

Fe-Ni-Water reaction at high pressure and high temperature

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The Earth's core is considered to be consisted mainly of iron with 5-15% nickel. Furthermore, it is suggested that the density deficit in the core is caused by some light elements. Hydrogen is one of the important candidates of light elements, considering the reaction between iron and water of the proto-Earth. In order to understand the transport process of hydrogen into the core, it is important to investigate a reaction between core material and water. We have studied the reaction in Fe-Ni-water system up to about 50GPa and 2000K by a laser-heated diamond anvil cell and in-situ X-ray diffraction measurements at KEK-PF:BL-13A. We observed the chemical reaction to form oxyhydroxide and hydride at 20GPa and 700K, while there was no reaction in pure iron system at the same condition. Then, The decomposition of (Fe,Ni)OOH into (Fe,Ni)H and (Fe,Ni)O was not observed up to 32GPa and 1400K. The results show that the amount of hydride is smaller in Fe-Ni-water system than that in the Fe-water system. Thus, the amount of hydrogen transported into the core in the early Earth was possibly smaller than ever expected.