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Melting relationships of the Fe-Ni-S system at 15GPa

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The planetary core consists of iron-nickel alloy and lightening elements, such as sulfur and silicon. Study of melting relations of iron alloys is of important to understand formation, evolution, and the present state of the planetary core. An addition of nickel to iron affects significantly the phase relations of iron alloys. Here, we report the results of quenching experiments on the Fe-Ni-S system at 15GPa.

Phase relations of the Fe-Ni-S system at 15 GPa were studied by using a KAWAI type high pressure apparatus at Okayama University. Recovered samples were examined by the electron microprobe JXA-8230.

At 15GPa, $(Fe,Ni)_3S_2$ and $(Fe,Ni)_3S$ are stable as intermediate compounds at subsolidus conditions. Iron solubility of $(Fe,Ni)_3S_2$ is limited to Fe/(Fe+Ni)=0.76 at 1000K, although Fei et al.(1997) reported that Fe_3S_2 is stable at 14GPa and 1125K. $(Fe,Ni)_3S$ is stable at only the Ni-rich portion. Addition of nickel depresses significantly the melting temperature of the Fe-FeS system. Ternary eutectic point locates around $Fe_{12}Ni_{55}S_{33}$ and its melting temperature is lower than 900K.

Keywords: core, Fe-Ni-S system, phase relations