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A compact and calibratable von Hamos X-Ray Spectrometer based on two full-cylinder HAPG mosaic crystals for high-resolution XES and RIXS

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In high-resolution X-ray Emission Spectroscopy (XES) crystal-based Wavelength-Dispersive Spectrometers (WDS) are being applied for characterization of nano- and microscaled materials. Thereby the so called von Hamos geometry provides high detection efficiency due to sagittal focusing using cylindrically bent crystals. To maximize the detection efficiency a full-cylinder optic can be applied.

A novel calibratable von Hamos X-ray spectrometer based on up to two full-cylinder optics was developed at the PTB. To realize the full-cylinder geometry Highly Annealed Pyrolytic Graphite (HAPG) [1] was used. Besides its good bending properties this mosaic crystal shows highly integrated reflectivity while offering low mosaicity ensuring high resolving power [2]. The spectrometer enables chemical speciation of elements in an energy range from 2.4 keV up to 18 keV. Using synchrotron radiation as a tunable excitation source resonant inelastic X-ray scattering (RIXS) can be carried out with the spectrometer. The design and commissioning of the spectrometer will be presented together with first results using synchrotron radiation as excitation source. The spectrometer combines high efficiency with high spectral resolution (ten times better than in commercial WDS systems) in a compact arrangement also suitable for laboratory arrangements.

References

- [1] H. Legall et al. (2006). Proc. FEL, BESSY FRAAU04, 798 –801
- [2] M. Gerlach et al. (2015). J. Appl. Cryst. 48, 2015, 1381-1390

Author: Mrs HOLFELDER, Ina (Physikalisch-Technische Bundesanstalt)

Co-authors: Dr KAYSER, Yves (Physikalische-Technische Bundesanstalt); Mr FLIEGAUF, Rolf (Physikalisch-Technische Bundesanstalt); Dr BECKHOFF, Burkhard (Physikalisch-Technische Bundesanstalt); Mr WANSLEBEN, Malte (Physikalisch-Technische Bundesanstalt); Mr WESER, Jan (Physikalisch-Technische Bundesanstalt)

Presenter: Mrs HOLFELDER, Ina (Physikalisch-Technische Bundesanstalt)

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