Viscosity of the Inner Core

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The Earth solid inner core (IC), composed mostly by iron, is a highly attenuating medium. This property of the core is at odds with the widely accepted paradigm of the hexagonal close-packed (hcp) phase stability under the inner core conditions, because sound waves propagate through the hcp iron without energy dissipation. We show by first-principles molecular dynamics that the body-centered cubic (bcc) phase of iron, recently demonstrated to be thermodynamically stable under the IC conditions, is considerably less elastic than the hcp phase. Being a crystalline phase, the bcc iron possesses the viscosity close to that of a liquid iron. The attenuation of the inner core is due to the unique diffusion characteristic of the bcc phase. The liquid-like nature of the bcc phase at extreme pressures and temperatures allow to resolve a number of controversies and explain enigmatic features of the Core.

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