

Hydrogenation of FeSi under high pressure

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ABSTRACT

Hydrogen is the most abundant element in the solar system, suggesting that hydrogen is one of the plausible light elements in the planetary cores. To investigate the solubility of hydrogen into FeSi and phase relations of the FeSi-H system under high pressure, we performed in situ X-ray diffraction experiments on the FeSi-H and FeSi systems at high pressure and high temperature. Hydrogen starts to dissolve in FeSi (hydrogenation) and form FeSiH_x with cubic B20 structure above 10 GPa. Hydrogen content (x), estimated from the volume difference between the FeSi-H and FeSi systems, increases from 0.07 to 0.22 with increasing pressure for $P > 10$ GPa. Comparing the present results with hydrogenation pressure of Fe, presence of Si in metal increases the minimal pressure for H incorporation. Hydrogen, therefore, can only incorporate into the Fe-Si core at the deeper part ($P > 10$ GPa) in the planetary interior.

Keywords: Hydrogen, FeSi, core, high pressure