

A preliminary Study on the surface diffraction from SiO₂/Si(001) interface

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Physics of phase transitions has been one of the most attractive subjects in solid state physics. Although numerous X-ray studies have been devoted to the structural phase transitions in bulk, few attentions appear to be paid for the one occurring at crystal surfaces. This is because the lack of photons in the available X-ray sources: more intense X-ray beam is necessary so as to measure the very weak surface diffuse scattering which would be the key to understand the origin of the surface phase transitions. Therefore, such a measurement can only be attained with the use of the brilliant synchrotron radiation sources, like SPring-8. As a preliminary experimental study, X-ray reflectivity(XR) and crystal truncation rod(CTR) scattering from a silicon 001 wafer of which surface was thermally oxidized was measured at room temperature.

Figure 1 is the XR as a function of the incident angle. The X-ray wavelength was 1.03Å. The distinct interference fringe pattern is seen, although we did not use the crystal analyzer. This means that the sufficient parallel beam for precise XR measurements has already be attained at this beamline,

Figure 2 is the CTR scattering from the same sample. This measurement was also performed without any crystal analyzer, and the chosen wavelength was 0.41Å. By subtracting the background, data-set of

integrated intensity of the CTR which affords us the surface structure on an atomic scale was obtained. From the XR and CTR, thickness of the oxide layer and the rms of the roughness at the oxide/Si(001) interface were estimated as 266Å and 2.1Å, respectively. Further analysis is in progress.

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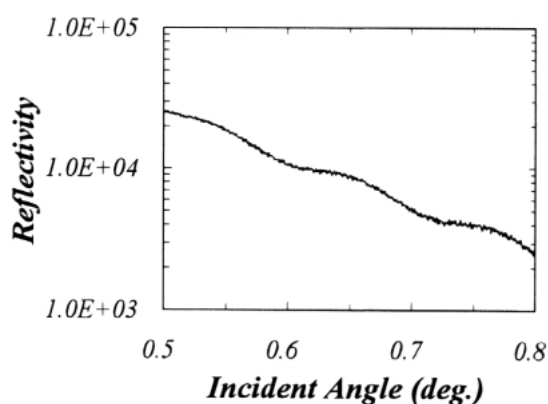


Fig. 1 X-ray reflectivity from SiO₂/Si(001)

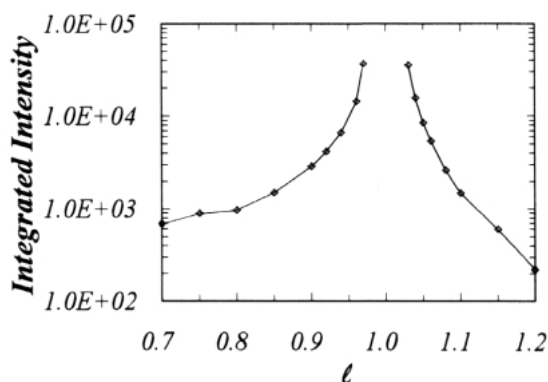


Fig. 2 CTR scattering from SiO₂/Si(001)