

Melting and phase relations of Fe-FeS system at high pressure and temperature and application to Martian interior

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The study of the melting relations in the system Fe-FeS at high pressure is important because iron alloys are believed to be the principal constituent of the core of the terrestrial planets, and sulfur is likely to be a major candidate for the light elements in the core.

We performed high pressure and temperature experiments to determine the stability fields and the melting temperature of 86wt%Fe-14wt%S, assuming the Martian core composition proposed by Dreibus and Wänke (1988). The experiments were conducted at pressures of 15GPa, 17GPa, and 19GPa, and temperature range from 800C to 940C. Chemical compositions of the recovered samples were analyzed by EPMA. At 15GPa and 17GPa, Fe and Fe₃S₂ phases appeared below the solidus temperature, and Fe and the melt coexisted above the solidus temperature. At 19GPa, Fe₃S and Fe phases are observed below the solidus temperature, and Fe and the melt are observed above the solidus temperature. The melting temperatures at 15GPa, 17GPa, 19GPa are 890C, 910C, and 930C, respectively.

Using these experimental data, we extrapolated the melting relation to the pressure of the Martian core (24.5GPa-40GPa). It is likely that the Martian core is partially molten, if we assumed a reasonable temperature distribution of the Martian interior.