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Structural, magnetic and transport properties of Ni_2MnAl thin films prepared by magnetron sputtering

IMR, Tohoku Univ.[1], NIMS[2], KEK[3], °Tomoki Tsuchiya[1], Tomoko Sugiyama[1], Takahide Kubota[1], Masaki Mizuguchi[1], Tetsuro Ueno[2], Nobuhito Inami[3], Kanta Ono[3], and Koki Takanashi[1]

E-mail: t.tomoki@imr.tohoku.ac.jp

Mn_3Ir is an antiferromagnetic material widely used in so-called spin valve structures. The spin valve structure plays an important role for enhancing sensitivity of magnetic sensors such as reading heads of hard disc drives (HDDs). Mn_3Ir has attractive properties of large exchange bias field and high blocking temperature, however high-cost of Ir will be a critical issue in near future for its scarcity. In this work, we focused on an anti-ferromagnetic Heusler alloy Ni_2MnAl for the replacement of Mn_3Ir. Ni_2MnAl is known to be an antiferromagnetic phase when the structure is *B*2 phase [1]. There have been few reports on fabrication of Ni_2MnAl thin films therefore structural and magnetic property of Ni_2MnAl thin films were investigated in this study.

Ni_2MnAl thin films were prepared on MgO (100) substrates by magnetron sputtering. Film composition was adjusted to be a stoichiometric composition by co-sputtering technique. Structural, magnetic, and transport properties of the films were measured by using x-ray diffractometer (XRD) and van der Paw technique, respectively.

Fig. 1 shows the XRD result of the samples deposited at different substrate temperatures (T_{sub}). Peak intensity of Ni_2MnAl increases with increasing T_{sub} and (002) diffraction which comes from *B*2 phase was confirmed for the samples prepared at T_{sub} over 300°C. Fig. 2 shows measurement temperature dependence of electrical resistivity for the sample of T_{sub} = 500°C. The graph has an inflection point at 250K which implies magnetic transition of the Ni_2MnAl film. Magnetic properties measured by VSM and synchrotron x-ray source will be discussed in the presentation.

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[1] I. Galanakis and E. Şaşıoğlu, Appl. Phys. Lett. **98**, 102514 (2011).

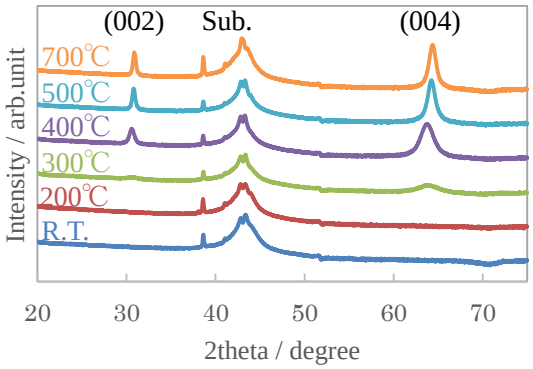

Fig. 1 XRD pattern of Ni_2MnAl films. Temperature noted inside figure is T_{sub}. Index number is of Ni_2MnAl plane.

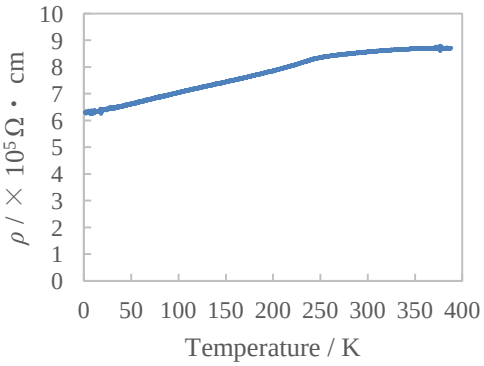

Fig. 2 The temperature dependence of the electrical resistivity.