Controlled growth of monolayer graphene on silicon carbide

DAVID TORRANCE, DAVID MILLER, MADELEINE PHILLIPS, HOLLY TINKNEY, EVAN GREEN, PHILLIP FIRST, Georgia Institute of Technology, GEORGIA TECH GRAPHENE TEAM — Controlled thermal decomposition of silicon carbide is so far the most effective method for growing graphene epitaxially and at the wafer scale. In this work we study the graphenization of SiC(0001) and SiC(000¯1) as a function of temperature and buffer-gas pressure in a custom-built ultrahigh vacuum (UHV) induction furnace. In-situ characterization by both Auger electron spectroscopy and low-energy electron diffraction (LEED) was used to determine the pressure-temperature “phase boundary” for the formation of monolayer graphene, and the transient growth rate of graphene layers otherwise. Sample quality was further assessed ex-situ using a variety of techniques such Raman spectroscopy and scanning tunneling microscopy. The effect of buffer gas was modeled with kinetic theory.

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