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Near-edge X-ray Absorption Fine Structure (NEXAFS) Spectroscopy study on Chlorinated Graphene through Plasma-based Surface Functionalization XU ZHANG, Massachusetts Institute of Technology, THEANNE SCHIROS, Columbia University , DENNIS NORDLUND, SLAC National Accelerator Laboratory, YONG CHEOL SHIN, JING KONG, MILDRED DRESSELHAUS, TOMAS PALACIOS, Massachusetts Institute of Technology, MIT/COLUMBIA UNIVERSITY/SLAC COLLABORATION — Plasma-based chlorination is a promising technique to realize controllable doping in graphene, while maintaining its high mobility. Meanwhile, synchrotron-based X-ray spectroscopy provides us a sensitive probe to investigate the surface states of functionalizing dopants in graphene. Here, we systematically studied the electronic states of chlorinated graphene on different substrates, including surface binding energy, dopant concentration and work function shift by use of Near Edge X-ray Absorption Fine Structure (NEXAFS) spectroscopy, XPS and photoemission threshold measurements. The concentration of absorbed chlorine is high enough to generate a distinct NEXAFS resonance at 286.2 eV (1s ->π* transition for C-Cl bonds). It is remarkable that the sp2 carbon core-hole exciton (291.85eV) retained its sharpness even after treatment, indicating the long-range periodicity in graphene is largely preserved. This distinguishes our approach as a noninvasive and effective doping method. The interaction between Cl and graphene also exhibits strong substrate effects: for Cu, graphene's Fermi level is shifted downwards by 0.35eV, while for graphene on SiO2, the much (4-5 times) higher chlorine concentration causes EF to shift by 0.9eV.

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