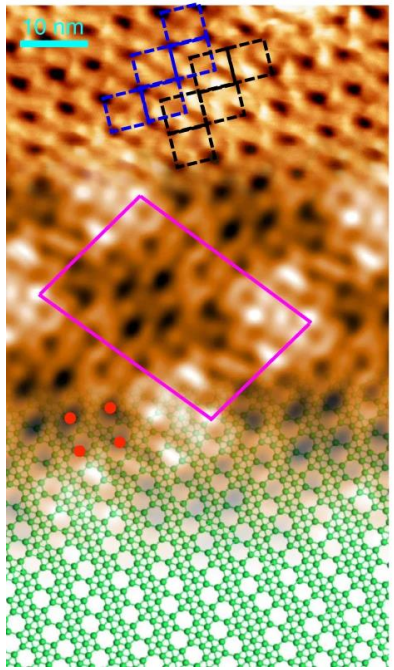
Beamline: ESM

Understanding Borophene —a Multipurpose Material



The image shows a continuous transition from the experimental STM topography, to the simulated STM image, to the atomic model.

Scientific Achievement

Scientists discovered a new phase of borophene and deciphered its atomic structure.

Significance and Impact

This new phase represents a new allotrope—a different physical form—of elemental boron that is a 2D quantum material with potential applications in flexible electronics, energy storage, and catalysis.

Research Details

- Synthesized different growth structures by controlling the boron deposition.
- Demonstrated the occurrence of four rotational borophene domains.
- Used in situ x-ray photoemission spectroscopy & synthesis capabilities at the ESM beamline at NSLS-II (operated in partnership with CFN) to discern the chemical signatures of copper and boron before and after growth.
- Used low-temperature scanning tunneling/atomic force microscope capabilities at CFN for Borophene growth and high-resolution imaging.
- Showed that the unit cell is formed of ten boron atoms and two vacancies and showed that the electronic band structure has four different Dirac cones.

Rongting Wu, Stephen Eltinge, Ilya K. Drozdov, Adrian Gozar, Percy Zahl, Jerzy T. Sadowski, Sohrab Ismail-Beigi, Ivan Božović Micrometre-scale single-crystalline borophene on a square-lattice Cu(100) surface. Nature Chem. 14 (4), 377-383 (2022). 10.1038/s41557-021-00879-9

This work was performed at the National Synchrotron Light Source II (NSLS-II) and the Center for Functional Nanomaterials (CFN) at Brookhaven National Laboratory.