replacing MAR17-2016-006737.

Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Borophene: Synthesis and Emergent Electronic Phenomena ANDREW MANNIX, Northwestern University, BRIAN KIRALY, Radboud University, JOSHUA WOOD, MARK HERSAM, Northwestern University, NATHAN GUISINGER, Argonne National Laboratory — Boron is the lightest metalloid element, and exhibits unusual physical characteristics derived from electron deficient, highly delocalized covalent bonds. Although bulk boron shows great structural complexity, nanoscale boron clusters form simple, aromatic planar molecules similar to those of carbon. Theoretical studies suggest that these clusters could form the basis for metallic nanostructured boron allotropes (e.g., nanotubes and sheets). Recently, we have reported the synthesis of borophenes on Ag(111) under ultra-high vacuum [Science 350, 1513–1516 (2015)]. Atomic-scale scanning tunneling microscopy shows the growth of two distinct phases, both of which exhibit anisotropic, chain-like structures. We confirm the atomically thin character of these sheets through multiple, orthogonal techniques. Furthermore, in situ scanning tunneling spectroscopy of the borophene sheets shows metallic characteristics consistent with theoretical predictions, in contrast to semiconducting bulk boron. The structure and electronic properties of borophenes are further studied at cryogenic temperatures (2.5 K). We observe no evidence for a significant structural phase change, but tunneling spectra show features suggestive of an electronic phase change. Several possible explanations for these spectral features will be discussed.

Andrew Mannix
Northwestern University

Date submitted: 11 Nov 2016 Electronic form version 1.4