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# Structural study of buried Si(111)-5×2-Au by GIXD

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## Introduction

Nanostructures or low-dimensional structures fabricated by metal adsorption on semiconductor surfaces exhibit a variety of exotic physical phenomena and have attracted considerable interest in recent years both academically and technologically[1]. We study the Si(111)-5×2-Au surface which is a superstructure induced by a submonolayer of gold atoms on the Si(111) substrate, and has one dimensional structure of the Au atoms. The precise arrangement of the surface atoms, however, has not been determined yet. Hitherto three structural models have been proposed; one is the model proposed by Marks and Plass[2] from the measurement of TED, and the other two models are proposed by Erwin[3] and Riikonen[4] based on the first principles calculations. Information on this structure is important for understanding of surface properties such as kinetics and electronic features.

The systems of metal on Si substrate are expected to be utilized industrially, such as quantum wiring. The Si(111)-5×2-Au surface is one of the most studied surfaces because it has a chained structure of Au atoms. From the view point of application, it is interesting to investigate whether such a one-dimensional structure is kept when the Si(111)-5×2-Au surface is buried by the deposition of amorphous material. The surface structure is widely studied, but the research on its buried structure is few.

## Result and Discussion

In this study, the Si(111)-5×2-Au structure capped with silicon was investigated by grazing incidence X-ray diffraction (GIXD). We evaluated the most probable model as the interface structure by comparing the experimental intensities with the calculated intensities for the three models. The measurements of GIXD were performed at BL15-B2, where a six-circle X-ray diffractometer is installed.

The sample of capped Si(111)-5×2-Au was prepared in an ultra high vacuum chamber. The thickness of the capped layer was 35Å, which was controlled by a quartz oscillator.

The intensity distribution of GIXD in two-dimensional reciprocal space is shown in Fig. 1. We could get fractional order spots peculiar to 5×2 construction. From this result, the 5×2 superstructure, at least, is found to be kept in the interface. However the number of observed peaks was not enough to construct a new model. We could not get weak peaks because of large backgrounds.

Least squares fitting analyses were used to compare the observed intensities of fractional order spots shown in Fig.1 with the calculated intensities for the three models. The result indicated that the Erwin model is the most probable model at the interface.

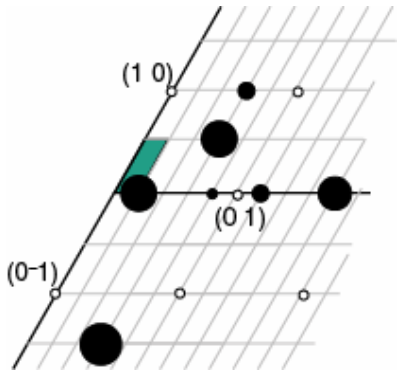


Figure1. Intensity distribution of fractional order spots observed for buried Si(111)-5×2-Au in GIXD.

## References

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