

Composition Dependence of Exchange Anisotropy in $Pt_xMn_{1-x}/Co_{70}Fe_{30}$ Films

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Abstract : We systematically investigated the exchange anisotropy for ferromagnetic $Co_{70}Fe_{30}$ and antiferromagnetic PtMn bilayer films. We focused on the relevance between the exchange bias and the composition of the Pt_xMn_{1-x} ($14 < x < 22$ and $45 < x < 56$ at %) films, and we successfully optimized the composition. The crystal structure of the Pt_xMn_{1-x} films was FCC for $14 < x < 22$ at % and FCT for $45 < x < 56$ at % after annealing at $370\text{ }^\circ\text{C}$ for 6 hours. The unidirectional anisotropy constant (J_k) for fcc- $Pt_{15}Mn_{85}$ (20 nm) and fct- $Pt_{48}Mn_{52}$ (20 nm) prepared under optimum conditions in composition were 0.16 and 0.20 erg/cm², respectively. Both $Pt_{15}Mn_{85}$ and $Pt_{48}Mn_{52}$ films showed a larger unidirectional anisotropy constant (J_k) than in other reports. They also showed a flatter surface than that of other antiferromagnetic materials. The obtained PtMn films with a large exchange anisotropy and slight roughness are useful as an antiferromagnetic layer in spintronic applications.

Keywords : antiferromagnetic material, PtMn thin film, exchange anisotropy, composition dependence

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