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Controlled Etching and Characterization of Multiple Graphene Layers on Copper JOSHUA WOOD, JAE WON DO, ROSHAN CHOXI, SCOTT SCHMUCKER, JUSTIN KOEPKE, JOSEPH LYDING, University of Illinois at Urbana-Champaign — Graphene growth on copper has attracted much interest due to the large graphene domain sizes and the high percentage of monolayer graphene coverage[1]. To use this grown graphene for other applications, one must characterize both the graphene coverage and number of graphene layers. We identify graphene coverage on as-grown copper samples by oxidizing the copper foil at $\approx$400 $^\circ$C. Due to graphene's low oxygen permeability[2], graphene-covered copper regions will not oxidize, leading to large contrast between the oxidized copper and graphene. The high contrast allows us to identify monolayer and few-layer graphene (FLG) sheets with a stereo microscope. With this, we find that our graphene domains are around 200μm in size, with some pieces as large as 2mm. We also use an oxygen plasma to etch the graphene on copper samples. Graphene sheets act as a shadow mask for the plasma, preventing portions of the copper from oxidizing. By controlling the plasma energy and etching time, we can selectively etch the graphene layer by layer, leaving only monolayer regions on the oxidized copper. We show that graphene grown on copper is not necessarily monolayer, with multiple layers forming at rough nucleation sites on the copper. [1]Li *et al.*, *Science* **324**, 1312 (2009). [2]Bunch *et al.*, *Nano Lett.* **8**, 2458 (2008).

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