Phase Imaging with X-ray Talbot Interferometer Using Gratings Fabricated with LIGA Process

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X-ray phase imaging attracts increasing attention in this decade. X-ray Talbot interferometry (XTI) has been proposed as a novel X-ray phase imaging and phase tomography [1, 2]. In this paper we demonstrate a phase measurement and tomographic image reconstruction with high-energy X-rays, which was realized by using gratings fabricated by the Lithographie, Galvanoformung, Abforming (LIGA) process. Higher-energy XTI makes it possible to capture wide-area phase images for large and thick biological and polymer samples.

The XTI uses two transmission gratings. When a transmission grating is illuminated by coherent X-rays a periodic pattern (self-image) is generated at specific distance from the grating, which is known as the ‘Talbot effect’. If a sample is placed in front of the grating, the self-image is correspondingly deformed, where differential phase shift by the sample is involved. In the XTI the deformation is then depicted as a moiré pattern, which is formed by the second grating placed on the self-mage.

For high-energy XTI the gratings are required to have a period of less than several microns and a high aspect ratio (more than 10 for an amplitude grating) to generate high-contrast moiré fringes. It is, however, difficult to fabricate such a grating with conventional techniques, especially when the period approaches one micron. The LIGA process is a promising method for fabricating such a grating. The LIGA allows us to make not only high-aspect-ratio but wide-area gratings, which is favorable for large and thick materials. We fabricated a grating using the LIGA process, and phase imaging and phase tomography of biological samples was successfully demonstrated.

[1] A. Momose, S. Kawamoto, I. Koyama, Y. Suzuki, *Jpn. J. Appl. Phys.* **42** (2003) L866.
[2] A. Momose, S. Kawamoto, I. Koyama, Y. Suzuki, *SPIE Proc.* Vol. 5535 (2004) 352.