Co} = 0.4 nm) under various in-plane uniaxial tensile strain.

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