Material Analysis
FOX2D CU 12_INF

Application Note n°AN-2D10

Xenocs
Reflecting Future Technology

S e t - u p

Source	Type:	Bruker rotating anode, Cu
	Working power:	1kW (50kV - 20mA)
	Size:	100 x 100 µm²
Optics	Model:	Xenocs FOX2D CU 12_INF collimating optics
Diffractometer	Model:	Bruker D8

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Fig. 1 : Bruker D8 X-ray diffractometer equipped with FOX2D optics.

Surface scattering and diffraction analysis of material microstructure

Data courtesy of Prof. E.J. Mittemeijer and Dr U. Welzel, Max Planck Institute for Metals Research, Stüttgart, Germany

I n t r o d u c t i o n

The Xenocs FOX2D CU 12_INF parabolic multilayer optic is one of the most versatile products to come out in the recent years. It is ideally suited for Small Angle X-ray Scattering and high resolution applications.

In addition to these traditional applications for collimating multilayer optics, other applications become interesting. Among these is the analysis of the anisotropy of the microstructure of polycrystalline materials employing parallel-beam geometry (see, for example, Welzel & Mittemeijer (2006) Powder Diffraction 20(4), pp. 376 - 392). Hence the FOX2D doubly-curved, single reflection optic proves to be a significant improvement for laboratory sources still equipped with double reflection optics.

E x p e r i m e n t

In the X-ray diffraction service group at the Max Planck Institute for Metals Research in Stuttgart Prof. E.J. Mittemeijer and Dr U. Welzel upgraded their rotating anode source (100 µm x 100 µm in point focus geometry, 1kW power) with a FOX2D CU 12_INF single reflection optic and obtained a significant gain in the diffracted intensity (between a factor of 4 and 15 depending on the beam size used) compared to the Kirkpatrick-Baez optic previously used.

The instrument has a broad range of applications, of which one example is given below: a sample of Ge islands grown on Si(001) by molecular beam epitaxy at the CEA Grenoble. The grazing incidence diffraction signal of these islands in the vicinity of the 220 reflection is plotted in red in Fig. 2. Data from such samples are generally recorded on synchrotron beamlines. To compare, the same measurement taken on BM32 at the ESRF in Grenoble is plotted in black.

Obtaining such a measurement with a laboratory diffractometer has been virtually impossible in the past due to a lack of intensity. With the use of the FOX2D single reflection X-ray optic however, the gap between laboratory and synchrotron diffraction measurements is narrowing.

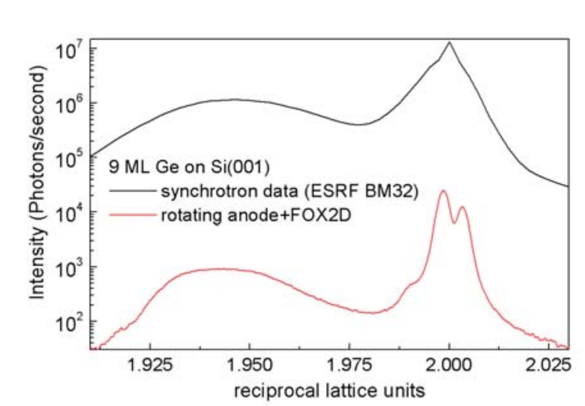

Fig. 2: : Radial scan across the 220 reflection of a sample of epitaxial Ge-islands on Si(001). The synchrotron data (Bending magnet 32 at the ESRF) are shown in black. The red curve was recorded from the same sample on a rotating anode equipped with a FOX2D CU 12_INF collimating optic.

C o n c l u s i o n

Upgrading the diffractometer with FOX2D CU 12_INF X-ray optics resulted in a significant gain in X-ray beam intensity. In addition to increasing the throughput of the diffractometer, it allowed experiments that previously had to be done at a synchrotron to be carried out in-house.

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