

High Efficiency Multilayer coated Blazed Grating for tender X-rays

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The tender x-ray range between 1.5 keV and 2.5 keV has potential interest for X-ray microscopy and spectroscopy techniques. But till today it is a grey zone for both grating and crystal monochromator systems. In particular plane grating monochromators have low transmission and large amount of stray light in this range, while crystal monochromators suffer from high heat load in normal incidence operation. A multilayer coating optimized for a high line density grating significantly improves its efficiency and makes it feasible for use at high energies.

A blazed grating with 2000 lines/mm has been manufactured at HZB using a mechanical ruling engine in combination with ion etching technique to reduce the blaze angle to a value below 1° . For the resulting blaze angle of 0.84° a multilayer period of 7.3 nm was calculated, deposited and analyzed at the University of Twente (NL) in collaboration with Tongji University (Shanghai, China) [1]. In order to cover the specified large energy range chromium and carbon have been chosen since none of them possesses absorption edges in the energy range between 600 eV and 5900 eV. All measurements reported here were carried out between 600 eV and 1900 eV using the reflectometer at the Optics Beamline [2] and above 2 keV using the compact reflectometer attached to the X-ray beamline KMC-1 at BESSY-II.

An extraordinary efficiency of 35 % was measured at 2 keV while a maximum efficiency of 55 % was achieved at 4 keV. In addition, the multilayer blazed grating shows a very strong suppression of higher orders. This feature can become of significant importance for future beamlines. The reason is understood and will be explained in this contribution in detail.

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References

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