Anomalous oscillation of an X-ray equal-inclination fringe pattern observed in ultra plane-wave topographs

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Introduction

In a previous paper [1] describing an anomalous oscillation in space (image nonprojectiveness) of equal-thickness Pendellösung fringes, we also found that equal-inclination fringes due to a minute strain center in the crystal (near the exit surface) as well show a similar anomalous oscillation. In recent experiments of Pendellösung fringes, we observed a similar equal-inclination fringe pattern showing the anomalous oscillation with a better fringe resolution than before. This observation is reported.

Experiment and results

The experiment was conducted at BL15C. The specimen was a wedge crystal of less than 2 mm in thickness, cut from a high-quality FZ silicon block. The wavelength was tuned at λ_o= 0.81 Å, the beam incident on the specimen was collimated to 0.08" in angular divergence, against 0.34" in previous experiments, and monochromated to $\Delta\lambda/\lambda_o=4\times10^{-4}$ in wavelength spread against $\Delta\lambda/\lambda_o= 9\times10^{-4}$ in previous experiments. The 220 diffraction images of the specimen were recorded by way of simultaneous imaging onto multi-stacked films.

Fig. 1 shows a set of multi-film topographs taken as described above. White contrast indicates stronger intensity here. A roughly triangular image seen in the center of each topograph is the equal-inclination fringe pattern under discussion, due to a minute strain center. From various observations, we can safely assume that the black-and-white contrast of the image is of phase contrast showing equal-inclination fringes, although strict verification is left to a future work. The background black-and-white pattern is of the main Pendellösung fringes. Nearly horizontal, faint fine striations show subsidiary fringes [2].

It is obvious that the image under discussion shows an oscillatory change among the whole multi-film topographs. It should be noted that images at front positions (near to the specimen) appear recurrently at rear positions, as T 1→T 5 (and T 6), T 2→T 8, T 4→T 7, *etc*., although the recurrence does not proceed in exactly regular way. Furthermore, steps of the continuous change of the image can be followed to some extent in the ten topographs shown. The oscillatory change with such features is quite similar to those of previous moiré and equal-thickness Pendellösung fringes. The analysis of such equal-inclination fringes would be useful for ellucidating this anomalous fringe oscillation problem.

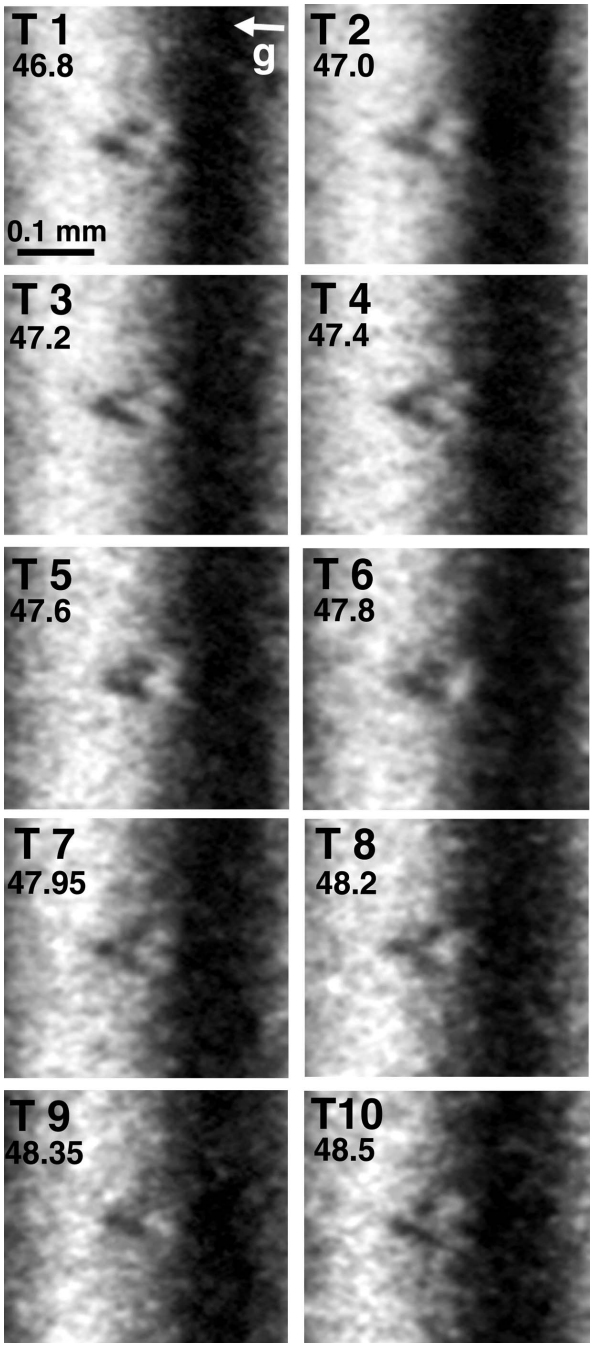

Fig. 1. Multi-film topographs showing an equal-inclination fringe pattern. Diffracted-wave image. Upper-left figures give the specimen-to-film distance in mm. Fuji #80 films (single-coated) were used. Exposure time was 25 s.

References

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