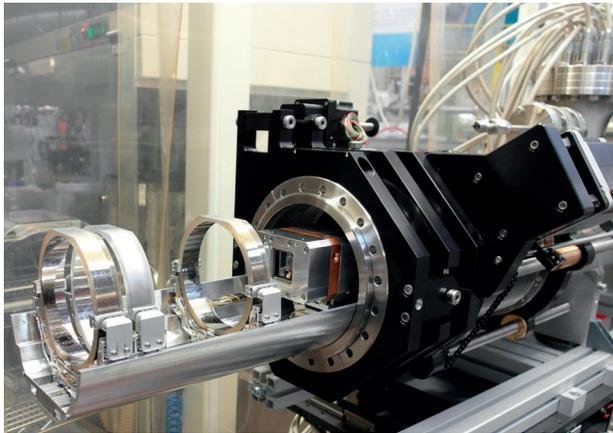


Calibratable von Hamos X-ray Spectrometer

Overview

- Calibratable
- Broad energy range: 2.3 keV – 20 keV
- Compactness and flexibility
- Higher signal-to-noise ratio
- Improved spectral resolution



Physikalisch-Technische Bundesanstalt
Abbestraße 2–12
10587 Berlin, Germany

Ina Holfelder
7.24 | X-ray Spectrometry

phone: +49 30 3481-7173
e-mail: ina.holfelder@ptb.de

Dr. Burkhard Beckhoff
7.24 | X-ray Spectrometry

phone: +49 30 3481-7170
e-mail: burkhard.beckhoff@ptb.de
www.ptb.de

Stand: 05/17



Physikalisch-Technische Bundesanstalt
National Metrology Institute

Calibratable
von Hamos X-ray Spectrometer



Calibratable von Hamos X-ray Spectrometer

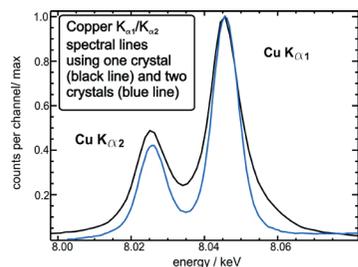
A compact and calibratable von Hamos X-ray Spectrometer based on two full-cylinder HAPG mosaic crystals for high-resolution XES and XAS

The further development and characterization of new advanced materials require high detection efficiency to prevent radiation damage and high spectral resolution to investigate their chemical speciation. Reference materials are often unavailable, hence calibrated instrumentation in terms of energy and photon intensity is needed. Therefore, a novel calibratable spectrometer has been designed and constructed. It is characterized by high detection efficiency as well as a high spectral resolution.

Technical Description

The spectrometer consists of two full-cylinder optics based on a 40- μm Highly Annealed Pyrolytic Graphite (HAPG) layer. The position for a third optic is included in the present spectrometer design. To detect the Bragg reflected fluorescence radiation, a water-cooled CCD camera is used. Three different measurement setups are included:

1. Using one optic for detection of an energy range from 2.3 keV up to 20 keV
2. Using two optics to achieve a higher signal-to-noise ratio and higher spectral resolution (energy range in first order reflection: 2.3 keV up to 10 keV; in second order reflection: 5 keV up to 20 keV)
3. Using two optics for one Bragg reflection to increase the spectral band width



Specifications:

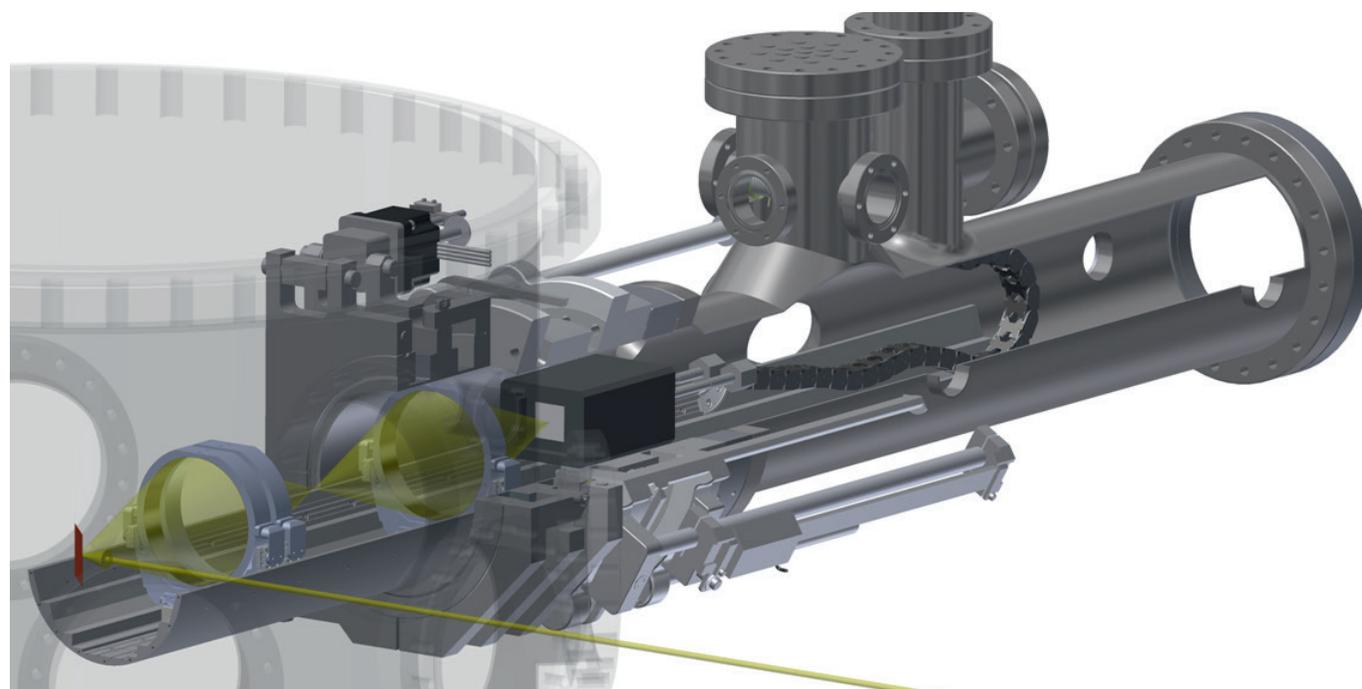
- Energy range: 2.3 keV to 20 keV
- Spectral band width: 500 eV (2.3 keV) to 700 eV (20 keV) when using one crystal
- Spectral resolution achieved: $E/\Delta E$ 1500 (Cu) to 2700 (V) depending on the energy (first order reflection) when using two Bragg reflections

Application fields:

- Analysis of chemical speciation
- Determination of atomic fundamental parameters
- Investigation of electronic structure (RIXS)

Status:

To validate the spectrometer performance XES experiments on copper and vanadium foils were performed at the synchrotron radiation facility BESSY II in Berlin, Germany. A spectral resolution better than $E/\Delta E$ 2500 has been detected for 4.9 keV (Vanadium K_{α} lines) when using two optics.



outer length: 1 meter