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FeS の高圧下 X 線吸収スペクトル測定：Fe の K 吸収端近傍構造
High-pressure X-ray absorption measurement of FeS: K-edge absorption spectra of Fe

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Iron sulfide (FeS) is important material to consider the cores of terrestrial planets such as Earth and Mars. FeS has been known to undergo several structural and electro-magnetic phase transformations with increasing with pressure and temperature. FeS takes a troilite structure (FeS I) and antiferromagnetic insulator (T_N = 598 K) at ambient condition, and it undergoes three pressure-induced transitions from FeS I to FeS II (orthorhombic MnP related structure) above 3.4 GPa and then to FeS III (monoclinic phase), and further transition to FeS VI reported recently above 36 GPa. The structural transition from FeS II to III is accompanied by a loss of magnetic ordering induced by high-spin to low-spin transition of Fe. In this study, we observed electronic state of Fe in high pressure by X-ray absorption near edge structure (XANES) experiment combined with diamond anvil cell (DAC), for understanding the relation between structural transition up to FeS VI and electronic transition.

X-ray absorption experiments under high pressure were performed at the BL-3A in KEK-PF, Tsukuba, Japan. We compressed powdered FeS sample with NaCl and measured X-ray energy dependence of absorption in the range of X-ray absorption near edge structure (7.0-7.2 keV) until 47 GPa. It was irradiated in three different beam diameters 0.1 mm, 0.3 mm and over 0.5 mm. We analyzed the difference of spectral patterns caused by change of structure and beam size. Absorption edges did not show a significant difference in each structure. But the pre-edge of absorption edge became sharp with structural transformation to high pressure phase.

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