

Structural analysis of alternate monoatomically deposited FeCo thin film

Tokyo Univ. of Sci.¹, ISSP of The Univ. of Tokyo², JASRI³

°(M2) Hisaaki Ito¹, (M1) Takuya Miyashita¹, (M1) Takuya Kumagai¹,

Toshio Miyamachi², Fumio Komori²,

Tomoyuki Koganezawa³, Takuo Ohkochi³, and Masato Kotsugi^{1*}

*E-mail: kotsugi@rs.tus.ac.jp

$L1_0$ -type FeCo ordered phase has attracted much attention as a rare-earth-free high-performance magnetic material, because of large magnetic anisotropy, large magnetic moment, and high Curie temperature [1]. A number of studies have been carried out for the fabrication of $L1_0$ -FeCo phase, but it has not been established yet [2]. One of the reasons is that the $L1_0$ structure is a non-equilibrium state in the FeCo system, and we inserted a periodic Ni buffer layer to maintain the fcc structure [3]. For establishing the fabrication process of $L1_0$ -FeCo, we here investigated the growth temperature dependence of specimen and characterized its structural and magnetic properties. We also developed a new sample heating system for controllable thermal treatment.

In this study, we prepared specimens by utilizing a technique involving the deposition of alternating monoatomic layers using pulsed laser deposition (PLD) with Nd: YAG laser (wavelength: 266 nm). An Fe seed layer (1 nm) and a Au layer (20 nm) were deposited at 80 °C on a MgO (100) single-crystal substrate, and a Cu layer (50 nm) was deposited at 300 °C. Then, we deposited (7 ML-FeCo/3 ML-buffer)₃ and utilized Ni as a buffer layer. The growth temperature is 150~750°C. The surface roughness and morphology of the samples were monitored by reflection high energy electron diffraction (RHEED) and observed by atomic force microscopy (AFM). The structural analyses carried out by X-ray diffraction (XRD) using Cu-K α and synchrotron radiation. The magnetic moment and magnetic anisotropy were evaluated by superconducting quantum interference device (SQUID) magnetometer.

Figure 1 shows out-of-plane XRD patterns of (7 ML-FeCo/3 ML-Ni)₃. As a result, the flatness of the surface was lost as the growth temperature was raised, and it was suggested that the regions transferred to B2 structure exited in the FeCo multilayer film.

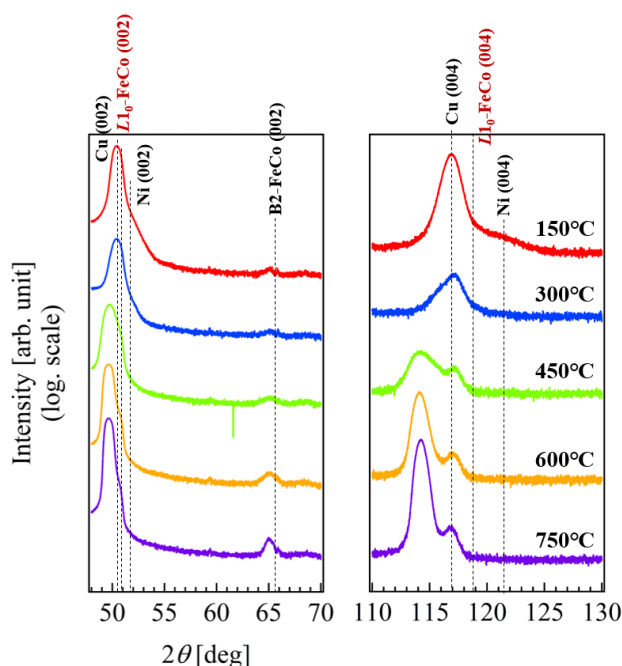


Fig.1 Out-of-plane XRD patterns measured using Cu-K α radiation for (7 ML-FeCo/3 ML-Ni)₃ films

References

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