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Nitrogen-doped graphene: beyond single substitution and enhanced molecular sensing SIMIN FENG, JUNJIE WANG, RUITAO LU, The Pennsylvania State University, USA, QING LI, Oak Ridge National Laboratory, USA, ANDRÉS R. BOTELLO-MÉNDEZ, XAVIER DECLERCK, AURÉLIEN LHERBIER, Université Catholique de Louvain, Belgium, AYSE BERKDEMIR, ANA LAURA ELÍAS, The Pennsylvania State University, USA, RODOLFO CRUZ-SILVA, MORINOBU ENDO, Shinshu University, Japan, HUMBERTO TERRONES, The Pennsylvania State University, USA, JEAN CHRISTOPHE CHARLIER, Université Catholique de Louvain, Belgium, MINGHU PAN, Oak Ridge National Laboratory, USA, JUN ZHU, The Pennsylvania State University, USA, MAURICIO TERRONES, The Pennsylvania State University, USA; Shinshu University, Japan — Large-area (~ 4 cm^2) and highly-crystalline monolayer nitrogen-doped graphene (NG) sheets have been synthesized on copper foils by ambient-pressure chemical vapor deposition (AP-CVD) method. Scanning tunneling microscopy (STM) and spectroscopy (STS) reveal that the nitrogen dopants in as-synthesized NG samples are separated by one carbon atom and sit consequently on the same sub-lattice of graphene. Based on our first principles and tight binding calculations, this unbalanced distribution of dopants on one of the graphene sublattices will promote the opening of an electronic band gap. We control the synthesis parameters and use Raman spectroscopy and electrical transport measurements to monitor the nitrogen doping levels. Finally, we will demonstrate that NG behaves as an efficient molecular sensor, especially when performing graphene-enhanced Raman scattering (GERS) of various organic and bio-molecules.

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