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Role of magnetoelastic coupling in magnetic anisotropy of Co_2(Fe)MnSi thin films[1] HIMANSHU PANDEY, P.K. ROUT, ANUPAM GULERIA, P.C. JOSHI, Z. HOSSAIN, Indian Institute of Technology Kanpur, R.C. BUDHANI, CSIR-National Physical Laboratory, New Delhi — The influence of epitaxial strain on uniaxial magnetic anisotropy of Co_2Fe(Mn)Si [CF(M)S] Heusler alloy thin films grown on (001) $SrTiO_3$ (STO) and MgO is reported. The in-plane biaxial strain is susceptible to tune by varying the thickness of the films on STO, while on MgO the films show in-plane easy axis for magnetization irrespective of their thickness. The analysis of magnetic free energy functional within the Stoner-Wohlfarth coherent rotation model with out-of-plane uniaxial anisotropy for the films on STO showed the presence of magnetoelastic anisotropy with magnetostriction constant $\sim (12.22\pm0.07)\times10^{-6}$ and $(2.02\pm0.06)\times10^{-6}$, in addition to intrinsic magnetocrystalline anisotropy $\sim$ -1.72$\times10^6$ erg/cm^3 and -3.94$\times10^6$ erg/cm^3 for CFS and CMS, respectively. The single-domain phase diagram reveals a gradual transition from in-plane to out-of-plane orientation of magnetization with the decreasing film thickness. A maximum canting angle of 41.5° with respect to film plane is predicted for the magnetization of the thinnest (12 nm) CFS film on STO. The distinct behaviour of magnetization in the films with lower thickness on STO is attributed to strain-induced tetragonal distortion.

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