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The global carbon cycle may involve iron carbide $\text{Fe}_7\text{C}_3$ as a major component of the Earth’s inner core. Testing the hypothesis of a carbon-rich inner core requires knowledge on the phase stability, density, and sound velocities of $\text{Fe}_7\text{C}_3$ under the corresponding pressure and temperature conditions. Here we report new x-ray diffraction spectra of $\text{Fe}_7\text{C}_3$ compressed to 1.7 Mbar, well into the pressure range of the Earth’s core. In combination with parallel measurements on $^{57}$Fe-enriched $\text{Fe}_7\text{C}_3$ using the synchrotron Mossbauer spectroscopy. Our data reveal two discontinuities in the compression curve, which we attribute to magneto-elastic coupling associated with pressure-induced second-order transitions. On the basis of the equation of state fitted to the XRD data above 60 GPa, we found that $\text{Fe}_7\text{C}_3$ provides a good match for the inner core density, supporting the notion that carbon is by far the largest reservoir of carbon inside the Earth.

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