

High-pressure properties of *fcc* phase FeH_x

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Face centered cubic (*fcc*) FeH_x was synthesized at pressures of 18 to 68 GPa and temperatures exceeding 1500 K. Thermally quenched samples were evaluated using synchrotron X-ray diffraction (XRD) and nuclear resonant inelastic X-ray scattering (NRIXS) to determine sample composition and sound velocities to 82 GPa. To aid in the interpretation of non-ideal ($X \neq 1$) stoichiometries, two new equations of state for FeH_x were developed, combining an empirical equation of state for iron with two possible synthetic compression curves for interstitial hydrogen. Matching the density deficit of the Earth's core using these equations of state requires 0.62-1.52 wt% hydrogen, but a comparison of the sound velocities of Preliminary Reference Earth Model (PREM) to a Birch's law extrapolation of our experimental results suggests hydrogen cannot be the sole light element in the Earth's core.