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The excitation mechanisms of the lowest-energy satellite bands in F 1s photoemission of SiF_4 and SF_6

K. Fujiwara[a](13117), G. Pruemper[a](13855), A. De Fanis[b](6276), Y. Tamenori[b](1308), H. Shindo[c](7751), T. Tanaka[c](9299), M. Kitajima[c](6368), H. Tanaka[c](5673), N. Saito[d](3191), M. Oura[e](356), and K.Ueda[a*](3219)

Tohoku Univ.[a], JASRI[b], Sophia Univ.[c], AIST[d], RIKEN[e]

We have investigated satellite bands in F 1s photoemission of SiF_4 and SF_6. Figure 1 illustrates appearance of the lowest-energy satellite band S1 at binding energy of ~9 eV lower than the F 1s mainline of SF_6. This band corresponds to HOMO-LUMO excitation accompanying the F 1s photoionization. We have measured the intensity of the HOMO-LUMO satellite bands of SiF_4 and SF_6 as a function of photon energy. We find that the satellite band of SiF_4 is enhanced at about the same *kinetic* energy as the F 1s main line as a result of the shape resonance effect, as expected by the shake-up model. The satellite band of SF_6 is, on the other hand, resonantly enhanced at about the same *photon* energy as the shape resonance of the main line, as shown in Fig. 2. This peculiar resonance enhancement was previously found also in C 1s photoemission of CO_2 [1] and suggests a dominant role of the final state correlations arising from the interaction between a primary photoelectron and a valence electron.

[1] Hoshino *et al.* J. Phys. B **36,** L381 (2003).

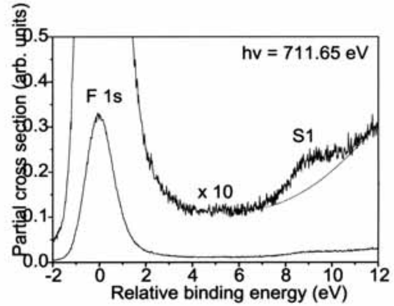

Fig.1. A portion of the photoemission spectrum of SF_6 recorded at hv = 711.65 eV.

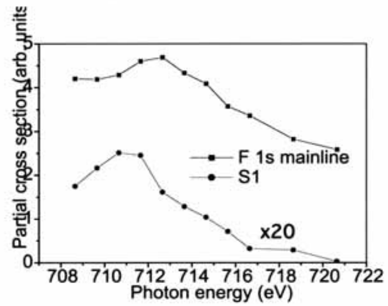

Fig. 2. Partial cross sections for the S1 satellite excitation and the F 1s single-hole ionization of SF_6.

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Depth Profiling of Gate Dielectrics/Si Interfacial Transition Layer

T. Hattori*(07880)[1], K. Higashi(13310)[2], E. Ikenaga(000448)[3], Y. Takata(01866)[4], M. Shioji(09776)[1], T. Shiraishi(08045)[1], T. Yoshida(09213)[1] and H. Nohira(08035)[1]

[1]Musashi Inst. of Technol., [2]Advanced LCD Technologies Develop. Center Co., Ltd.

[3]Soft X-ray Spectroscopy Lab., RIKEN, [4]Japan Synchrotron Radiation Res. Inst.

The formation of high-quality gate dielectric/Si interfaces at temperatures lower than 400C is a key process for fabricating polycrystalline silicon thin film transistors on glass or plastic substrates. In the previous studies we studied the the chemical structures at the SiO_2/Si(100) interfaces, which were formed using three kinds of atomic oxygen at 300°C, by measuring 1050 eV photons excited Si 2p photoelectron spectra and the uniformity of the oxide films, which were formed using three kinds of atomic oxygen at 300°C, by measuring 714 eV excited O 1s photoelectron spectra. The highest uniformity was obtained for 1.17-nm-thick oxide film formed in by krypton-mixed oxygen (Kr:O_2 = 97:3) plasma (abbreviated hereafter as Kr/O_2 plasma oxide).

The same kinds of studies were performed on SiO_2/Si(111) interfaces, which were formed using three kinds of atomic oxygen at 300°C. In contrast to Kr/O_2 plasma oxide formed on Si(100), the uniformity of the Kr/O_2 plasma oxide formed on Si(111) is comparable to the uniformity of oxide film formed in O_2 plasma and that of the oxide film formed using atomic oxygen, which was generated by exciting molecular oxygen with 172-nm-wavelength light from a xenon excimer lamp. In addition to these measurements, we determined the electron escape depth in silicon oxide from the angle resolved Si 2p photoelectron spectra, the example of which is shown in Fig. 1. In the case of oxides formed on Si(100), the electron escape depth in Kr/O_2 plasma oxide and that in thermal oxide formed in dry O_2 at 900°C are 2.3 nm and 2.7 nm, respectively.

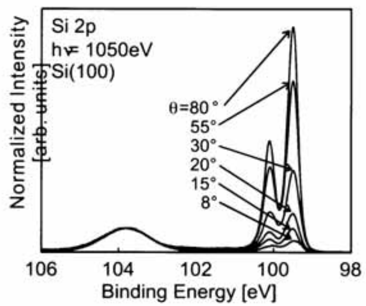

Fig. 1 Angle-resolved Si 2p spectra