Hydrogenation-Induced Reversible Spin Reorientation Transition in $Co_{50}Pd_{50}$ Alloy Thin Films

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Because of the Pd-catalyzed hydrogen dissociation and absorption, magnetic Pd-alloys provide a model system for the investigation of the critical hydrogenation effect on magnetism. In this study, $Co_{50}Pd_{50}$ (CoPd) alloy thin films were fabricated by e-beam-heated co-evaporation on $Al_2O_3(0001)$ substrates. These films exhibited a thickness-dependent spin reorientation transition (SRT) from perpendicular direction to in-plane direction with increase of thickness. For 10-30 nm-thick CoPd alloy films with perpendicular magnetic anisotropy (PMA), hydrogenation triggered a SRT to an in-plane anisotropy. The reversibility of SRT was demonstrated by cyclicly changing the hydrogen gas pressure. Furthermore, hydrogenation-induced SRT randomized the magnetic domain orientation. In comparison with a bare CoPd film , a stronger PMA and a less pronounced hydrogenation-induced SRT were observed in a Pd-capped CoPd film. These observations suggest that the hydrogen content in CoPd alloy films can drastically and reversibly modify PMA, inferring the possible hydrogenation-induced charge transfer and modulation of electronic structure in CoPd.

References:

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