Modulation of CTR Scattering under Bragg Condition

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Effect of Bragg diffraction on CTR scattering intensity under Bragg condition which has been predicted by our dynamical calculations [1] and shown to be sensitive to the atomic structures near crystal surfaces[2].

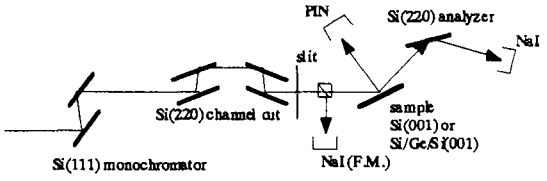

Fig. 1. Experimental arrangement.

Figure 1 shows the schematic view of the experimental arrangement. The SR beam, premonochromatized by Si(111) double crystal, was further monochromatized by two Si(220) channel-cut crystals arranged in the (+ +) setting geometry. Samples were placed on the multi-axis diffractometer designed for surface and interface studies. A Si(001) single crystal and a Si(800Å)/1MLGe/Si(001) delta-doped crystal were used as sample to confirm our calculations. We investigated the CTR scattering intensity along the 00 rod during incident angle scans around the 555 Bragg point. The intensity of 555 asymmetric Bragg reflection was monitored by PIN photodiode, while the CTR scattering was analyzed by a Si(220) single crystal at each incidence angle. The wavelength for the Si(001) sample was fixed at 1.241Å. In this case, the Ewald sphere intersects the 00 rod at a point close to the 004 Bragg point. On the other hand, the wavelength for the delta-doped sample was fixed at 1.220Å, which gets the intersection point far away from the Bragg point. In fact, by our calculation, the modulation profiles near Bragg points are no longer sensitive to surface structures. Thus, in the former case, the modulation profile should be expected to contain only the bulk information, while in the latter case the different type of modulation profile from the former's could be expected which is due to the cap layers of the latter sample. The result for Si(001) sample, as shown in Fig. 2, agrees well with the prediction, and that for delta-doped sample is in the process of analysis.

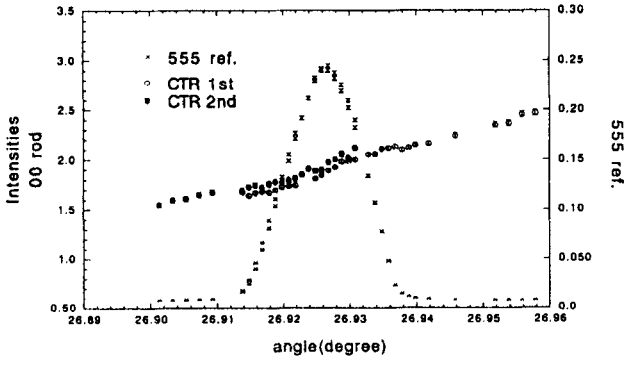

Fig.2. Experimental result for Si(001)

[1] T. Takahashi and S. Nakatani: Surf. Sci. 326 (1995) 347-360. [2] W. Yashiro: Master thesis at the University of Tokyo (1997).