Effects of Energetic Heavy Ion Irradiation on the Structure and Magnetic Properties of FeRh Thin Films

N. Fujita¹, Y. Zushi¹, T. Matsui¹, Y. Saito², A. Iwase¹

¹Department of Materials Science, Osaka Prefecture University, Sakai, Osaka 599-8531,Japan

²Japan Atomic Energy Agency(JAEA), Takasaki, Gumma, 370-1292, Japan

Equiatomic FeRh alloy, Fe-50at.%Rh, with B2 structure shows a first order antiferromagnetic-ferromagnetic phase transition. In our previous study, we have shown that the intrinsic anti-ferromagnetic phase of Fe-50at.%Rh bulk samples at low temperatures is changed to the ferromagnetic phase by the irradiation. The effects of the irradiation, however, appear only near the surface of FeRh alloy because the ion range is much smaller than the thickness of bulk FeRh samples. To discuss the dependence of the irradiation effects on the energy of irradiating ions more clearly, we tried to make FeRh thin films, the thickness of which is much smaller than ion ranges. Thin films were deposited on a-SiO₂ substrates at room temperature by using the ion beam sputtering from Fe-50at.%Rh target. The thin films include not only anti-ferromagnetic B2-structured region but also ferromagnetic B2-structured and nonmagnetic fcc regions at low temperatures. They were irradiated with 10-200MeV heavy ions (I or Xe) at room temperature. Before and after the irradiations, the changes in magnetization and the lattice structure were measured by using superconducting quantum interference device (SQUID) and X-ray diffractometer (XRD), respectively. For the low fluence of the irradiation, the SQUID measurement at 20K shows that the anti-ferromagnetic region of the thin films is changed into ferromagnetic region by the irradiation. For the high fluence of the irradiation, the magnetization of the film is strongly decreased by the irradiation. The destruction was confirmed by the XRD measurement. The dependence of the change in magnetic properties on the energy of irradiation ions will be discussed.

- [1] M. Fukuzumi et al., Nucl. Instr. Meth. **B230**(2005) 269-273
- [2] M. Fukuzumi et al, Nucl. Instr. Meth. B245(2006)161-165
- [3] Y. Zushi et al., Nucl. Instr. Meth. B256(2007) 434-437