

Single Crystal Diamond Compound Refractive Lenses and CRL Transfocators

The beam coherence preservation capabilities of the beamline optical elements are compelled to evolve at pace with the rapidly advancing X-ray source. In the field of CRLs, Be and Al have been the go-to materials since the nineties. However, due to the inherent grainy structure of these metals, concerns regarding their coherence preservation are emerging. Single crystal diamonds could be the new workhorse material of CRLs in that they offer; an excellent heat conduction, high level of beam hardening, relatively low absorption and of course crystallinity.

The engineering challenges in developing deployable single crystal lenses are nevertheless not trivial exercises. JJ X-ray is presently maturing the production of single crystal diamond lenses using a laser to carve the optical profile and package the lens in a Cu disk – alike to the known principle with Be in a Kovar disk. There are three critical parameters in describing the quality of the laser carving A) roughness, B) waviness and C) the absorbing material length between successive lenses. In the current stage of development, a roughness of 130nm RMS and a waviness of 3.0 μ m RMS, both at the center of a parabolic, and a lens-to-lens distance of 23 μ m have been archived.