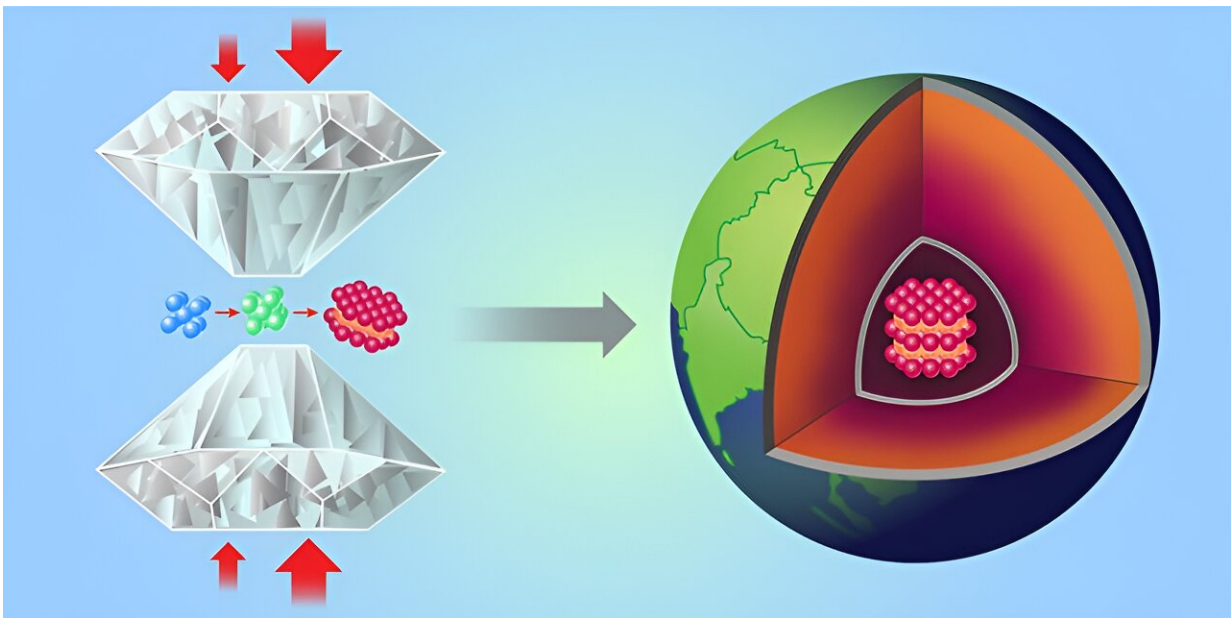


Physicists synthesize single-crystalline iron in the form likely found in Earth's core

August 4 2023, by Bob Yirka



By compressing a specific crystalline orientation of iron in a diamond-anvil cell, researchers have for the first time created a version of the metal in the structure that it likely takes in Earth's core. Credit: APS/C. Cain; S. Deemyad/University of Utah

A team of physicists and geologists at CEA DAM-DIF and Université Paris-Saclay, working with a colleague from ESRF, BP220, F-38043 Grenoble Cedex and another from the European Synchrotron Radiation Facility, has succeeded in synthesizing a single-crystalline iron in a form

that iron has in the Earth's core.

In their [paper](#) published in the journal *Physical Review Letters*, the group describes how they used an experimental approach to synthesize pure single-crystalline ϵ -iron and possible uses for the material

In trying to understand Earth's internal composition, scientists have had to rely mostly on seismological data. Such studies have led scientists to believe that the core is solid and that it is surrounded by liquid. But questions have remained. For example, back in the 1980s, studies revealed that seismic waves travel faster through the Earth when traveling pole to pole versus equator to equator, and no one could explain why.

Most theories have suggested it is likely because of the way the iron in the core is structured. Most in the field agree that if the type of iron that exists in the core could be made and tested at the surface, such questions could be answered with a reasonable degree of certainty. But doing so has proven to be challenging due to fracturing during synthesis. In this new effort, the research team has found a way around such problems and in so doing have found a way to synthesize a type of iron that can be used for testing the properties of iron in Earth's core.

The work by the team involved compressing a sample of α -iron at 7GPa. Doing so caused its temperature to rise to approximately 800 Kelvin. That led to the transformation of its structure into γ -iron crystals. More pressure pushed the γ -iron to form into ϵ -structure iron—single crystals that are believed to be the same types as those in the iron at Earth's core.

The research team conducted experiments that showed the directionally-dependent elasticity of their ϵ -iron behaving as iron does in the Earth's core, with vibrations traveled faster along one axis of a sphere than along the other. They suggest their approach can be used for generating [iron](#)

samples for testing theories regarding the makeup of Earth's core.

More information: Agnès Dewaele et al, Synthesis of Single Crystals of ϵ -Iron and Direct Measurements of Its Elastic Constants, *Physical Review Letters* (2023). [DOI: 10.1103/PhysRevLett.131.034101](https://doi.org/10.1103/PhysRevLett.131.034101)

© 2023 Science X Network

Citation: Physicists synthesize single-crystalline iron in the form likely found in Earth's core (2023, August 4) retrieved 29 April 2024 from <https://phys.org/news/2023-08-physicists-single-crystalline-iron-earth-core.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.