X-Ray Diffraction Experiments on the Fe-FeS Eutectic Melt at 10 GPa

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The Earth's core has been believed to consist of iron and light elements, such as sulfur and oxygen. The physical properties such as density and viscosity of the molten iron alloys are the important factor governing the core-mantle separation process. These properties of molten iron alloy are closely related to its structure. Thus, we have conducted the structure analysis of the iron sulfide melt at high pressures using synchrotron radiation [1]. Here we report the results of trial experiments on the structure of Fe-FeS melts using the SPEED-1500 system installed at BL04B1.

High-pressure and high-temperature were generated by 6-8 two stage compression type high pressure apparatus. X-ray diffraction profiles were acquired by the energy dispersive method using white X-ray and Ge-SSD. The upper limit of Bragg angle was mechanically restricted to 13°, which is too small to analyze the structure of melts. The sample was a mixture of Fe and FeS with a molar ratio of 4 to 3, which is close to the eutectic composition of system Fe-FeS at 10 GPa.

The X-ray diffraction profiles of Fe-FeS eutectic melt were observed at 10 GPa and 1300°C (shown in Fig. 1). Although the sharp diffraction peaks from the solid materials surrounding the molten sample overlap the diffraction profiles of Fe-FeS melt, the oscillation in the hallow pattern of Fe-FeS melt are clear. However, pressure-induced structure change in Fe-FeS eutectic melt predicted by the viscosity measurement [2] is not detected. In order to perform the study on the liquid structure, it is necessary to improve the SPEED-1500 system.

References

[1] S. Urakawa et al., *The Rev. High Pressure Sci. Technol.*, 7, 286, 1998.
[2] G. E. LeBlanc and R. A. Secco, *Geophys. Res. Lett.*, **23**, 213, 1996.

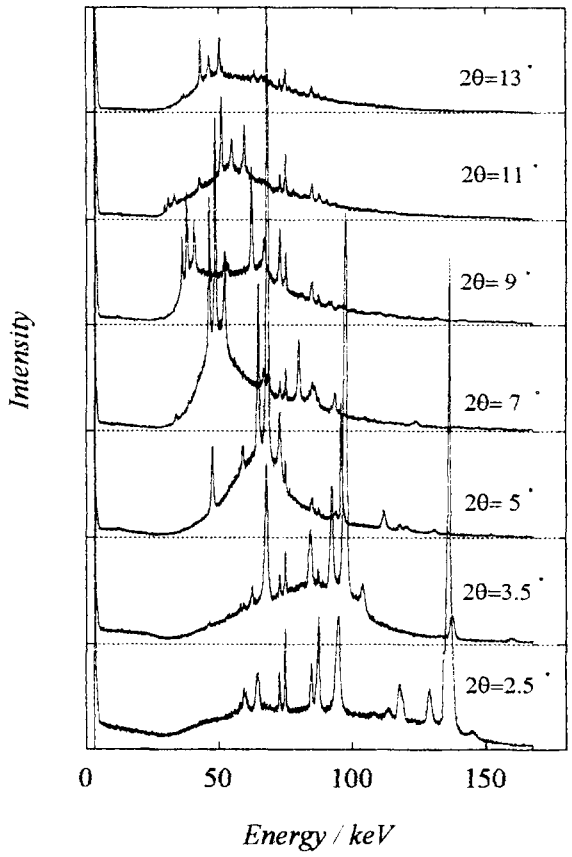

Fig. 1 Hallow pattern of Fe-FeS eutectic melt at 10 GPa and 1300°C. Peaks are the diffraction from the parts of pressure cell assembly.