

**MANA**Research Center
for Materials
Nanoarchitectonics[About MANA](#)[Research](#)[People](#)[News Room](#)[Outreach](#)[Employment](#)[Alumni](#)[Home](#) > [Research](#) > [Research Highlights](#) > Vol. 82 Demystifies Conductivity of Ru...

Research



Research Highlights

[Quantum Materials Field](#)[Nanomaterials Field](#)[Research Support](#)[Research Highlights](#)[Hot Topics](#)**[Vol. 82]**

Demystifies Conductivity of Ruthenate Nanosheets, Moving Towards Next-generation Electronics

17 Feb, 2023

[Previous](#)[Index](#)[Next](#)

A research team at MANA has shed light on how electrical conduction in oxide nanosheets can be markedly affected by small changes in their atomic arrangement.



The physical properties of a material are dictated by the arrangement of its atoms. This holds true not only for classical three-dimensional crystals but also for two-dimensional structures such as atomically thin nanosheets that are quickly becoming the cornerstone of many next-generation technologies.

However, the detailed atomic arrangement of certain nanosheets has not been fully elucidated, which limits experts' understanding of the origin of their desirable properties. This problem is also encountered when investigating ruthenate nanosheets, conductive oxides with promising applications in electronics and energy storage.

The mystery underlying the conduction mechanisms in ruthenate nanosheets motivated a team of researchers at MANA, led by Dr. Satoshi Tominaka, to further investigate their atomic structure. In a recent study, they analyzed how the possible structural symmetries in ruthenate nanosheets altered their conducting properties.

The researchers employed a pair distribution function (PDF), which described the probability of finding two atoms at a certain distance apart inside a material. Using PDF, they found that ruthenate nanosheets with the same atomic composition can adopt two different atomic arrangements, leading to differences in their symmetry. "Although the structural difference was not large, symmetry changes resulted in remarkably different properties, with ruthenate nanosheets behaving either as a graphene-

like semimetal or a semiconductor as confirmed by our calculations," explains Dr. Tominaka. "This highlights the importance of symmetry analysis, even in low-dimensional materials."

Overall, this study paves the way to a better understanding of oxide nanosheets, which could be a game changer in the development of future electronic and electrochemical devices.

Reference

"Symmetric Breakage-Induced Semimetallic State: Polymorphism in Ruthenate Nanosheets"

Kazutaka Sonobe, [Satoshi Tominaka](#), and Wataru Sugimoto.

Journal: Journal of the American Chemical Society 2022, 144, 33, 15008–15012 (July 25, 2022)

DOI : [10.1021/jacs.2c05951](https://doi.org/10.1021/jacs.2c05951)

Affiliations

International Center for Materials Nanoarchitectonics (WPI-MANA), National Institute for Materials Science (NIMS), Namiki 1-1, Tsukuba, Ibaraki 305-0044, Japan

Contact information

Research Center for Materials Nanoarchitectonics (MANA)

National Institute for Materials Science
1-1 Namiki, Tsukuba, Ibaraki 305-0044 Japan
Phone: +81-29-860-4710
E-mail: [mana-pr\[at\]nims.go.jp](mailto:mana-pr[at]nims.go.jp)

To receive our e-mail newsletter "MANA Research Highlights", please send an e-mail with "MANA Research Highlights request" in the subject line or main text to the following address: mana-pr_at_nims.go.jp *Please change "_at_" in the email address to @.

[Page Top](#)



Research Center for Materials Nanoarchitectonics (MANA)

National Institute for Materials Science (NIMS)

1-1 Namiki Tsukuba, Ibaraki 305-0044 JAPAN

+81-29-860-4709

E-mail: [mana\[at\]nims.go.jp](mailto:mana[at]nims.go.jp)