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# Fabrication and Characterization of Diamond X-ray Refractive Optics

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The compound refractive lens (CRL) made of single crystalline diamond material for focusing X-ray beam at synchrotron radiation and X-ray free electron laser (XFEL), especially high power and high photon energy sources, has become a promotive topic during the last decade. Plenty of advantages such as non-toxic, higher refractive power, mechanical and radiation hardness, thermal conductivity, as well as optical purity allow the diamond as a promising alternative material rather than conventional Beryllium to be manufactured as refractive X-ray optics. This work presents the homemade stack of 10 bi-concave two-dimensional (2D) diamond CRLs in radius curvature of 50 μm fabricated by femtosecond pulse laser ablation. The shape quality of the individual lens was evaluated by extracting a paraboloid fit of its height profile measured by a confocal scanning laser microscope, which could reveal the surface error right after the fabrication process. Furthermore, the performance of the CRL stack was determined at beamline P06 at DESY via Ptychography by retrieving the beam profile around focus where a diffraction-limited focal spot of 250 nm was achieved (Fig. 1 (a)) and the accurate wavefront error at the exit of the CRL stack (Fig. 1 (b)). The results from these methods of metrology both show that our diamond CRL, whether as an individual lens or as a stack of 10 lenses, provides an improvement in lens shape and beam focus quality over the commercially available beryllium and diamond CRLs [1]. In addition, we can manufacture a corrective phase plate (PP) to compensate for the residual aberrations introduced by the CRL stack [2] (Fig. 1 (c)).
Figure 1 Evaluation results of the diamond CRL stack

## I plan to submit also conference proceedings

No

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