

Diamond in X-ray optics

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In the past, diamond has been studied for a long time with X-rays as a very interesting sample regarding crystal defects and their structural properties. Only more recently, with the advent of modern synchrotron X-ray sources, diamond has become a very important material as monochromator for conditioning the powerful beams generated by these sources. The advantages over silicon and germanium as the classical materials are the high heat conductivity, the low thermal expansion and the low absorption. Then also its application as polarising optical element was discovered. The prerequisite for the application of diamond is its availability as a highly perfect crystal, big enough to intercept the X-ray beams.

Today, diamond is widely used as highly efficient synchrotron X-ray monochromator and polariser, as beam splitter permitting to run several experimental stations on a single insertion device source, and also as window material for high power front ends. It has even given its name to a synchrotron research facility under construction in the United Kingdom. It seems that diamond is the only material capable to withstand the extremely “hot” beams generated by free electron lasers, the fourth generation light sources of the future.

After a short historical introduction the presentation will review the unique properties and the various applications and performances of diamond single crystals.