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The Melting Curve of Iron to 250 Gigapascals: A Constraint on the Temperature at Earth's Center

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ABSTRACT

The melting curve of iron, the primary constituent of Earth's core, has been measured to pressures of 250 gigapascals with a combination of static and dynamic techniques. The melting temperature of iron at the pressure of the core-mantle boundary (136 gigapascals) is 4800 ± 200 K. whereas at the inner core-outer core boundary (330 gigapascals), it is 7600 ± 500 K. Corrected for melting point depression resulting from the presence of impurities, a melting temperature for iron-rich alloy of 6600 K at the inner core-outer core boundary and a maximum temperature of 6900 K at Earth's center are inferred. This latter value is the first experimental upper bound on the temperature at Earth's center, and these results imply that the temperature of the lower mantle is significantly less than that of the outer core.

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