



Contribution ID: 197

Type: Poster

Some novel imaging and diffraction capabilities on B16 Test Beam Line at Diamond Light Source, UK

Friday, 27 November 2015 13:30 (45 minutes)

The development of micro- and nano-focusing optics is a key factor for the advancement of capabilities of modern synchrotron radiation beamlines. We present two newly developed micro-focusing optics systems recently commissioned at the B16 Test Beam Line at Diamond Light Source, UK: Compound Refractive Lenses (CRLs) and Kirkpatrick-Baez (KB) mirrors. These setups facilitate studies at the micro- and nano-meter length scale using both monochromatic and polychromatic radiation.

The main emphasis of B16 is placed on combining imaging and diffraction to study complex engineering materials such as alloys, ceramics, tissues and crystal structures. The results of four recent high resolution studies are presented in order to demonstrate the capabilities of the CRL and KB focusing arrangements:

1. Phase composition and residual strain mapping in a veneered zirconia dental prosthesis
2. Nano-scale mapping of lattice strain and orientation inside carbon core SiC fibres [1]
3. Development of an iterative algorithm capable of providing quantitative broadband Fresnel phase retrieval under white beam conditions
4. X-ray birefringence imaging to probe orientation properties of molecules and/or bonds in anisotropic solids [2]

References:

- [1] N. Baimpas, A.J.G. Lunt, I.P. Dolbnya, J. Dluhos & A.M. Korsunsky, Carbon 79 (2014) p. 85-92.
- [2] B.A. Palmer, G.R. Edwards-Gau, B.M. Kariuki, K.D.M. Harris, I.P. Dolbnya, S.P. Collins, Science 344, (2014) p. 1013-1016.

Keywords

B16 Diamond Light Source, Compound Refractive Lenses, Kirkpatrick-Baez Mirrors

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Session Classification: Poster Session 2

Track Classification: Beamlines, Instrumentation and Techniques