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BAMline 2.0 – further technical developments for a broader multipurpose hard X-ray beamline @ BESSY II (Berlin, Germany)

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The BAMline was the first hard X-ray beamline being installed at BESSY II in 2001 [1]. Owing to a 7 Tesla wavelength shifter (WLS) installed at the electron storage ring, a continuous broad energetic spectrum up to 100 keV is achieved. The available analytical methods fall into the three main groups: X-ray fluorescence spectroscopy (XRF), X-ray absorption spectroscopy (XAS) and X-ray computed tomography (CT).

An upgrade of this beamline is being currently carried out. The purpose is to achieve a broader range of analytical possibilities for questions regarding catalysis, 'green chemistry', material, biology, medicine or environment.

At the moment the double multilayer monochromator (DMM) consists of alternating layers of W/Si with an intrinsic energy bandwidth of 2.3 %. Although the reflectivity is high up to 50 keV, there is a sudden drop between 10-13 keV due to absorption of tungsten L-lines. This hinders applications, which deal with elements in this energy range. In order to overcome this, a multistripe coating DMM is being developed. Furthermore, one of the coatings is planned for a broader energy bandwidth, which is essential for applications that require a polychromatic beam in a single shot.

The properties of these coatings are summarized in table 1. A detailed explanation with concrete examples of applications will be presented.

Table 1 – Multistripe properties

Stripe 1 2 3

Layer structure Periodic Single Periodic

Layer Mo/B4C Pd W/Si

Periodic thickness d 2.9 nm 30 nm 2.9 nm

Γ 0.4 - 0.4

Number of bilayers 300 - 200

Optimal energy range 5-16 keV - 5-10 keV

15-60 keV

Bandwidth (@ 8 keV) ~1.3 % Total reflection ~3 %

References

[1] W. Goerner et al. BAMline: the first hard X-ray beamline at BESSY II. Nuclear Instruments and Methods in Physics Research A 467-468 (2001) 703-706.

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