Pressure change of melting relations of the system Fe—FeS—FeO

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Planetary core is thought to be consists of iron nickel alloy and light elements, such as sulfur and oxygen. Melting relationships of the iron-light elements system are clue to elucidate the formation process and constituents of the planetary core. Core formation process is considered to proceed under the pressure up to several GPa in the planetesimals and planetary embryos. Here we focus a core of the small planetary bodies and report the results of melting experiments of the system Fe—FeS—FeO up to 3GPa.
Experiments were conducted by using the piston cylinder type apparatus and the KAWAI-type apparatus. Textural and chemical analyses of the recovered samples allow us to evaluate the pressure change of the melting relations in the system Fe—FeS—FeO.
Up to 10 to 20 GPa, the liquid immiscible region is an outstanding feature of the liquidus surface of the Fe—FeS—FeO ternary system. The liquid immiscible region between the Fe-rich metallic liquid and the O-rich ionic liquid extends from the Fe—FeO join towards FeS end. At atmospheric pressure, since the melting temperature of Fe is much higher than those of FeS and FeO, the ternary eutectic point is located near the FeS—FeO join and the Fe primary field extends to the FeS—FeO join. The melting temperatures of FeS and FeO increase significantly by pressure than that of Fe. This changes liquidus surface drastically up to 3 GPa. At 3GPa, the ternary eutectic point is located close to the Fe—FeS binary eutectic point, and the Fe primary field is restricted to the Fe—FeS join and the FeO primary field extends. The shifts of the ternary eutectic point from the vicinity of FeS—FeO join to the vicinity of the Fe—FeS join is thought to occur between 1.5 GPa and 3 GPa.
These changes of melting relationships of the system Fe—FeS—FeO with pressure affect not only the major composition of the core but also the partitioning behavior of minor and trace elements, especially of siderophile elements.

Keywords: planetary core, light elements, Fe alloy

