Reconstruction of 2D silver at the interface between graphene and SiC

V. D Pham[1], B. Zheng[2], A. Jain[2], C. Dong[2], L-S. Lu[4], Z. W. Henshaw[3], W. H. Blades[3], J. A. Robinson[2], V. H. Crespi[2], A. Trampert[1], R. Engel-Herbert[1]

[1] Paul-Drude-Institut für Festkörperelektronik, Leibniz-Institut im Forschungsverbund Berlin e. V., Hausvogteiplatz 5–7, 10117 Berlin, Germany
[2] Department of Physics, The Pennsylvania State University, University Park, Pennsylvania 16802, USA
[3] Department of Physics and Engineering Physics, Juniata College, Huntingdon, Pennsylvania 16652, USA

Atomically thin metals confined between graphene and SiC represent a compelling materials platform. In this reduced-dimensionality environment, 2D metals can exhibit exotic physical properties with potential relevance to electronic devices and quantum technology. Despite this promise, the structural behavior of metals confined to this nanospace has remained largely unexplored.

In this work, we shed new light on this problem. Focusing on monolayer silver epitaxially grown on SiC (0001), we show how strain at the silver-SiC interface drives the formation of a non-ideal silver structure, specifically a one-dimensional reconstruction known as a Frenkel-Kontorova domain. This strain arises from competing interactions between silver-SiC bonding and silver-silver interatomic forces, producing a long-range structural modulation and a characteristic electronic state at 0.75 eV above the Fermi level. The findings were obtained using cryogenic scanning tunneling microscopy, supported by first-principles density functional theory (DFT) calculations.

The results uncover the interplay between atomic structure and electronic properties in this confined system and open new pathways for engineering 2D metals at the nanoscale. The work has been published in Physical Review Materials and selected as an Editor's Suggestion [1].

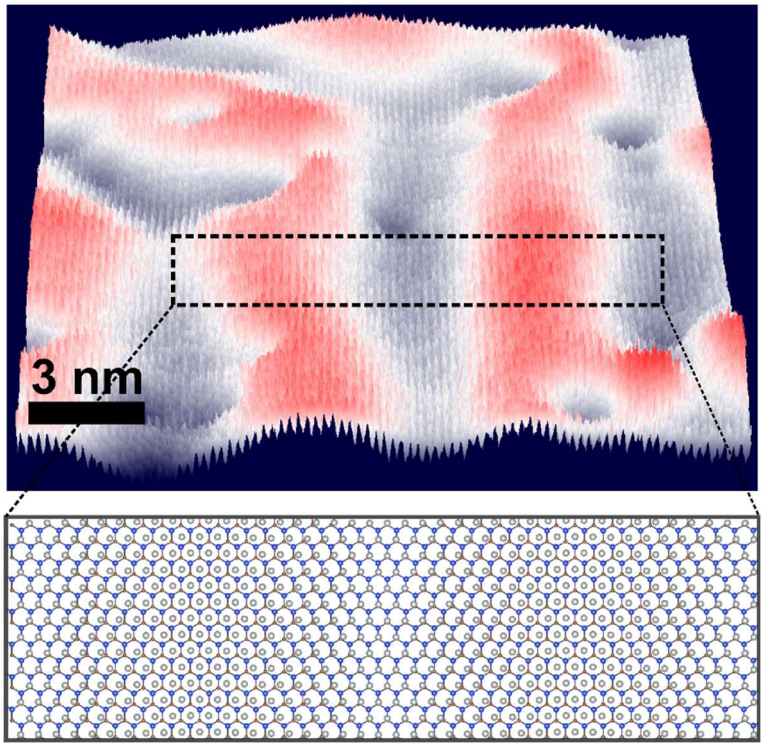

Fig. 1: High-resolution STM image and calculated DFT of the reconstructed monolayer of silver under graphene.

References:

[1] V. D Pham[1,*,†], B. Zheng[2*], A. Jain[3], C. Dong[2], L-S. Lu[4], Z. W. Henshaw[6], W. H. Blades[6], J. A. Robinson[2,3], V. H. Crespi[2], A. Trampert[1], R. Engel-Herbert[1]. Phys. Rev. Materials **10** (2026), 034003.