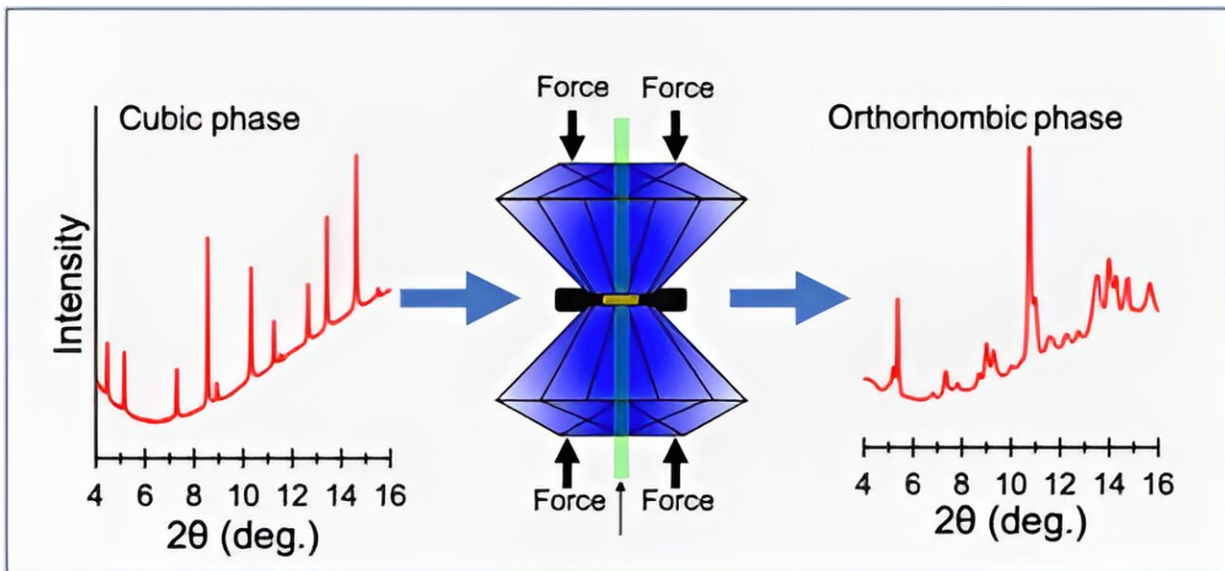


# How high-pressure techniques can induce changes in crystalline materials

May 15 2024



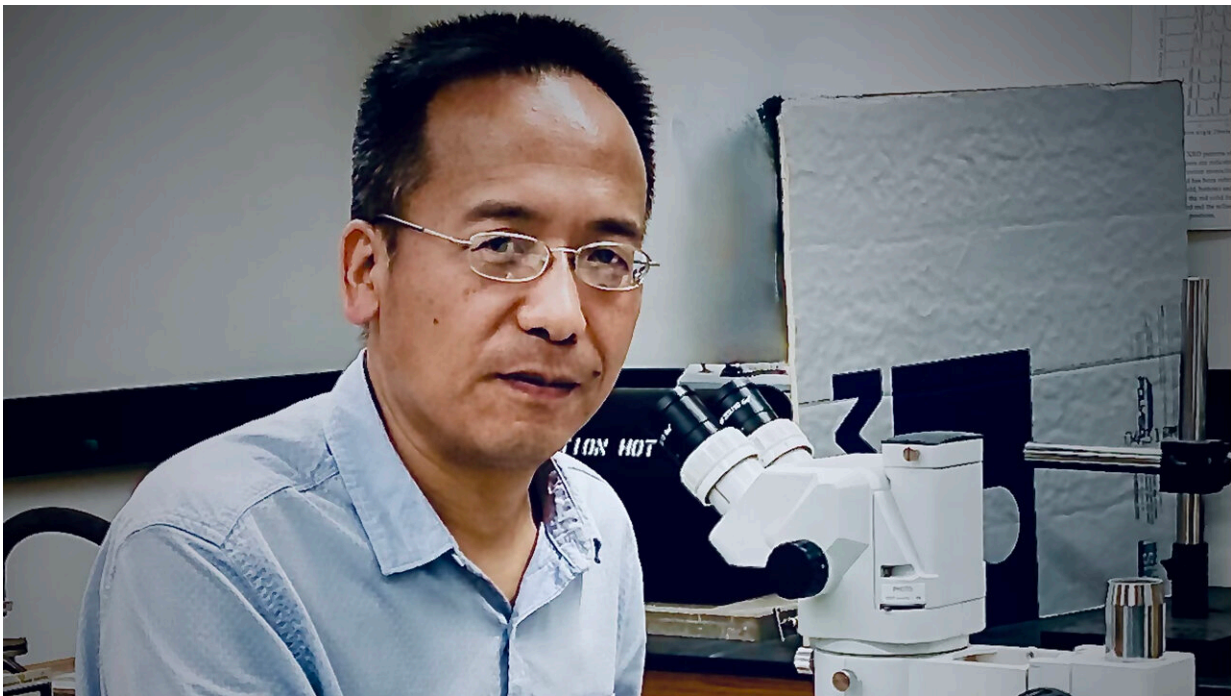
Graphical abstract. Credit: *Chemistry of Materials* (2024). DOI: 10.1021/acs.chemmater.3c02488

