High-energy X-ray focused microbeam by using KB mirrors and sagittal bent Laue monochromator

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Introduction and Objectives

It is proven that the high-energy X-ray diffraction in terms of atomic pair distribution function (PDF) technique is a powerful tool for studying crystalline, disordered and nano materials [1-3]. Although there is increasingly demand for high energy X-ray microbeam in the fields of material sciences and high pressure geosciences, focusing a high energy X-ray beam down to microbeam size is still a challenge.

Results and Discussion

The double-Laue crystal monochromator (DLCM) has advantages of high angular acceptance, high photon flux and high thermal loading stability, making it well suited for providing the intense high-energy X-ray beam. The high-energy DLCM at the X17B3 beamline, the National Synchrotron Light Source (NSLS), Brookhaven National Laboratory, has a fixed energy at 80 keV for high-energy diffraction experiment[4]. However, acquiring PDFs using a large unfocused beam for high-pressure DAC experiments results in low intensity imposed by tiny sample chamber of the DAC and long-time data collection, making PDF measurement at pressures much higher than 10 GPa not yet possible [2].

In this conference, we present our recent progress in focusing the high energy X-ray beam to obtain intense microbeam by using KB mirrors in combination with sagittal bent Laue monochromator. Some examples of the compressibility properties of nanoparticles, such as n-Au, n-Ag and n-Pt, in the diamond anvil cell under quasi-hydrostatic conditions at high pressures will be presented.

Conclusions

We have obtained intense high-energy microbeam for decent high-pressure PDF measurements by a combination of KB mirrors with the bending DLCM focusing techniques.

References:

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