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Thermodynamics of melting relations in the system Fe-FeO

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Thermodynamics of melting relations in the system Fe-FeO was investigated to the outer core-inner core boundary (ICB) pressure from a self-consistent thermodynamic database for Fe and FeO phases which was evaluated from the latest static high-pressure and -temperature experiments. With the ideal solution model assumed for liquids at the ICB pressure condition, the eutectic temperature is 3680 K, which contradicts the results of the DAC experiments showing a solid assemblage Fe+FeO was stable up to 4200 K. Then, non-ideality of mixing for liquids was assessed to make the eutectic temperature consistent with the experiments. I will present a new solution model for the liquids in the system Fe+FeO in order to predict the eutectic composition under the core pressures, which compositions would put the limit of the oxygen content in the core because the density of solid FeO is too small to match the inner core density. From the Gibbs free energy for the Fe-FeO liquids, I calculated the density, sound velocity, and adiabatic temperature gradient of a hypothetical oxygen-bearing outer core. From the calculated density and sound velocity, I will discuss if oxygen can be a major light element in the core or not.

Keywords: core, thermodynamics, Fe-FeO, high-pressure