P-wave velocity of Fe_3S under high pressure and temperature

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Martian cores have been thought to include a certain amount of sulfur as a light element. Sohl and Spohn (1997) proposed seismic wave velocity and density profiles of the interior of Mars based on equations of state of core matrials although seismic wave velocities of core materials are needed for presice estimation. However, there have been only a limited number of works for V_P of Fe alloys with sulfur. In the Fe-FeS system, V_P of FeS and FeS_2 have been studied (e.g. Badro et al. 2007) but these compounds are not appropriate for the core materials of Mars because Fe_3S is a stable phase above 20 GPa corresponding to Martian core conditions (Fei et al., 1997, 2000) up to at least 200 GPa (Kamada et al., 2010, 2012). Therefore, Fe_3S is a subsolidus phase together with ε -Fe in the Fe-Fe_3S system at Martian core conditions and it is essential to study V_P of Fe_3S to understand seismic properties of the Martian core. We have measured sound V_P of Fe_3S under high temperature and pressure at BL35XU of SPring-8.
In this study, a synthesized Fe_3S was used as a starting material. A symmetric diamond anvil cell was used to generate high pressures. IXS(Inelastic X-ray Scattering) and XRD experiments were performed at the beamline 35XU of SPring-8, Japan (Baron et al., 2000). V_P of Fe_3S were measured up to 100 GPa and 2000 K. We will discuss temperature effect on the V_P of Fe_3S and the Birch's law and seismic wave velocity profile of the Martian core.

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