

# Fine subsidiary fringe patterns appearing in X-ray Pendellösung and moiré fringes

Jun-ichi YOSHIMURA<sup>\*1</sup>, Keiichi HIRANO<sup>2</sup>, Xiaowei ZHANG<sup>2</sup>

<sup>1</sup>Faculty of Engineering, Yamanashi University, 4-3-11 Takeda, Kofu, Yamanashi 400-8511, Japan

<sup>2</sup>Photon Factory, High Energy Accelerator Research Organization, Tsukuba, Ibaraki 305-0801, Japan

## Introduction

Regarding X-ray Pendellösung- and moiré- fringed diffraction images taken by plane-wave topography, anomalies in the fringe profile such as asymmetric profile and an anomalous spatial oscillation of fringes (called image nonprojectiveness so far) have been reported [1] as anomalies unexplained by the current diffraction theory of X rays. In addition to these anomalies, the presence of fine faint extra subsidiary fringe patterns (hereafter subfringes) superposed on the main Pendellösung or moiré fringes should be pointed out as another anomalous experimental fact.

## Results

Fig.1 shows, as an example, subfringes accompanying Pendellösung fringes, in two topographs taken from the same sample by the single film successive imaging [2] with a time difference 30 s and the sample-to-film distance varied by 0.40 mm. The experiment was made at BL 15C, and the experimental method has been described in a previous report [2]. Thick vertical fringes are Pendellösung fringes as the main interference pattern. White contrast indicates stronger intensity here. Subfringes with a good clarity can be seen in areas noted by arrows. In areas indicated by vertical arrows, fine fringes lying in the nearly horizontal direction and crossing the main Pendellösung fringes at nearly right angle can be seen. In areas with horizontal arrow fine subfringes running nearly parallel to the main fringes can be seen. More than one system of subfringes exists like this. The spacing of subfringes ranges from one part in a few tens to more than one tenth of that of the main fringes. Subfringes appear in antinodal as well as nodal positions of main fringes, and are seen to continue between the nodal and antinodal positions. Furthermore, subfringes appear in the whole field of main fringes, in the area where main fringes have a high contrast as well as in that of low-contrasted main fringes.

Finally, comparison of Figs. 1(a) and (b) shows that the subfringe pattern changes greatly between the two topographs so as to give a nearly full change of the subfringe pattern, whereas main Pendellösung fringes do not change so much as to be clearly recognized by visual inspection (the change of the main fringes can be found by fringe profiles). Like this, subfringes make a much larger nonprojective change of the fringe pattern than the main fringes. This fact indicates that there is a close connection between the occurrence of subfringes and the nonprojectiveness of the whole interference-fringed image.

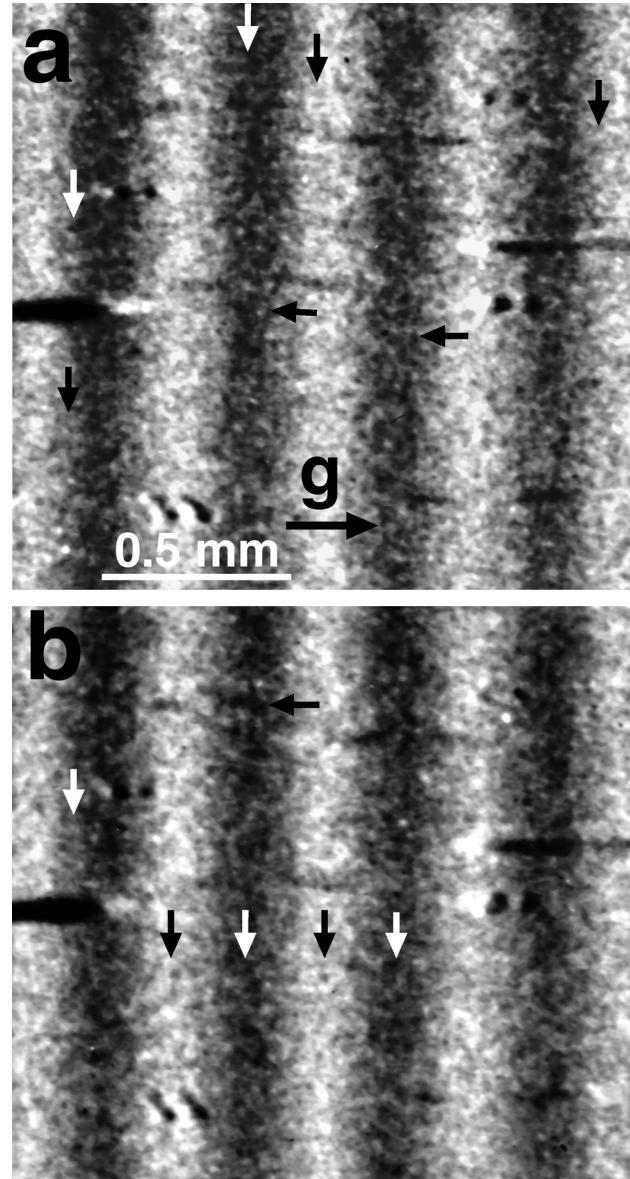


Fig.1. Topographs showing subfringes in a Pendellösung fringe pattern. Si 220 refl., wavelength used 0.71 Å.

## References

- [1] J. Yoshimura, J. Synchrotron Rad. 7, 374 (2000).
- [2] J. Yoshimura, K. Hirano & X. Zhang, PF Activity Report #17, 311 (2000).