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Structural and magnetic properties of full Heusler alloys $Co_2Fe_{0.4}Mn_{0.6}Si$ grown on glass substrate

○Kangkang Meng, Mikihiko Oogane*, Hiroshi Naganuma, and Yasuo Ando
Department of Applied Physics, Tohoku University, Sendai 980-8579, Japan
*Email:oogane@mlab.apph.tohoku.ac.jp

Co-based full Heusler alloys $Co_2Fe_xMn_{1-x}Si$ has attracted a great deal of attention because of the half-metallic nature predicted theoretically and films with $L2_1$-ordered structure obtained easily. Recently, it has been applied as ferromagnetic electrodes into magnetic tunnel junctions and current-perpendicular-to-plane giant magnetoresistance devices, achieving a high magnetoresistance[1, 2].Preparing a magnetically optimized ferromagnetic electrode on amorphous substrates is required to realize spintronic devices with Heusler alloy electrodes. In this work, we have investigated the structural and magnetic properties of $Co_2Fe_{0.4}Mn_{0.6}Si$ (CFMS) grown on glass substrate.

Films with structure of glass-sub./$Cr_{90}Ru_{10}$(40)/CFMS(20)/$Cr_{90}Ru_{10}$(3) and glass-sub./$Cr_{90}Ru_{10}$(40)/Ag(20)/CFMS(20)/$Cr_{90}Ru_{10}$(3) (in nm) were prepared by dc magnetron sputtering. After deposition, the films were annealed at various temperatures (T_a). The structural and magnetic properties were characterized by x-ray diffraction(XRD) and superconducting quantum interference device (SQUID).

Figs. 1 and 2 show XRD patterns for the films with and without Ag buffer layer. Insets show the annealing temperature dependence of saturation magnetization. Considering the results shown in figs. 1 and 2, we found that the films without Ag buffer layer and annealed at T_a=350°C showed good structural and magnetic properties. We have also investigated the CFMS thickness dependence of structural and magnetic properties in the films with structure of glass/$Cr_{90}Ru_{10}$(40)/CFMS(d)/$Cr_{90}Ru_{10}$(3) annealed at T_a=350°C. We found that CFMS with thickness above 3 nm exhibited good structural and magnetic properties. This work was supported by Western digital company.

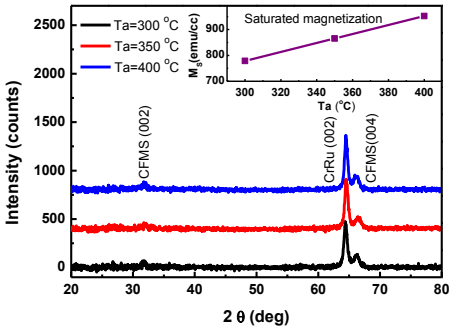

Fig. 1 XRD patterns and annealing temperature dependence of magnetization for the films without Ag buffer layer.

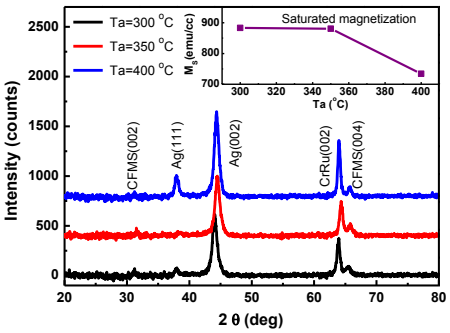

Fig. 2 XRD patterns and annealing temperature dependence of magnetization for the films with Ag buffer layer.

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[2] J. Sato, M. Oogane, H. Naganuma, and Y. Ando, Appl. Phys. Express **4**, 113005 (2011).