

Compressional velocity of hcp Fe-Si alloy by inelastic X-ray scattering and composition of the inner core

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The compressional velocity of hcp Fe_{0.89}Si_{0.11} (Fe-6wt%Si) alloy was measured at pressures from 45 to 84 GPa and temperatures of 300 and 1800 K using inelastic X-ray scattering (IXS) from laser-heated samples in diamond anvil cell (DAC). The measurement was made at beamline BL35XU of SPring8. The compressional velocity and density of the alloy are observed to follow a linear relationship at a given temperature. We found $V_p = 1.03 \times \rho - 1.45 + [3.8 \times 10^{-5} \times (T - 300) \times (\rho - 15.37)]$ including non-negligible temperature dependence for hcp-Fe_{0.89}Si_{0.11} alloy. The present results of compressional velocity and density of the alloy indicates that 3-6 wt.% of silicon in the inner core with the additional amount of nickel can explain the compressional velocity and density of the preliminary Earth reference model (PREM), assuming that the inner core temperature is 5500 K and silicon is the only light element in the inner core.

Keywords: Fe-Si alloy, Compressional velocity, Inner core