RESEARCH HIGHLIGHTS

High-pressure synthesis: Pressing perovskite

Subject Categories: *Earth & environment*

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Materials produced in high-pressure laboratories can reveal how magnetic behaviour arises in minerals

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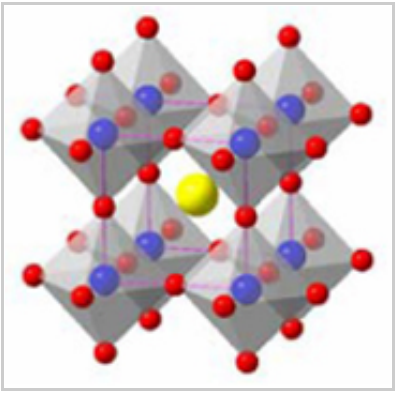

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Advanced high-pressure systems can simulate conditions far below the Earth's surface, providing insights for the geosciences. The systems also produce materials with densely packed crystal structures called perovskites, which can be used as conducting layers in electronics. Now Changqing Jin at the Chinese Academy of Science in Beijing and co-workers[1] have used high-pressure synthesis to create a new perovskite form of barium ruthenate that has helped them to map out the evolution of magnetism in minerals.

Theory predicts that as pressure is increased, barium ruthenate passes through three different crystal structures before reaching a perovskite structure (pictured), but no-one has achieved sufficiently high pressures until now. Jin and co-workers succeeded in obtaining perovskite barium ruthenate at 1,000 °C and 18 gigapascals — close to the pressures found at the boundary between the Earth's upper and lower mantle.

The magnetic properties of perovskites are determined by the shape and strength of bonds between the ruthenium and oxygen. The researchers found that their new compound has straighter and longer bonds than ruthenates of strontium and calcium, with the large barium atoms producing an almost perfect perovskite structure. As a result the Curie temperature, at which barium ruthenate loses its ferromagnetic property, is as low as -213 °C.

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Reference

1. Jin, C. Q. *et al.* High-pressure synthesis of the cubic perovskite $BaRuO_3$ and evolution of ferromagnetism in $ARuO_3$ (A = Ca, Sr, Ba) ruthenates. Proc. Natl Acad. Sci. USA 105, 7115–7119 (2008).10.1073/pnas.0710928105 | Article | PubMed |

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