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The sound velocity measurements of Fe_3S

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Abstract

We measured the sound velocity of Fe_3S at room temperature up to 85 GPa employing inelastic X-ray scattering to better constrain the constitution of the inner core. The density of Fe_3S was also determined by X-ray diffraction under the same conditions. The relation of the P-wave velocity (v_P) and density (ρ) of Fe_3S follows Birch's law, $v_P(m/s) = 1.14(5) \times \rho(kg/m^3) - 2580(410)$. Based on Birch's law determined here for Fe_3S and that for ε-Fe reported previously, we found that sulfur decreases both density and compressional velocity of hcp-Fe at the core pressure and 300 K.

Keywords: Fe_3S, inner core, sound velocity, Birch's law, inelastic X-ray scattering