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Anomalous oscillation of X-ray Pendellösung fringes observed under ultra plane-wave condition (ω = 0.08”); topographic observation

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Introduction

We have conducted experiments of anomalous oscillation in space (image nonprojectiveness) of moiré and Pendellösung interference fringes of X-rays [1]. During the past year, the experimental research has been extended so as to use much more parallel and monochromatic beam than before. In this ultra plane-wave experiment the oscillation of Pendellösung fringes from a silicon wedge crystal was observed with a significantly improved clarity with larger amplitude than in previous experiments.

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. By repeating asymmetric diffraction at monochromators crystals, the beam incident on the specimen was collimated to ω=0.08” in angular divergence, against ω=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 was recorded by way of simultaneous imaging onto multi-stacked films

Fig. 1 compares six successive member topographs of all ten multi-film simultaneous topographs in one set. White contrast indicates stronger intensity here. Equal-thickness Pendellösung fringes run vertically with a spacing of Λ=0.352 mm. Compare, for example, the topographs at heights indicated by arrows *A*, *B* and *C*. It is noted then that the distances between neighboring fringes and the local orientations of fringes oscillate among the multi-film topographs. The fringe oscillation here is produced with a much larger amplitude than in previous topographs with ω=0.34”, so that the oscillation is easily recognized by visual inspection of the topographs. In addition, anomalies in the fringe profile become more noticeable, and details of subsidiary fringe patterns [2] appear more clearly under this ultra plane-wave condition.

References

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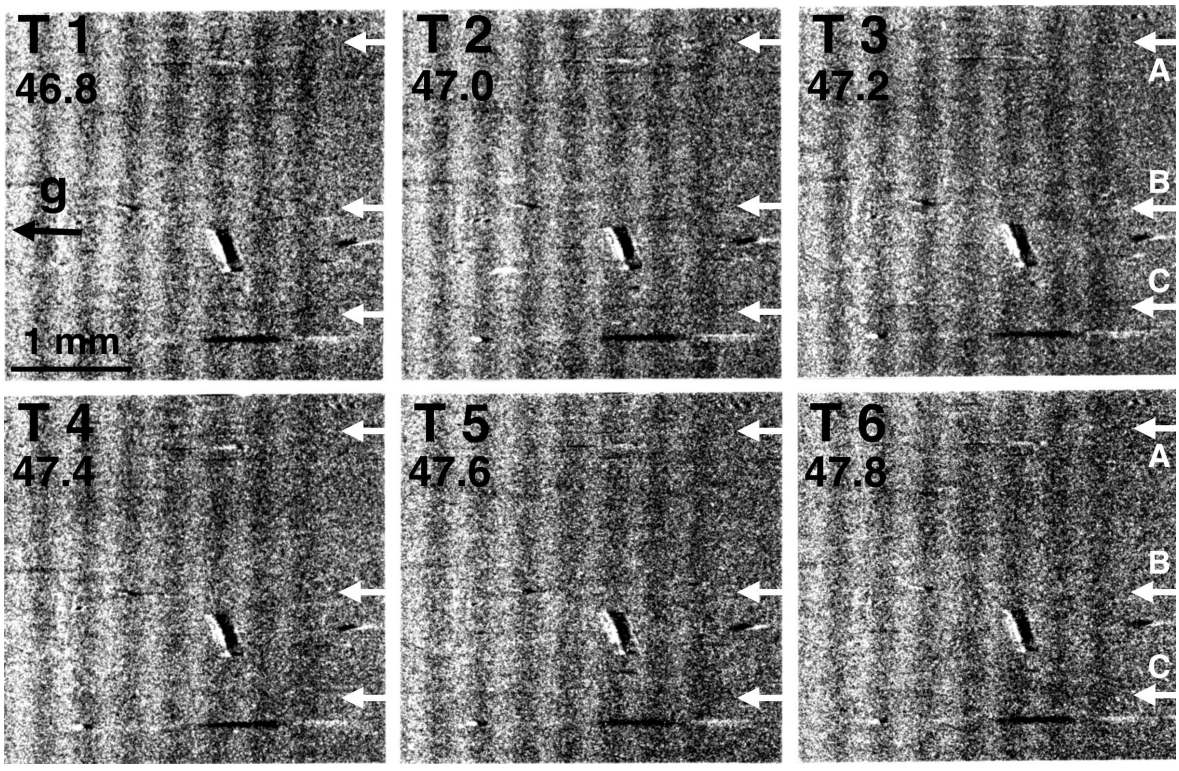

Fig. 1. Multi-film topographs showing Pendelloesung fringes. Diffracted-wave image. Taken at a deviation angle from the diffraction peak Δθ = -0.25”. Exposure time was 25 s. Upper-left figures gives the specimen-to-film distance in mm.