X-ray phase scanner using Talbot-Lau interferometry for non-destructive testing

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X-ray grating interferometry has a great potential for X-ray phase-contrast imaging over conventional X-ray absorption-contrast imaging which does not provide significant contrast for weakly absorbing objects and soft biological tissues [1]. An attempt has been made to use X-ray phase imaging method with Talbot-Lau interferometer [2] using laboratory X-ray source for non-destructive testing. This paper represents development and overview of an X-ray phase scanner available for moving samples.

The phase scanner consists of vertical cone beam X-ray source installed at bottom, three optical gratings mounted at middle and an image detector placed on the top (Fig. 1). The optical gratings are mounted horizontally and perpendicular to X-ray beam using mechanical stages. The sample stage is located between phase and absorption gratings and moves across the X-ray beam as that of conveyor belt system. An image detector (*Hypix-3000*) developed by Rigaku, Japan is used to capture a movie of moiré pattern. The detector is a photon-counting two-dimensional hybrid pixel array semiconductor detector having an active area of 77.5 mm x 38.5 mm with a pixel size of 100 μm x 100 μm. With Talbot-Lau interferometer configuration, a moving sample can be scanned at speed of 5 mm/s with 200 μm spatial resolution. Absorption, differential-phase, and visibility images are generated by processing the moiré movie with our specially developed phase-measurement algorithm. This scanner will be used to study the feasibility of X-ray phase imaging for non-destructive testing in combination with a conveyer system in the future.

REFERENCES

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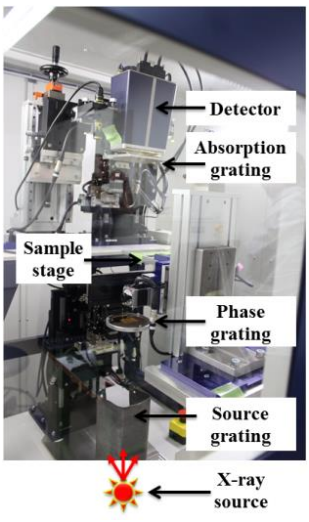

Fig.1: X-ray phase scanner