Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

SIT036-P09 Room: Convention Hall Time: May 24 17:15-18:45

Hydrogen solubility into FeSi under high pressure

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Hydrogen is the most abundant element in the solar system. It is widely known that hydrogen can dissolve to various metals, such as Fe and Ni, under high pressures [e.g. Fukai, 1993]. Melting temperature of FeH decreases 600 K compared to that of Fe in the range of 10-21 GPa [Sakamaki et al. 2008]. Thus, if hydrogen dissolves into iron-light element alloy, such as Fe-S and Fe-Si, melting temperature of the alloy may show significantly lower temperature than those of binary iron-light element alloys. In this study, we performed high pressure X-ray diffraction experiment in the system of Fe-Si-H in order to investigate the hydrogen solubility into FeSi and melting temperature of this alloy.

High pressure experiments were carried out using 1500 ton Kawai-type multi-anvil device installed at BL04B1, SPring-8. FeSi powder was used as sample and $LiAlH_4$was enclosed as a hydrogen source at the bottom of NaCl capsule.

The experiments were carried out in the pressure range of 3-16 GPa. We also performed the diffraction experiments of FeSi alloy without using hydrogen source at the same conditions with the experiment of Fe-Si-H system in order to obtain the volume data and melting temperature of Fe-Si binary system. Hydrogen content was estimated from atomic volume difference between the sample and FeSi and the volume increase per hydrogen atom. Hydrogen solubility into FeSi alloy under high pressure and melting temperature of Fe-Si-H alloy will be discussed.

Keywords: Hydrogen, FeSi, Core, solubility, melting