Characterization of the chemically etched SiC(000$\bar{1}$) surfaces by photoelectron spectroscopy

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Introduction

Silicon carbide (SiC) is a semiconductor, which has a potential application to the high-power and high-frequency electronic devices. The performance of these devices strongly depend on the surface properties of this crystal. Therefore the surface characterization is an important role in the device fabrication.

Experimental

6H-SiC single crystals were used in this study. The (000$\bar{1}$)C surface of this crystal was etched in HF solution at room temperature for 3 hours. The measurements of the photoelectron spectroscopy for this surface was carried out at the beam line BL25SU of the SPring-8. This beam line is equipped with a SES200 spherical mirror analyzer. The photoelectrons were accepted with angle θ to the sample surface normal. The photoelectron spectra were collected with various incident photon energy and different θ.

Results and discussion

Fig.1 shows the C1s spectra for (000$\bar{1}$)C surface where the binding energy is referred to that of bulk C1s. The signals with the higher binding energy by about 2eV should be originated from the contaminant C layer (C-H and C-C bonding) on the surface, since the electron mean free paths λ are about 1.4 nm for $h\nu$=800eV and 0.8 nm for $h\nu$=500eV. [1,2] In the spectra measured with θ=10°, a little shoulder is observed at the higher energy about 3eV (C=O bonding). This suggests that the damaged layers introduced by the polishing is not completely removed.[3] In the spectrum at θ=50°, the signal for bulk C1s almost disappears. This implies that only one or two contaminant layer remains on the (000$\bar{1}$)C surface for the present surface treatment.

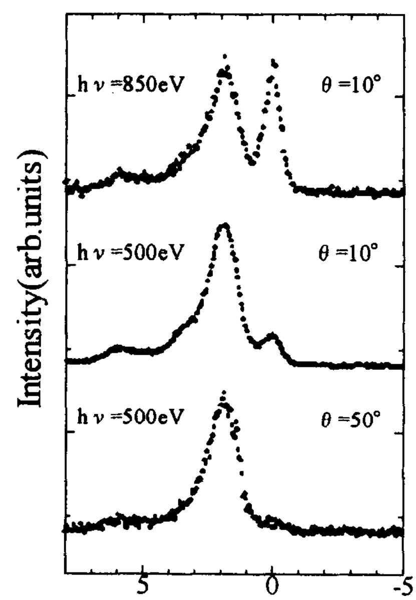

Fig.1. Spectra of C1s, recorded using different photon energy ($h\nu$=500eV,800eV) and angle θ (θ=10°, 50°)

Reference

[1]Y.Mizokawa et al., J.Appl.Phys. 67(1990)264
[2]S.Tamura et al., Surf.Interface Anal.17(1991)927
[3]H.Tsuchida et al., Jpn.J.Appl.Phys. 34(1995)6003