UD09

Magnetic Properties and Structure of (Fe-Rh) Alloy Thin Films

S. Inoue*[1], J. Cao[1], and T. Suzuki[1]

[1] Information Storage Materials Laboratory, Toyota Technological Institute, 2-12-1, Hisakata Tenpaku ward, Nagoya city, Aichi, 468-8511, Japan

*Corresponding author: sd06406@toyota-ti.ac.jp, Phone: +81-52-809-1872, Fax: +81-52-809-1874

It is known that an alloy of $Fe_{50}Rh_{50}$ exhibits the first order transition at about 80 deg. at which the change in magnetism from anti-ferromagnetism to ferromagnetism takes place. Alloys of $Fe_{100-x}Rh_x$ form the CsCl-type crystal structure for x > 20 at.% and undergo the first order transition at 70~80 deg. for 48.5<x<51.5 at.%[1-3]. However, the transition temperature of FeRh thin films is known to be very broad in temperature, and the mechanism is open to question. This work aims to clarify the mechanism and the magnetic property of single crystalline FeRh alloy thin films.

Thin films of $Fe_{1-x}Rh_x$ alloy were fabricated onto MgO(100) substrate from an $Fe_{50}Rh_{50}$ target by a multi-functional deposition sputtering system (48<x<51 at.%). The base pressure of the system is less than 5.0×10^{-8} Torr. The substrates were kept at an ambient temperature during deposition. It was effective to change Ar gas pressure, PAr, in controlling the composition ratio. The composition ratio of samples fabricated at 0.6 $\leq P_{Ar} \leq$ 5.0 mTorr were 48<x<51 at.%. Following the depositing, the samples were annealed in the vacuum of 10^{-7} Torr at 600 deg. for more than 2 hours.

The present results suggest that the dependence of transition temperature on composition for thin films is different from that for bulk reported previously[4]. The temperature dependence of magnetic properties, the annealing time dependence of transition temperature and crystal structure measured by XRD is being investigated. Work is in progress to clarify the correlation between magnetic properties and structure.

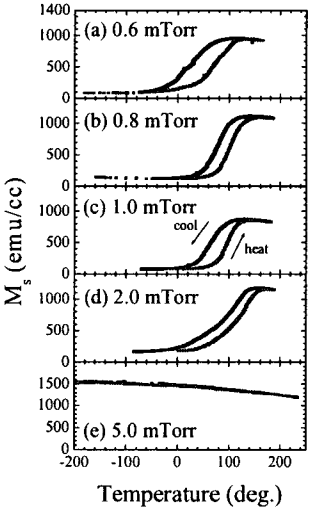

Fig. 1. MS-Temperature curves at each of PAr. (a) The film was made at P_{Ar} = 0.6 mTorr, (b) P_{Ar} = 0.8 mTorr, (c) P_{Ar} = 1.0 mTorr, (d) P_{Ar} = 2.0 mTorr, (e) P_{Ar} = 5.0 mTorr.

REFERENCES

[1] J.S.Kouvel, J. Appl. Phys., 37, No.3, 1257(1966).
[2] Jan-Ulrich Thiele, Stefan Mat, and Eric E. Fullerton, Appl. Phys. Lett., 82, No.17, 2859(2003).
[3] G. Shirane, C.W.Chen, and P.A.Flinn, and R.Nathans. Phys. Rev., 131, No.1, 183(1963).
[4] O. Kubaschewski, IRON-Binary Phase Diagrams (Springer, Bsrlin, 1982), p.121.

UD10

Structural and magnetic properties of NiMnSb films prepared by flash evporation

N. P. Duong, N.A. Tuan, L.T. Hung and T.D. Hien

International Training Institute for Materials Science (ITIMS)
Hanoi University of Technology, 01 Dai Co Viet Str., Hanoi, Vietnam

*Corresponding author: duong@itims.edu.vn Phone: + 04 8 692 136, Fax: 04 869 2006

NiMnSb thin films have been grown on Si (111) by flash evaporation. The film deposition occurred at 300°C. The as-deposited films were annealed at temperature between 300°C and 500°C in vacuum for 20 minutes. The crystal structure of the films was studied by X-ray diffraction which shows the typical $C1_b$ structure with a high degree of (220) texture and a small amount of possible amorphous phase. The magnetic measurements by means of a vibrating sample magnetometer show the best ferromagnetic properties for the film obtained with heat-treatment at 300oC, i.e. Curie temperature T_C = 690 K, saturation magnetization M_s = 412 emu/cm^3 and coercivity H_C = 10 Oe at 300 K. Alpha-step measurements indicate for this film average thickness of 140 nm and average surface roughness of 0.75 nm. The topography of the films was investigated using an AFM. These parameters were compared with that of the bulk material and that of NiMnSb films prepared by other technique such as sputtering and pulsed laser deposition which have been reported in literature.

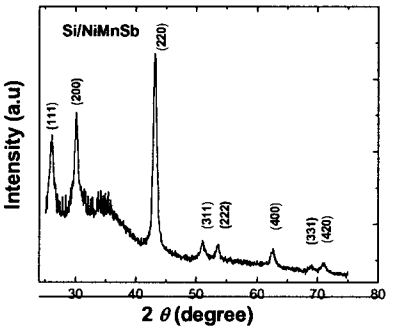

Fig. 1. X-ray diffraction spectrum at room temperature of NiMnSb film annealed at 300°C for 20 min.

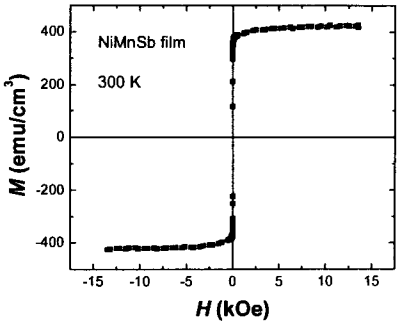

Fig. 2. Hysteresis loop at room temperature of NiMnSb film annealed at 300°C for 20 min.

REFERENCES

[1] J.-P. Schlomka, W. Press, M.R. Fitzsimmons, M. Lütt, I. Grigorov, "*Structural and magnetic properties of ion beam sputtered NiMnSb films*", Physica B **248** (1998) 140-145
[2] J. Androulakis, S. Gadelis, J. Giapintzakis, P.D. Buckle, "Magnetic properties of the half-metallic ferromagnet NiMnSb grown on InSb by pulsed laser deposition", Applied Physics A **79** (2004) 1211-1213