Chemical reaction between molten iron and silicates under the lower mantle condition

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Coexistence relation between iron and silicates is common not only at the present earth's core mantle boundary but also in the early stage of the earth. High pressure and high temperature reaction among these minerals and transportation of some elements to iron are important to know the structure and history of the evolution of the earth. Some studies on the same system have been performed so far by different groups to claim different results. In the last meeting we reported the results of subsolidus condition. We report here new results at higher temperatures obtained by in situ X-ray diffraction experiments using laser-heated diamond anvil cell combined with synchrotron radiation (KEK-PF:BL-13A). Starting materials are silicate perovskite, pyrope garnet and MORB glass for silicate component, and pure iron for metal. The thin foil of iron sandwiched by silicate plates was compressed in the rhenium gasket without pressure medium, then it was heated for 15-60 minutes from both side by multimode driven Nd:YAG laser up to melting point of the iron. The experimental pressure range was 20-80 GPa, which was determined by ruby fluorescence method or equation of state of platinum. The diffracted X-ray of the temperature quenched sample from about 30 micron area in diameter was collected using an imaging plate. The results show that no reaction to produce new alloy or oxide was not observed in the diffraction patterns other than the normally expected high pressure phases. Some of the recovered sample was examined by EPMA or ATEM to analyze a possible change of chemical composition of the iron. The preliminary results indicate that less than 1at% of oxygen or silicon dissolved to the iron. Further analysis are in progress and to be reported.