

実験報告書様式(一般利用課題・成果公開利用)

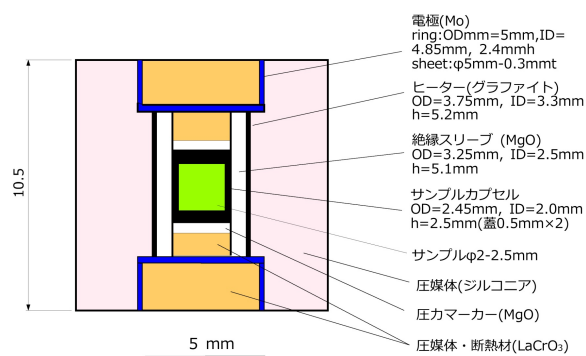
(※本報告書は英語で記述してください。ただし、産業利用課題として採択されている方は日本語で記述していただいても結構です。)

	承認日 Date of Approval 2014/8/27 承認者 Approver Takanori HATTORI 提出日 Date of Report 2014/8/18
課題番号 Project No. 2014A0049 実験課題名 Title of experiment: Hydrogen in Iron Formed by the Reaction of Iron, Silicate, and Water under High-Pressure and High-Temperature Conditions 実験責任者名 Name of principal investigator : Takehiko Yagi 所属 Affiliation : University of Tokyo	装置責任者 Name of Instrument scientist Takanori Hattori 装置名 Name of Instrument/(BL No.) BL-11 実施日 Date of Experiment 2014/6/2 & 6/4-6/8 (5 days)

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。(適宜、図表添付のこと)
 Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.

A powder mixture of Fe, Mg(OD)₂, and SiO₂ in the molar ratio of 2:1:1. This mixture was placed in the sample chamber made of graphite and compressed in the solid pressure transmitting medium as below.



2. 実験方法及び結果 (実験がうまくいかなかった場合、その理由を記述してください。)

Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.

In total five high pressure runs were made but “blow out” have happened in two of them. We have tested the sample assembly in advance at ISSP, University of Tokyo, many times without such problems. We have found that the anvils used at PLANET are very brittle and easy to break when it was used several times. It looks that the current design of anvils used at PLANET has some problems and we can reach only up to very limited P-T range. In order to overcome this problem, we are now designing new anvils and we have made preliminary tests but because of the limitation of machine time, we could not use it in the present machine time.

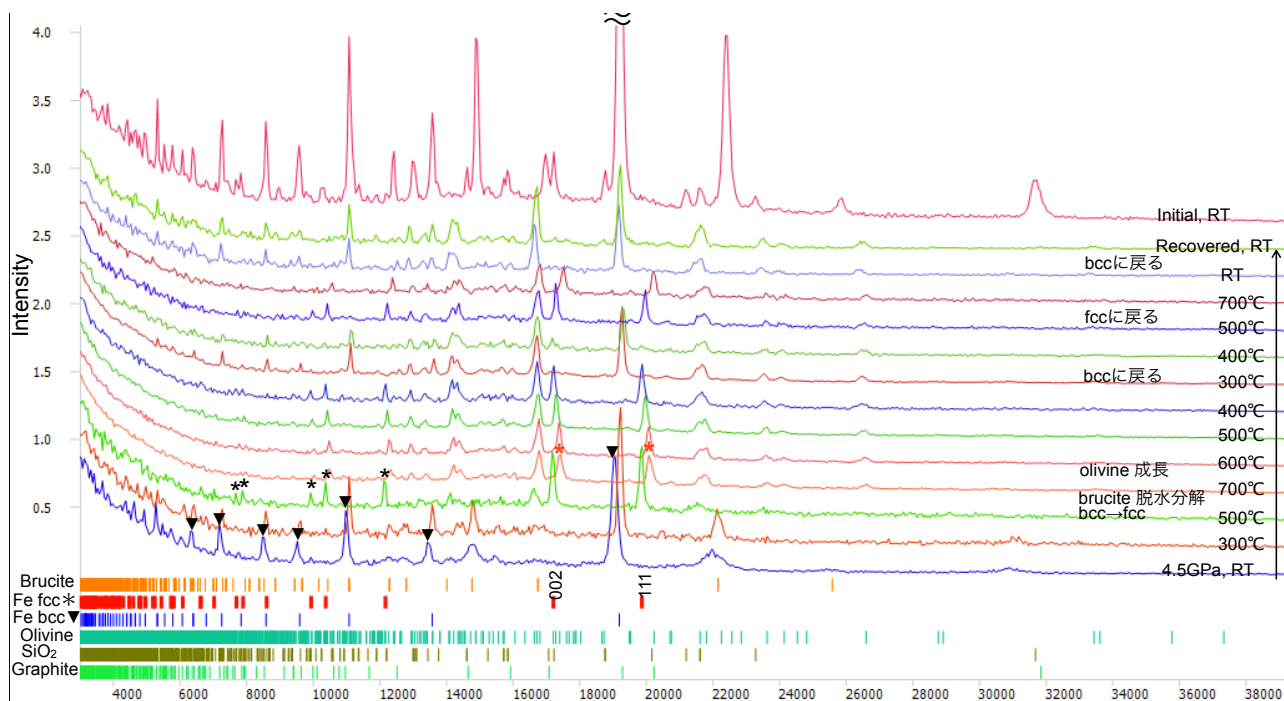
Another problem we have found was the dissolution of carbon to the sample. We have tested various materials for sample capsule. It has to satisfy the following conditions: high capability to seal hydrogen and high enough melting temperature to keep the molted sample. All the metals such as Pt and Re has melted below 1500 °C under the existence of hydrogen and graphite was the only material which satisfied these requirements but the amount of carbon dissolved into the sample was higher than we expected and we have lowered the temperature in the 5th run.

2. 実験方法及び結果(つづき) Experimental method and results (continued)

Various parameters of experiments are summarized below.

Run#	A0120	A0121	A0122	A0123	A0124
2nd Anvil	TEL7mm used TMS05	TEL7mm new TMS05*	TEL7mm new MF10	TEL7mm used TMS05*	TEL10mm used MF10
Cell assembly	ZrO ₂ cube with baked pyro pregaskets	ZrO ₂ cube with baked pyro pregaskets	ZrO ₂ cube with baked pyro pregaskets	ZrO ₂ cube with baked pyro pregaskets	ZrO ₂ cube (15mm) with ZrO ₂ pregaskets
Sample capsule	graphite	graphite	graphite	single crystal MgO	graphite
Pressure	800 kNまで	800 kN ~8.4 GPa	800 kN ~8.3 GPa	750 kN ~7.8 GPa	800 kN ~4.5 GPa
Temp.	RT	1400°C 実は 1800°C	900°C 実は 1150°C	300°C 実は 400°C	700°C
Products	B.O. @680kN during compression	Fe ₃ C + olivine	FeC? + olivine	B.O. @750kN during heating	Fe + olivine

Examples of the diffraction pattern we have obtained in run A0124 are shown below.



The quality of the diffraction patterns under high P-T conditions are quite high, as expected, but the P-T conditions we could reach was lower than that we have anticipated. Therefore we need some more experiments before we can get any conclusive results.