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Wide-gap Semiconducting Graphene from Nitrogen-seeded SiC[1]

FENG WANG, Georgia Inst of Tech, G. LIU, Rutgers Univ., S. ROTHWELL, Univ. of Minnesota, M. NEVIUS, Georgia Inst of Tech, A. LOCATELLI, T. MENTES, A. SALA, Elettra Synchrotron Trieste, I. RODRIGUEZ, A. RETANA, A. TEJEDA, A. TALEB-IBRAHIMI, Synchrotron Soleil, L. FIELDMAN, Rutgers Univ., P. COHEN, Univ. of Minnesota, E. CONRAD, Georgia Inst of Tech — We demonstrate a new approach to produce semiconducting graphene that uses surface nitrogen-seeded SiC substrates to grow graphene. The surface nitrogen atoms pin the graphene to the SiC. The starting material is a sub-monolayer of N produced by NO annealing the SiC surface at 1175C. The oxide is then removed chemically to leave ~0.5ML of N that is stable at the graphene growth temperature. Graphene is grown at 1400C by CCS(confinement controlled sublimation) method. Post growth studies with LEED, ARPES, LEEM, PEEM, micro-ARPES and STM show that this N-graphene is continuous but rippled. No nitrogen defect is included in the graphene film. The most important finding is that both ARPES and PEEM show that the N-graphene has a finite bandgap ~0.5-0.7eV depend on graphene thickness. The origin of the band gap is not yet understood although there are strong experimental reasons to suspect strain gradients play an important role. We will also show that the SiC/nitrogen surface can be pre-patterned to high resolution prior to graphene growth. Post growth, the graphene film becomes a periodic N-graphene/normal-graphene modulated structure.

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