Tandem influence of two classes of defects on graphene: An experimental and theoretical perspective

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The exceptional transport properties of a 2-dimensional sheet of graphene has endeared it to great promise for an array of prospective applications ranging from ultra-high frequency transistors, gas sensors and transparent flexible electrode materials. However graphene's use in these applications has been limited due to either the presence of intrinsic defects, such as vacancies and Stone-Wales configurations; or due to extrinsic defects such as adsorbed species. Both of which can introduce a bandgap and alter the transport properties[1]. Some have already taken advantage of this fact by investigating either one or the other[2,3]. However, to date there is a dearth of literature that investigates the coupling of both classes of defects and its effects on the transport properties of graphene. In this work we examine the tandem influence of first creating intrinsic defects in graphene grown on Ir(111) followed by functionalizing these defects with adsorbed species. In trinsic defects are introduced into the system by irradiation and precisely controlled by irradiation time, voltage and ion concentration. Extrinsic defects are further added by pumping in an adsorbate at low concentrations. The defective system is then characterized by scanning tunneling microscopy (STM) in order to identify any modification of the Moire patterns. We combine these experimental studies with DFT and MD calculations in order to unveil a better understanding of the mechanism of the adsorbed species onto defective sites and its resultant effect on the density of states and transport properties.

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