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Crystallographic effects of copper substrate on graphene growth and fluorination JOSHUA WOOD, SCOTT SCHMUCKER, GREGORY DOIDGE, THADDEUS KRAWCZYK, AUSTIN LYONS, ERIC POP, JOSEPH LYDING, University of Illinois at Urbana-Champaign — Graphene grown by chemical vapor deposition (CVD) on Cu is appealing due to supposed large-area monolayer growth and the low cost of the Cu foil substrate. However, this Cu substrate is inherently polycrystalline, with low and high index facets, annealing twins, and rough sites. We characterize CVD graphene growth on the Cu surfaces by combining Raman spectroscopy, electron-backscatter diffraction (EBSD), and scanning electron microscopy (SEM). We find that graphene growth on Cu(100) is multilayered and of low-quality, while growth on Cu(111) is monolayer and of high-quality. High index Cu facets containing a high percentage of (111) terraces are more monolayer-like than Cu(100). Graphene has a higher growth rate on (111) surfaces, growing the fastest on Cu(111). At temperatures below 900 °C, compact islands of graphene form from lowered growth rate. To open a bandgap in graphene, quantum confinement or covalent chemistry must be used. We do the latter by exposing our graphene films to XeF₂ gas, terminating in an insulating C₄F stoichiometry and covalent C-F bonds. Rougher facets fluorinate first, which allows possible bandgap engineering by the Cu crystallography. Additionally, film defects assist in fluorination effectiveness. We also show preliminary results on Cu crystallography effects for CVD of hexagonal boron nitride (h-BN).

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