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Plasma enhanced atomic layer deposition of Co thin film on τ-MnAl for effective magnetic exchange coupling and enhanced energy products

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Abstract:

τ-MnAl thin film was deposited by DC magnetron sputtering. Co thin film was deposited on the surface of τ-MnAl thin film by Plasma Enhanced Atomic Layer Deposition (PEALD). In three parallel experiments, the Co layer thickness is controlled as 2, 4 and 6 nm, respectively. The surface chemical states of as-deposited τ-MnAl and Co thin films were determined by XPS. The magnetic properties of both τ-MnAl and τ-MnAl/Co thin films were investigated by VSM. The results showed that when the Co layer thickness was 2 and 4 nm, effective magnetic exchange coupling was occurring between τ-MnAl and Co, which was indicated by smooth magnetic hysteresis loops and enhanced $(BH)_{max}$. However, when the Co layer thickness was increased to 6 nm, the magnetic exchange coupling between MnAl and Co was reduced, which was indicated by the kinks in the magnetic hysteresis loop and decreased $(BH)_{max}$.

Keywords: Atomic Layer Deposition; τ-MnAl; Cobalt; thin film; exchange coupling.

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