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Substitutional Doping of Graphene via Hyperthermal Ion Implantation (HyTII) CORY CRESS, US Naval Research Laboratory, SCOTT SCHMUCKER, National Research Council PostDoc at NRL, ADAM FRIEDMAN, US Naval Research Laboratory, PRATIBAIBHA DEV, National Research Council PostDoc at NRL, JEREMY ROBINSON, US Naval Research Laboratory — The ability to manipulate materials with atomic precision is central to nanoscience. Hyperthermal ion implantation (HyTII) is a kinetic approach to doping with sub-nanometer control and is ideally suited for modifying 2D nanomaterials like graphene, yet few experimental studies have capitalized on this potential.[1] In this presentation, we experimentally investigate the effects of nitrogen ion implantation (N-HyTII) with ion energies ranging from 25 – 100 eV and doses up to 10^{15} N^+/cm^2. Following N-HyTII processing and transferring the graphene to a SiO_2/Si substrate, we collect Raman spatial maps over the entire sample surface, and perform XPS and STM analysis on a subset of the variable-energy samples along with HOPG as a control. The STM and XPS analysis confirm the substitutional incorporation of N into the graphene lattice at 45 eV, while the Raman D-peak to D‘-peak ratios reveal distinct differences over the full energy range that are consistent with the different hyperthermal ion-substrate interactions pertaining to surface adsorption, substitutional doping, defect formation. We conclude this study by demonstrating the use of HyTII in graphene device processing, and highlight the effects of N-doping on the magnetotransport properties of graphene.[2] References: [1] C.D. Cress, et al. *ACS Nano* **10**, 3714 (2016). [2] A.L. Friedman, et al. *Phys. Rev. B*, **93** 161409(R) (2016).

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