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Nitrogen incorporation into epitaxial graphene formed on SiC[1]

EDWARD CONRAD, WANG WANG, School of Physics, Georgia Institute of Technology, GANG LIU, Electrical and Computer Eng., Rutgers Univ., SARA ROTHWELL, Electrical and Computer Eng., Univ. of Minnesota, LEONARD C. FELDMAN, Electrical and Computer Eng., Rutgers Univ., PHIL COHEN, Electrical and Computer Eng., Univ. of Minnesota — Substitutional doping is an important way to modify the electronic, chemical, optical and magnetic property of graphene. A significant body of work has shown that nitrogen can be introduced into the graphene structure during CVD growth or by plasma treatments [1,2]. These methods produce a variety of nitrogen defect sites. We present new results on the direct incorporation of nitrogen into graphene as it grows from SiC. The starting material is a sub-monolayer of N at the SiC/SiO2 interface introduced by NO annealing at 1175C [3]. The oxygen is chemically removed to leave ∼0.5 ML nitrogen layer that is stable on the SiC(000-1) surface up to 1550C. When heated to 1450C, nitrogen is introduced into the graphene as it grows from the SiC. Post growth studies with Raman Spectroscopy, ARPES, XPS, and LEED show that the N-doped graphene is entirely pyridinic and has a small finite bandgap. This method has an advantage in that the SiC/nitrogen surface can be pre-patterned to high resolution prior to graphene fabrication.

[1] Zhao, L. Y. et al. Science 333, 999-1003 (2011); [2] Lin, Y. C. et al. Appl. Phys. Lett. 96, 133110 (2010); [3] J. Rozen et al, IEEE Transactions on Electron Devices, 0018-9383, 2011

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