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CVD growth of large-grain graphene on Cu(111) thin films DAVID L. MILLER, KYLE M. DIEDERICHSEN, MARK W. KELLER, National Institute of Standards and Technology, Boulder, CO — Chemical vapor deposition of graphene on polycrystalline Cu foils has produced high quality films with carrier mobility approaching that of exfoliated graphene. Growth on single-crystal films of Cu has received less attention, despite its potential advantages for graphene quality and its importance for eventual applications. This is likely due to the difficulty of obtaining large (≥ 1 mm) grains in Cu thin films, as well as dewetting and roughening of Cu films at temperatures near the Cu melting point (1084 C). We found that 450 nm of Cu(111), epitaxially grown by sputtering onto Al₂O₃(0001), formed > 1 mm grains when annealed at 1065 C for 40 minutes in 40 Torr of Ar and 2.5 mTorr of H₂. After this annealing, adding 3 mTorr of CH₄ for 8 minutes produced a monolayer graphene film covering $> 99\%$ of the Cu surface. Stopping growth after 4 minutes produced dendritic graphene islands with 6-fold symmetry and diameter of 20 μm to 100 μm . After growth, the Cu film remained smooth except for thermal grooving at grain boundaries and a few holes of diameter ≈ 10 μm where Cu dewetted completely (≈ 10 holes on each 5 mm x 6 mm chip).

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