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NEW OPTICS FOR SOFT X-RAY PTYCHOGRAPHY

There is growing interest in combining soft X-ray ptychography with spectroscopy and applying it to the study of functional materials and biological systems in situ [1-3]. Realising the full potential of this method depends on efficient nanofocusing of the X-ray beam. Fresnel zone plates (FZP) are commonly employed, but their efficiency is typically less than 10% [4]. Achieving higher efficiency generally demands complex nanofabrication strategies that require replacing the radially concentric pattern of opaque and transparent zones with one that approximates a structure with continuous variation in thickness [5].

A linear tilted zone plate (LTZP) design based on a Kinoform optic [6], was optimised for use at the Soft X-ray Imaging (SXRI) beamline of the Australian Synchrotron [7]. The LTZP design aims to produce a continuous modulo 2π phase shift in the illumination using only planar nanofabrication methods. A continuous variation in projected thickness is achieved by tilting a particular planar geometric design with respect to the incident beam. By varying the tilt angle, high efficiency can be achieved over a wide X-ray energy range.

The LTZP was successfully fabricated using electron beam lithography (EBL). Efficiency better than 70% was demonstrated using a photon energy of 320 eV. We will describe the design and fabrication of the LTZP optics and outline the potential improvements to multi-dimensional ptychographic imaging experiments that they can provide. We will also outline plans for further developments that exploit new nanofabrication capabilities based on grey-scale (3D) electron beam lithography and thermal scanning probe lithography.

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Keywords or phrases (comma separated)

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No

Are you an ECR? (<5 yrs</br>since PhD/Masters)

Yes

What is your gender?

Female

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