

CO₂ Study Adds to Picture of Global Carbon Cycle

Scientific Achievement

Using inelastic x-ray scattering, discovered that carbon dioxide (CO₂) enters an amorphous phase, a precursor to crystalline superhard phases, at pressures lower than previously thought

Significance and Impact

Details may help yield a better understanding of the global carbon cycle, and the evolution and dynamics of Earth's interior

Research Details

- Data show CO₂ becomes an amorphous polymorph, a solid without long-range order, at 37 gigapascals (GPa) (equal to about 560 miles below Earth's surface), refuting previous reports of a transition near 50 GPa
- Phase change is evidenced by data showing a switch from double carbon-oxygen bonds to single bonds
- Study also resolves questions about the carbon atom's "coordination number," a measure of how the atoms pack together, in the amorphous polymorph. Coordination is fourfold, with each carbon bound to four O atoms, also taking the form of the short-lived species CO and CO₃.

SR Shieh, I Jarrige, M Wu, N Hiraoka, JS Tse, Z Mi, L Kaci, J-Z Jiang, YQ Cai, *Proc. Nat. Acad. Sci.* 2013 110 (46) 18402-18406

Work was performed at the SPring-8 synchrotron

Inelastic x-ray scattering data for CO₂ under pressure. X-ray scans were taken across the K edge of (a) oxygen and (b) carbon for pressures up to 63 GPa.

