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Barrier-Guided Growth of Micro- and Nano-Structured Graphene NATHANIEL SAFRON, MYUNGWOONG KIM, PADMA GOPALAN, MICHAEL ARNOLD, University of Wisconsin: Madison — The patterning of graphene is necessary for tuning its physical and electronic structure and for device-integration. Traditionally, patterning has been achieved via *top-down* chemical or physical etching, which induces defects and disorder that degrades performance. In this work, we overcome these challenges through a fundamentally new *bottom-up* growth method for the rational synthesis of patterned graphene called Barrier-Guided Chemical Vapor Deposition (BG-CVD). We deposit patterned barriers on the Cu surface, using scalable lithography methods, which guide the growth of graphene around them into any desired shape. The barriers locally passivate the surface, (i) preventing the decomposition of the methane, and (ii) blocking the growth of graphene on the barrier. By designing appropriate barrier layers, we have grown arbitrary patterns, nanoribbons, and nanoperforated graphene with features down to 25 nm with high mobility (215 cm^2/Vs). These materials are highly crystalline with domain size >4 μm and have 2-10x less edge defects than comparable top-down etched materials. The pattern reproducibility is <1 nm and thus, ultimately, should enable the bottom-up synthesis of sub-5 nm features. These results indicate BG-CVD as a superior production route to patterned graphene.

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