Stacking-dependent superstructures and taxonomy at armchair interfaces of bilayer/trilayer graphene

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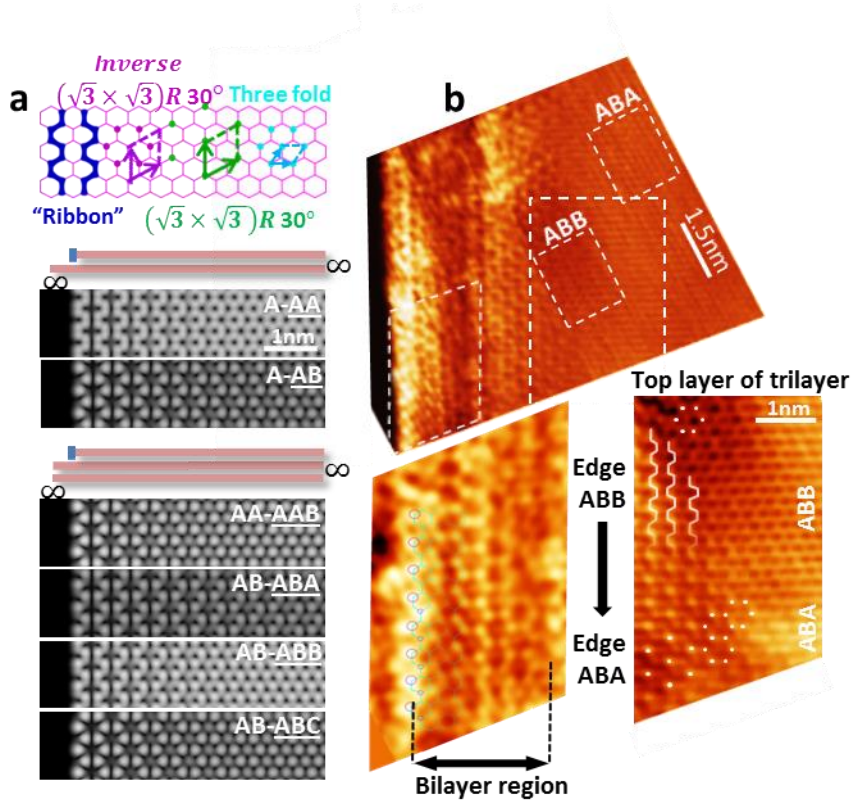
We present the first study of quantum interference patterns (QIP) at bilayer-trilayer armchair interfaces, for different stacking sequences [1]. The resulting QIPs allow us to establish a pattern taxonomy for multi-layered graphene systems. Visualization using scanning tunneling microscopy and theoretical calculations (by the embedding method [2], and corroborated with density functional theory) provides direct evidence that near armchair edges electron behavior is dominated by the "hard" edge, where the layer is abruptly truncated, as opposed to the "soft" edges, where layers continue across the boundary. Intervalley reflection causes universal quenching of the wavefunction with a periodicity of three rows of C atoms, while the exact interference patterns depend on the stacking sequence and appear to be robust to disorder and chemical terminations. Lateral interfaces within multi-stacked graphene systems can provide unique system-specific opportunities for wave-function engineering to be exploited in devices employing quantum-interference.

References

[1] A.S. Kazemi, S. Crampin, A. Ilie, Appl. Phys. Lett. **102** (2013) 16311.
[2] J. E. Inglesfield, Comput. Phys. Commun. **137** (2001), 89.

Figures



(a) Example of pattern taxonomy for stacked graphene systems at armchair edges/interfaces; STM image simulations of mono-bilayer and bilayer-trilayer armchair interfaces for various armchair edge extents (i.e. finite vs. infinite) within the multi-stack. (b) Experimental STM images at a bilayer-trilayer interface, showing a change in stacking on the top layer of the trilayer side; magnified regions show patterns that are interpreted based on scattering processes and the given taxonomy.