

Phase relations in the system Fe-FeSi at 21 GPa

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ABSTRACT

High-pressure experiments were conducted to investigate the phase relations in the binary system Fe-FeSi at a pressure of 21 GPa and temperatures between 1350 and 2200 °C by using a multi-anvil apparatus. The system has a eutectic point at 26 wt% Si and 1820 °C, which is 400 °C lower than the melting point of pure Fe. On the Fe-rich side of the eutectic point, the temperature difference between the solidus and liquidus curves is less than 50 °C and the compositional difference is small between the coexisting solid and liquid. At subsolidus temperatures, homogeneous Fe-Si alloys were quenched with compositions up to 21.7 wt% Si. The more Si-enriched composition, Fe(+25.1 wt% Si), was found to coexist with CsCl-type FeSi. These results suggest that a large amount of Si could have dissolved into liquid Fe at high pressures during core formation if it occurred under reducing conditions. However, the difference in Si content between the outer core and the inner core would be very small, if the solubility of Si in solid Fe remains large at inner core pressures.