Argonne NATIONAL LABORATORY

BOROPHENE'S WAVY NATURE COULD MAKE IT USEFUL IN **FLEXIBLE DEVICES**

THE IMPETUS

The recent discovery of borophene, a two-dimensional version of boron, opened the door to a new field of boron-based nanoscale materials science. Two-dimensional materials like borophene tend to be mechanically flexible yet planar, especially when adhered on metal substrates. In borophene grown on a silver substrate, the borophene takes on a "wavy" appearance. This structure suggests that the wavy borophene would be especially stretchable.

THE WORK

Researchers at the Center for Nanoscale Materials (CNM), a U.S. Department of Energy Office of Science user facility located at Argonne National Laboratory, and collaborators combined first-principles calculations and atomic-scale ultrahigh vacuum scanning tunneling microscopy to reveal the wavy appearance of the borophene. The combination of observation and theory demonstrates that the wavy configuration is more stable than the planar form of borophene because of the anisotropic high bending flexibility of the material. The undulations are believed to be caused primarily as a source of strain relief. Borophene growth and scanning tunneling microscopy were performed by CNM scientists partnered with Northwestern University and in collaboration with the theoretical efforts led by Rice University.

THE IMPACT

By understanding the role of strain in two-dimensional materials, scientists can design future synthesis strategies with intentional strain engineering to modify material properties. This structural model suggests the transfer of wavy borophene onto a flexible surface would allow for stretchability — with potential for flexible devices.

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September 2022