# X-ray Photoelectron Diffraction (XPD) Analysis of Sb/GaAs(110)

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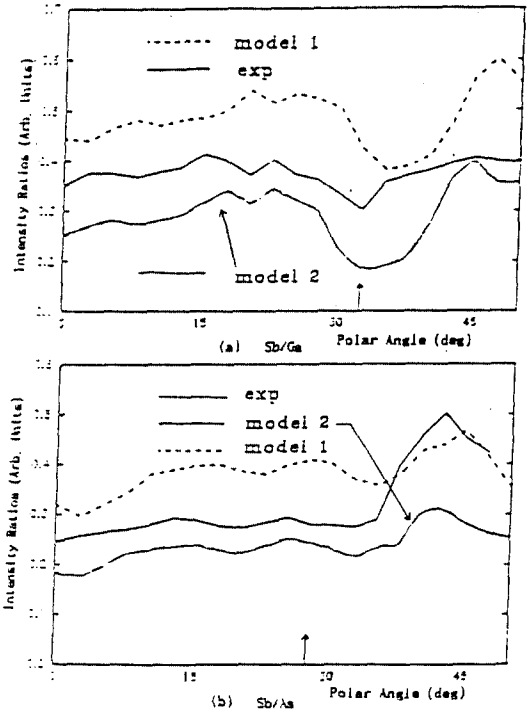
XPD is by now becoming a widely used probe of structures of surfaces. The X-ray photoelectron peak intensity of a core level from a single crystal generally shows a large variation both along the polar and azimuthal take-off angles. In XPD experiments, we use the X-ray sources which have higher energy than 1 KeV and we can consider only the forward scattering in this high energy range. Therefore, the diffraction of high energy electrons can usually be calculated considering only single scattering without serious error.(Single Scattering Cluster theory)

Since GaAs is well cleaved along the [110] direction, many groups have investigated the surface adsorptions on GaAs(110) including Sb/GaAs(110). They have elucidated the ordered overlayer structure of Sb/GaAs(110) and proposed some models, on which our models were based, to describe the detail geometry.

We could get the clean GaAs(110) surface by cleaving an n-type GaAs under the pressure less than $1\times10^{-9}$mbar. The XPD patterns for the clean GaAs(110), which are the intensity ratios of Ga3d and As3d along the azimuthal and polar angles of the sample relative to the detector, determined the orientation of the sample by being compared with the known patterns.[1)]

Sb was evaporated to form the overlayer, and we could get the XPD patterns of the intensity ratios of Ga3d/As3d, Sb4d/As3d and Sb4d/Ga3d. Then we compared the experimental patterns and the model calculation patterns. Figure shows a polar XPD pattern of Sb4d/Ga3d and Sb4d/As3d at a fixed azimuth. From these and other XPD patterns, we could conclude that the model 2 geometry, in which the zigzag chains of Sb atoms bridge the chains of Ga and As atoms on a nearly unrelaxed GaAs(110) substrate, is the better-fit to the experimental real geometry.

In principle, we can obtain the best-fit model by minimizing the standard deviation (the reliability factor).




1) 이 덕형, 박사학위논문 (서울대)