Pt/Ru/Co/CoO/TiO_x 構造の電圧誘起保磁力変化のポストアニール効果

Post-annealing effect on voltage induced coercivity change in Pt/Ru/Co/CoO/TiO_x system

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We have reported a large voltage-induced coercivity (H_c) changes after optimal post-annealing in Pt/Ru/Co/CoO/amorphous TiO_x structures with surface oxidation of Co.[1] In this study, as a next step, we investigated the effect of post-annealing on Pt/Ru/Co/CoO/amorphous TiO_x structures more detail from MOKE measurements under bias-voltage, structural analysis by STEM-EDX, capacitance measurements, and magnetic moment analysis by XAS/XCMD measurements. Figure 1(a) shows the nominal structure of the sample. It is confirmed that about 1.0 nm of Co is oxidized during TiO_x deposition, and CoO is formed at the Co/TiO_x interface. Figures 1(b)-(c) show the magnetization curves under bias-voltage in the nominal Co-1.9 nm-thick sample before and after post-annealing. Annealing at 350 ºC promotes an increase in squareness and H_c, indicating an enhancement of PMA. Accompanying this improvement in PMA, a large voltage induced H_c change was observed in the 350 ºC annealed sample. STEM-EDX analysis confirmed that Co atoms diffused into the Pt layer, and capacitance and XAS measurements suggest that a part of CoO is reduced by the post-annealing. XMCD measurements revealed that annealing causes an increase in the interfacial orbital magnetic moment. Our results indicate that the PMA and VCMA at the Co/oxide upper interface are increased possibly due to the interdiffusion of Co and Pt, by post-annealing. This work was partly based on results obtained from a project, JPNP16007, commissioned by the New Energy and Industrial Technology Development Organization (NEDO).

Reference: [1] T. Nozaki et al., Sci. Rep. **11**, 21448 (2021).

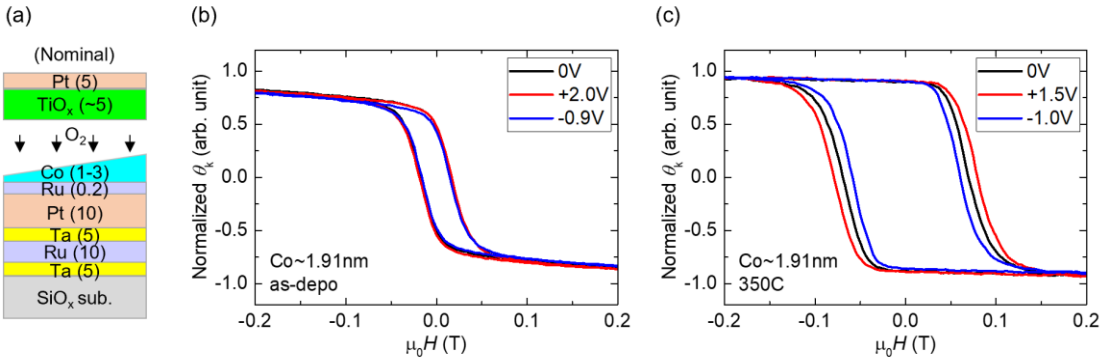

Fig. 1(a) Schematics of the nominal structure. (b)-(c) Normalized perpendicular magnetization curve by MOKE under bias voltage for as-deposited and 350ºC annealed sample (nominal Co thickness = 1.9 nm).