Hydrostatic compression of cristobalite(SiO_2) using SPEED1500

※M. Yamakata[1], N. Nishiyama[2], W. Utsumi[3] and K.Funakoshi[1]
1)Japan Synchrotron Radiation Research Institute, 2)Department of Earth Science, Ehime Univ. 3)Japan Atomic Energy Research Institute

Hydrostaticity of applied pressure affects not only the compression curve and phase transition pressure but also the crystal structure of high pressure phase. A previous study[1] reported that under hydrostatic condition, cristobalite, one of the polymorphs of SiO_2, transformed to a novel phase. This high pressure phase has a crystal structure very close to stishovite but its unit cell was slightly different from that. The crystal structure may be explained as a super lattice structure of stishovite, but its precise structure has not been determined yet. This is partly because of the smallness of the sample volume in the diamond anvil cell (DAC), which was used in the previous experiment. In this study, we utilized a large volume press for hydrostatic compression in order to obtain a precise x-ray diffraction signal from the sample.

The experiment was carried out using a large volume high pressure apparatus, SPEED1500, installed at BL04B1. Perfect hydrostatic condition is available only when liquid pressure transmitting medium is used. For this purpose, a teflon capsule filled with methanol-ethanol mixture (4:1 by weight) was embedded in the solid pressure medium. Cristobalite sample was placed in this teflon capsule. Fig.1 shows the two sample assemblies attempted in the experiment. The truncation length of the second stage anvil was 3mm. High pressure *in situ* observation was made using the energy dispersive powder x-ray diffraction technique.

In each experiment, the liquid pressure medium flowed out during the initial compression process so that hydrostatic condition was not achieved. It is thought that the teflon capsule deformed considerably with cell assembly. In order to prevent the liquid pressure medium from flowing out the capsule, it is necessary to optimize the capsule size and material. A metal capsule may have a good performance for this purpose.

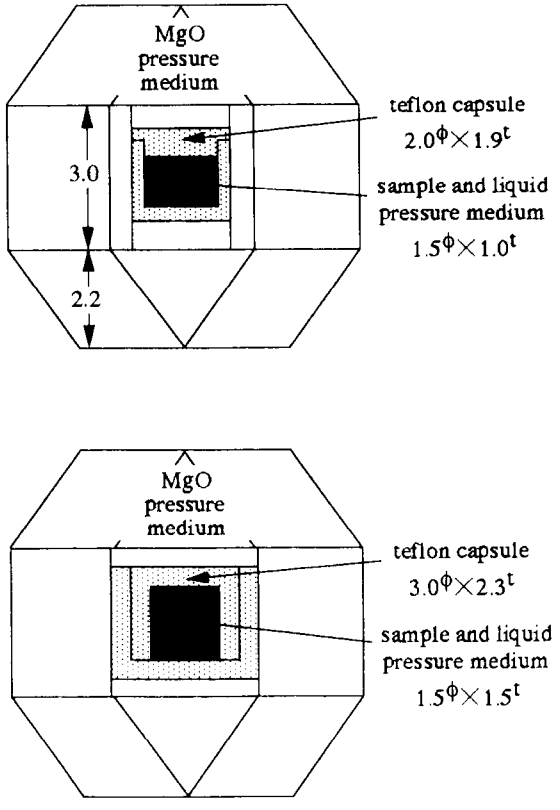

Fig.1. Sample assembly for hydrostatic compression.

References

[1] M. Yamakata and T.Yagi, *Proc. Jpn Acad.*, **73(B)**, 85 (1997).