Fabrication and Testing of a Lithium Compound Refractive X-Ray Lens*

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ABSTRACT

Compound refractive lenses (CRLs) are arrays of concave lenses used to focus x-rays. Their simple design and ease in implementation and alignment make them attractive as focusing devices.

Several factors are considered when designing CRLs. This includes lens material, method of fabrication, and alignment. Lithium is a desirable material because it provides the largest index of refraction decrement per unit absorption length of any low atomic number elements. However, it is a difficult material to handle and fabricate because it is rather malleable and more importantly, it reacts with moisture, and to a lesser extent, with oxygen and nitrogen in air. It also tends to adhere to molds and dies.

We report on the fabrication and performance of parabolic lithium lenses with 100µm radii. The lenses were fabricated in a high-precision press using computer numerically controlled (CNC) machined stainless steel parabolic indenters. The lens array consisted of 32 lenses with an expected focal length of 1.7 m at 10 keV.

Keywords: focusing, x-ray lens, Compound Refractive Lens, lithium

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