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Large Single-Crystal Graphene Growth on Copper: The Role of Oxygen YUFENG HAO, University of Texas at Austin, M.S. BHARATHI, Institute of High Performance Computing, A*STAR, Singapore, LEI WANG, Columbia University, YUANYUE LIU, Rice University, HUA CHEN, University of Texas at Austin, SHU NIE, Sandia National Lab, XIAOHAN WANG, HARRY CHOU, CHENG TAN, BABAK FALLAHAZAD, University of Texas at Austin, HARIHARAPUTRAN RAMANARAYAN, Institute of High Performance Computing, A*STAR, Singapore, EMANUEL TUTUC, University of Texas at Austin, BORIS I. YAKOBSON, Rice University, KEVIN F. MCCARTY, Sandia National Lab, YONG-WEI ZHANG, Institute of High Performance Computing, A*STAR, Singapore, PHILIP KIM, JAMES HONE, Columbia University, LUIGI COLOMBO, RODNEY S. RUOFF, University of Texas at Austin — Graphene grown by CVD on Cu is enabling fundamental studies and applications. However, growth of high quality single crystals with controlled domain size and morphology has not been achieved, implying unknown or uncontrolled growth parameters. We discovered that oxygen on the Cu surface not only decreases the graphene nucleation density but also accelerate graphene domain growth and affect the domain shapes. SEM, EBSD, Raman, and LEED were used to characterize and analyze the graphene domains under the effects of oxygen. First-principles calculations and phase-field simulations provide deeper insight into the proposed growth mechanisms. Finally, electric- and magneto-transport measurements show that the graphene quality is comparable to mechanically exfoliated graphene, in spite of being grown in the presence of oxygen.

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