Structural and Magnetic Depth Profile Analysis of $L1_0$ FeNi Film by Polarized Neutron Reflectometry

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High magnetic anisotropy is one of the requirements for the permanent magnet material. $L1_0$-ordered FeNi, which exhibits large magnetocrystalline anisotropy, is a possible candidate for rare-earth-free permanent magnet material. Because of the difficulty in producing bulk amount of $L1_0$ FeNi, alternate monolayer stacking of Fe and Ni by molecular beam epitaxy was developed [1]. In order to enhance the degree of crystalline order of the $L1_0$ structure and the magnetocrystalline anisotropy, several kinds of buffer layer have been adopted so far [2,3]. Therefore the structural and magnetic depth profile of the multilayer stacking needs to be analyzed to optimize the fabrication procedures. In this study, we performed a polarized neutron reflectometry (PNR) experiment on multilayer samples including $L1_0$-ordered FeNi

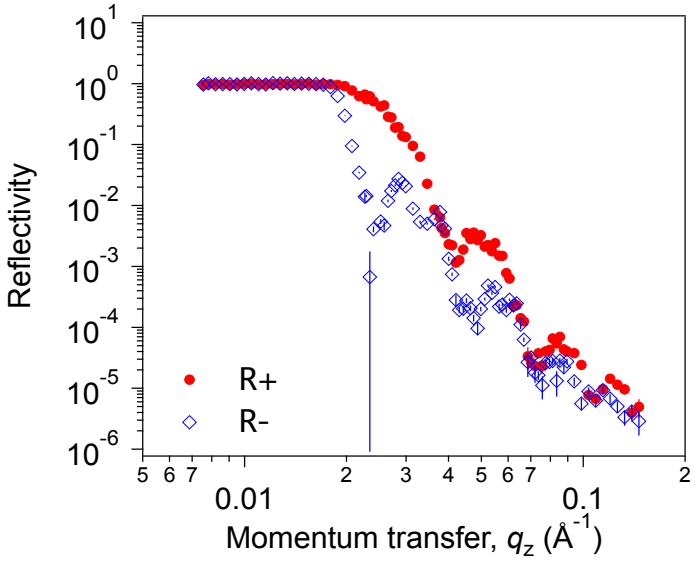

Fig. 1. Polarized neutron reflectivity for a multilayer with $L1_0$-ordered FeNi layer measured at room temperature.

or disordered FeNi layer. PNR experiment was performed at BL-17 of MLF, J-PARC. Figure 1 shows the polarized neutron reflectivity for a multilayer sample including $L1_0$-ordered FeNi film. Reflectivity for different polarization of neutron (R+ and R-) shows different behavior to momentum transfer (q_z). Fitting analysis revealed the layer thickness, roughness at each interface, and magnetic moment distribution of the whole multilayer structure.

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