In an article published in *Chemistry of Materials* Oakland University Associate Professor of Physics Yuejian Wang explored how high-pressure techniques can induce changes in certain crystalline materials, similar to the way graphite can be converted into diamond when subjected to high pressure and high temperature.

"High pressure serves as a potent tool for unraveling the mysteries

concealed within material that remain undiscovered at room temperature and ambient pressure," Wang said. "By significantly altering the distance between atoms, pressure can dynamically modify crystal structures, leading to profound changes in [physical properties](#), as exemplified by the transformation between diamond and graphite.

"In the field of [high-pressure](#) materials science, we subject materials to high-pressure conditions and then utilize X-ray techniques, as well as other tools, to observe the resulting changes within the materials," he added. "Just as X-rays are used in [medical applications](#) to visualize internal structures of the human body, they can also be employed to detect and analyze the crystal structures within materials. This allows scientists to gain insights into the intricate transformation."



Oakland University Associate Professor of Physics Yuejian Wang. Credit: Oakland University

In the article, titled "[Pressure-Induced Changes in the Crystal Structure and Electrical Conductivity of GeV<sub>4</sub>S<sub>8</sub>](#)," Wang investigated GeV<sub>4</sub>S<sub>8</sub>, a member of the Spinel family, by using high-pressure techniques, along with multiple characterization tools. Spinel is commonly found in metamorphic or igneous rocks, and is renowned for its diverse array of colors, which encompass red, blue, green, purple, orange, yellow, and black variants.

"Among spinels, GeV<sub>4</sub>S<sub>8</sub> has attracted considerable attention owing to its unique electrical and magnetic properties," Wang said.

The results of the study, Wang said, provide significant insights into both chemistry and physics domains.

"It presents a comprehensive and detailed understanding of the compression-induced transition from cubic to orthorhombic structure, shedding light on the intricate mechanisms involved. Moreover, the study delves into the materials physics aspect, elucidating the transition from semiconductor to conductor and exploring the role of the Jahn-Teller effect in governing these transitions."

According to Wang, the results of the study not only enrich humanity's understanding of this system but also holds the potential to spark broad interest and inspire further investigations.

"For instance, delving into how this material behaves under simultaneous compression and cooling could serve as an extraordinary and worthwhile topic for future exploration," he said. "Such inquiries could lead to new insights and applications in the realm of material science and condensed matter physics."

**More information:** Yuejian Wang et al, Pressure-Induced Changes in the Crystal Structure and Electrical Conductivity of GeV<sub>4</sub>S<sub>8</sub>, *Chemistry*

*of Materials* (2024). [DOI: 10.1021/acs.chemmater.3c02488](https://doi.org/10.1021/acs.chemmater.3c02488)

Provided by Oakland University

Citation: How high-pressure techniques can induce changes in crystalline materials (2024, May 15) retrieved 17 July 2024 from

<https://phys.org/news/2024-05-high-pressure-techniques-crystalline-materials.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.