at the Fe/MgO(100) interface do not detect any oxygen diffusion in the Fe film showing a sharp interface with the Fe crystallographic cell tetragonally distorted to match the MgO crystal lattice. These results will be discussed in relation to the magnetic properties of the systems.
[1] P. Luches et al, Phys. Rev. Lett. 96, 106106 (2006).

Keywords: interfaces, X-ray absorption fine structure, thin films

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Surface X-ray diffraction studies of CaF_2(110)/Si(001) interface formation

Takayoshi Shimura[1], Sergey M Suturin[2], Nikolai S Sokolov[2], Alexander G Banshchikov[2], Reginald N Kyutt[2], Osami Sakata[3], Jimpei Harada[4], Masao Tabuchi[5], Yoshikazu Takeda[5]
[1]Osaka Univ., Material & Life Science, 2-1 Yamadaoka, Suita, Osaka, 565-0871, Japan, [2]Ioffe Physical Technical Institute, 26 Polytechnicheskaya str., St. Petersburg, 194021, Russia, [3]Japan Synchrotron Radiation Research Institute (JASRI)/SPring-8, Kouto, Sayo, Hyogo 679-5198, Japan, [4]Rigaku Co., 3-9-12 Matsubara, Akishima, Tokyo 196-8666, Japan, [5]Nagoya Univ., Furo-cho, Chikusa-ku, Nagoya 464-8603, Japan, E-mail：shimura@mls.eng.osaka-u.ac.jp

In the earlier studies [1, 2] it was found that an interface of CaF_2(110)/Si(001) with non-trivial relations was formed during CaF_2 epitaxial growth on Si(001) surface at high temperature. The atomic structure of this interface was related to the formation of the wetting layer consisting of nanostripes running along [110] direction. In order to investigate the structure of the interface *in situ* surface X-ray diffraction (SXRD) measurements were carried out at the BL13XU of SPring-8. CaF_2 of 0.7-2.0 monolayer was grown on Si(001) substrate and over 40 in-plane reflections and 8 fractional order rods were measured. SXRD revealed the 3×1-like surface reconstruction (fig. 1) which is consistent with the electron diffraction studies [2]. A two-dimensional structural model was constructed based on the electron density distribution obtained from in-plane reflectioin data. The intensity profiles along the rods, reflecting the electron density distribution across the interface, suggested that more than one molecular layer were involved in the formation of the interface wetting layer.

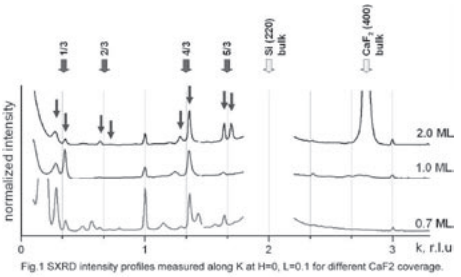

Fig.1 SXRD intensity profiles measured along K at H=0, L=0.1 for different CaF2 coverage.

[1] T. Sumiya et al., Surf. Sci. 376, 192 (1996).
[2] L. Pasquali et al., Phys. Rev. B72, 045448 (2005).

Keywords: surfaces and interfaces, surface diffraction, *in-situ* experiments

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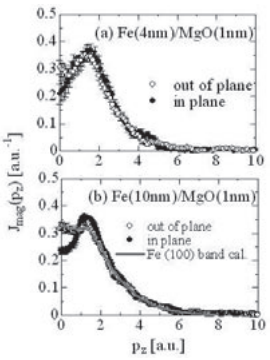
Electroic states at the interface of Fe/MgO magnetic tunneling junction

Hiroshi Sakurai[1], Takuro Tamura[1], Toshitaka Kurachi[1], Satoshi Homma[1], Hiromi Oike[1], Akane Agui[2], Yoshiharu Sakurai[3], Masayoshi Itou[3], Hiromichi Adachi[4], Hiroshi Kawata[4]
[1]Gunma University, Production Science and Technology, 1-5-1 Tenjin-cho, Kiryu, Gunma, 376-8515, Japan, [2]SRRC, JAEA, 1-1-1Kouto, Sayou-gun, Hyogo, 679-5148, Japan, [3]SPring-8/JASRI, 1-1-1Kouto, Sayou-gun, Hyogo, 679-5198, Japan, [4]KEK-PF, 1-1 Oho, Tsukuba, Ibaraki, 305-0801, Japan, E-mail：sakuraih@el.gunma-u.ac.jp

Recently fully epitaxial Fe/MgO/Fe MTJs have the likelihood of an extremely high MR ratio because of the coherent tunneling effect. For conservation of wave function coherency, an electronic structure at the interface is important. In this paper we discuss the electronic states at the interface of Fe/MgO magnetic tunneling junction by measuring magnetic Compton profiles (MCPs). Fe(xnm)/MgO(1nm) (x=4,10) multilayes were fabricated on Si(111) substrates and Al foil substrates by R.F. sputtering. Total thickness was adjusted to about 1000nm. The texture of Fe(200) and MgO(200) was confirmed by XRD measurements. No Fe oxide diffraction peak was observed. Magnetization measurements showed magnetic dead layer of 1nm at the interface. The MCP measurements were carried out at SPring-8-BL08W and KEK-PF-ARNE1A1. Fig.1(a),(b) show the MCPs of the Fe/MgO multilayers. The “hollow” around the pz=0 is deeper in the case of the Fe(4nm)/MgO(1nm) than Fe(10nm)/MgO(1nm). This indicates existence of relatively large spin polarization of conduction electron at the interface and suggests that the spin polarization of conduction electron remain although the Fe3d magnetization disappears.



Keywords: Compton profiles, multilayer films, interface characterization

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Thin film structures of epitaxial chromium on MgO(001) substrates by MBE

Kiyoshi Sakaue, Noriyoshi Tanaka, Isao Takahashi, Hikaru Terauchi
Kwansei Gakuin University, Department of Science and Technology, Gakuen 2 chome 1, Sanda city, Hyogo prefcture, 669-1337, Japan, E-mail：sakaue@kwansei.ac.jp

Thin films of chromium (Cr) were epitaxially grown on MgO(001) substrates by means of molecular beam epitaxy (MBE) and studied by in-situ reflection high energy electron diffraction (RHEED) and ex-situ X-ray diffraction. Depositions of the Cr films were carried out from room temperature to 973K with vacuum of the order of 10-5 Pa. Epitaxial relations of Cr(001)//MgO(001) and Cr[100]//MgO[110] were obtained. We find that Cr(001) layers grown at the temperature higher than 673K and slow deposition rate of 0.1 nm/s shows 2X2 surface reconstructions. Epitaxial growth progressed further, clear horizontally-elongated RHEED streaks were found when the azimuth of the incident electron beam was parallel to the Cr[100] and superposed to usual streak and spotty pattern. Horizontal streaks were observed under following conditions; (1) low deposition rate and (2) high substrate temperature. Horizontal RHEED streaks can be speculated that the Cr thin films have wire-like structures along with [110] direction of Cr layer and was somewhat related to the existence of oxygen in the residual gas. X-ray diffraction from the Cr film, however, revealed that no evidence of chromium oxide, such as Cr_2O_3, was found.