Heating Effect on Antiferromagnetic Domain Structure in NiO(100)

Kuniaki Arai[1] , Taichi Okuda[1], Fang-Zhun Guo[2], Keiki Fukumoto[2], Takanori Wakita[2], Hai-Lin Sun[1], Hiroaki Miyata[3], Tomohiro Matsushita[2], Yusuke Tamenori[2], Takayuki Muro[2], Keisuke Kobayashi[2], Yuuki Maeda[1], Keiji Kura[1], Akito Kakizaki[1] and Toyohiko Kinoshita[2]

[1] Institute for Solid State Physics, The University of Tokyo, Kashiwa 277-8581, Japan
[2]SPring-8/JASRI, Kouto 1-1-1, Mikazuki, Sayo-gun, Hyogo 679-5198, Japan
[3] Toray research center, Sonoyama 3-3-7, Otu, Shiga 520-8567, Japan

Antiferromagnetic(AFM) layer is widely used in spin valves utilizing magnetoresistive effect. Such AFM materials show magnetic phase transition at the Néel temperature. In order to know the stability of the domain structure, to investigation whether AFM domain structure changes reversibly or irreversibly by heating is an important issue. We have studied AFM domain structure at the surface of cleaved NiO(100) before and after heating.

The experiments were performed using PEEMSPECTOR and SPELEEM at the beamline BL25SU and BL27SU of the SPring-8. AFM domain images on NiO(100) surface are acquired using (magnetic) linear dichroism at Ni L_2 edge and O K-edge with linear and circular polarized light. Changes of AFM domain structure in NiO(100) before and after annealing above the Néel temperature(523K) were observed at room temperature. Figure 1 shows AFM domain images on NiO(100) surface at O K-edge before and after the annealing. After annealing, T-domains, which mainly originate from crystallographic distortion[1], change as shown in Fig.1. In addition, S-domains, which originate from spins, changed drastically (not shown here). The previous report has suggested that T-domain topology was not affected by macroscopic defects on the surface, and unchanged after heating above the Néel temperature[2]. However, after the repetition of annealing, we found that the domain structure is affected by macroscopic defects and scratches on the surface. The detailed behavior of the change will be discussed.

References: [1] T.Kinoshita et al., J.Phys.Soc.Jpn.**73**(2004)2932.
[2] F.U.Hillebrecht et al., Phys. Rev. Lett. **86**, 3419(2001).

(a) (b)

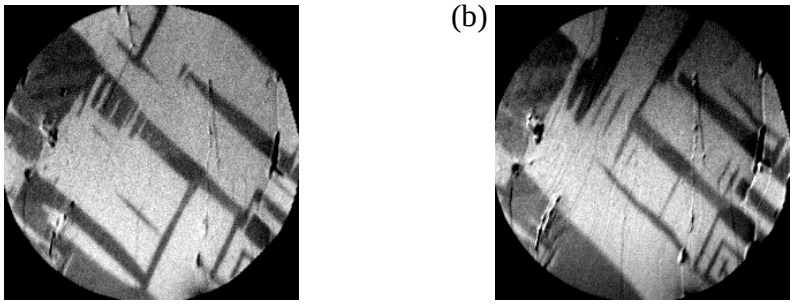

Fig.1. AFM domains on NiO(100) surface observed at O K-edge (a) before and (b) after annealing. The field of view is 50 micron.