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硫黄と酸素の存在下における核中の水素
Hydrogen in the core under the co-existence of sulfur and oxygen

山下智也 [1], 近藤 忠 [1*], 寺崎 英紀 [1], 亀卦川卓美 [2]
Tomoya Yamashita[1], Tadashi Kondo[1*], Hidenori Terasaki[1], Takumi Kikegawa[2]

[1] 大阪大学大学院理学研究科宇宙地球科学専攻, [2] 物質構造科学研究所
[1]Earth and Space Sci., Osaka Univ., [2]IMSS, KEK-PF

Hydrogen, oxygen and sulfur are important candidates of light elements in the Earth's core for considering reaction between metallic iron and water in the early earth. In this study, we investigated direct reaction between FeS and water to constrain the scenario in the core formation and the abundance of light elements in the core. Starting materials of FeS was confined with pure water in the hole of rhenium gasket. In-situ X-ray diffraction experiments under pressures and temperatures using laser-heated diamond anvil cell (LHDAC) were performed at KEK-AR-NE1A station, Tsukuba, Japan. After the sample was compressed to the nominal pressure at room temperature, it was heated to around the melting temperature of water ice. Pressures were determined using the equation of state of water ice VII (Somayazulu et al., 2008). The X-ray diffraction pattern at each condition was collected on an imaging plate. No ruby was used to avoid forming hydrous aluminous phase. High temperatures generate by a Nd:YAG laser driven in multimode were measured based on the emission spectra from the heated area. We performed the high P-T experiments up to 65GPa and 1700K and found that FeS reacts with H2O to form FeS2, FeH and FeO. No significant volume change was observed in high-pressure polymorphs of FeS and FeS2 indicating most hydrogen is preferentially incorporated into iron-hydride, FeHx, under the presence of FeS and FeO. This result is contrasted to the previous study on FeS-H2 system (Shibasaki et al., 2011) The recovered sample was examined by SEM-EDS and we found the sulfur rich portion than starting composition on the contact surface between water and FeS. This is consistent with X-ray observation of sulfur-rich phase. Furthermore, the stability field of delta-MOOH phase was significantly extended to higher pressure region comparing to that of Fe-H2O system (Ohtani et al., 2005). The delta phase eventually decomposed to hydride and oxide(s) around 35GPa. Hydrogen abundance X in the FeHx phase is 0.80-0.90 which is comparable to the Fe-H2O system. The results suggest that hydrogen in the FeS and its high pressure polymorphs were reduced under the co-existence FeO and FeH.

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