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Strong spin-orbit coupling arising from unusual pseudomorphism at the interface of the proton-irradiated Co_3O_4/Pd superlattice SANGHOON KIM, SOOGIL LEE, Yonsei University, HYUN HWI LEE, Pohang Accelerator Laboratory, SEONG-HUN PARK, JAE-HOON PARK, Pohang University of Science and Technology, HAN-KOO LEE, Pohang Accelerator Laboratory, JONGILL HONG, Yonsei University — We previously reported that the proton irradiation induces reduction from an oxidic paramagnetic Co_3O_4/Pd superlattice to a metallic ferromagnetic Co/Pd superlattice without any noticeable damages, which is radically different from any other irradiation methods [1]. In this presentation, we demonstrate that such an enhancement of perpendicular magnetic anisotropy stems from the strong spin-orbit coupling at the interface between the reduced Co and the metallic Pd layers. We found that Co atoms are pseudomorphically rearranged on the Pd atoms at the interfaces during reduction by the proton irradiation. This pseudomorphic rearrangement of the reduced Co atoms causes the significantly large interface magnetoelastic effect in the proton-irradiated superlattice. The x-ray magnetic circular dichroism study shows that the orbital to spin moment ratio has increased by ∼30% at the interface due to the strong pseudomorphism when we compare it with the metallic Co/Pd superlattice. This result signifies that the proton-irradiated Co_3O_4/Pd superlattice has spin-orbit coupling much stronger than the metallic superlattice. Our study has an important implication for generating spin-orbit torque effects or observing new magnetic objects such as skyrmions in novel spintronic devices.

[1] Sanghoon Kim, et al. Nature Nanotechnology 7, 567 (2012).

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