

Poster Presentation

MS27.P04

Recent Micro X-ray Focusing Optics and High-Pressure Applications at SPring-8

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We have developed unique x-ray focusing optics by using compound x-ray refractive lens (CRL) designated for the high-pressure XRD beamline BL10XU [1] of SPring-8. The CRL is a set of planar cross-lenses with a quasi-parabolic profile for focusing in two directions, and are fabricated from the SU-8 polymer by deep x-ray lithography at the IMT in Germany [2]. The focusing optics consisted by two sets of CRL and a pinhole in tandem. The set of the upstream CRL and the pinhole as a virtual source are used for generation of homogeneously divergent beam. The downstream CRL, which is placed between a pinhole and a focal point (sample position), is utilized for focusing the x-ray towards the micron size. The focused beam size is defined by the relationship between a pinhole diameter and the ratio of source-lens versus lens-focal point distances. We have succeeded in focusing the x-ray beam down to 2.4 microns in vertical and 2.1 microns in horizontal, as we had designed, under the following conditions: 30 keV x-ray, 10 micron pinhole in diameter and 11:1 ratio of source-lens:lens-sample distances. The beam flux, which was converted to flux density as about 1015 cps/mm², was enough strong to obtain XRD profiles in sub-second exposure, even at the sample condition under few hundred GPa. Using this system, we have obtained clearly distriected XRD profiles from sub-structures of microns size in DAC, such as electrodes for electrical resistance measurement, micro-anvils settled in the sample chamber, and so on. Micro-beam technique will bring us new applications for high-pressure experiments, and become more important in order to enhance precise analysis, such as grains/elements distribution, partial melting, solution and/or chemical reactions in a sample chamber of DAC, as well as in order to collect high-quality XRD under above 500 GPa. Furtehrmore, the sub-micron beam focusing is now achievable and will be a key-technique for a probe of a scanning XRD microscope.

[1] Y. Ohishi, A. Q. R. Baron, M. Ishii, T. Ishikawa, O. Shimomura, *Nucl. Instrum. Methods A* 2001, 467–468, 962–965, [2] V. Nazmov, E. Reznikova, A. Somogyi, J. Mohr, and V. Saile, *Proc. SPIE*, 2004, 5539, 235–243

Keywords: Micro beam, High-pressure, X-ray refractive lens