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BL11S2

XAFS measurements of Ge under high-pressure

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1．背景と研究目的

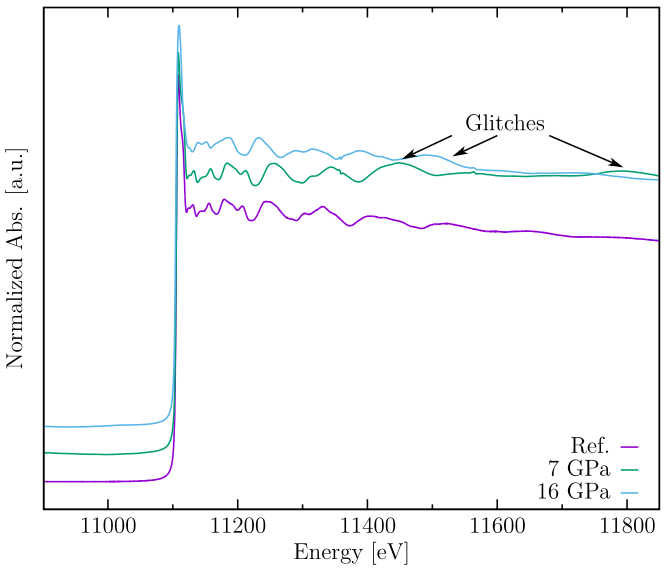
Experiments performed at high pressure conditions are of fundamental importance for discovering new phases of materials, synthesis of new materials and for studies related to geophysics. In laboratory, these conditions are created through the use of devices such as Diamond Anvil Cells (DAC). To observe the structural changes, X-ray diffraction is often used for crystalline materials, but in case of amorphous materials, like glasses, X-ray absorption spectroscopy (XAFS) is better suited. Although, XAFS experiments using a DAC present various challenges related to sample requirements (optimal thickness) and technical problems (Bragg diffraction from the diamonds, beam-size, etc.). During this beamtime, we wanted to test the feasibility of such type of experiments at BL11S2.

2．実験内容

We loaded a DAC with a mixture of powder Ge (purity 99.99%, 4N) and BN in order to have an optimal absorption thickness at the Ge K-edge. Ge was chosen because it has a phase transition at relatively low pressure (around 8 GPa) [1]. The DAC was then mounted on a metal plate and attached to the motorized sample holder of the beamline. Critical requirement for the experiment was to have a beam size smaller than the window available on the DAC (about 100 μm), so we used the poly-capillary available at the beamline. Thanks to carefully alignment and making use of the concavity of the DAC, we managed to have the focus close to the sample inside the DAC.

3．結果および考察

Initially the pressure of the DAC was set at around 7 GPa, determined by the flourescence of the ruby inserted inside the gasket together with powder mixture. Ge K-edge XAFS spectra were measured in transmission mode after careful alignment. Obtained spectra was similar to the reference sample, a pellet of Ge/BN, with oscillations shifted because of the bond contraction. After that, pressure of the DAC was increased up to about 17 GPa and measured again. Clear changes in the spectra are visible, confirming the phase transition. Some glitches are present, which are probably due to the diffraction of the X-rays from the diamonds. Similar effects can be seen on previously published data that used a similar setup[2]. Apart from this, the spectra quality is good.



4．参考文献

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