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Analysis of controlled structural disorder in few layer graphite and graphene

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Abstract content
   (Max 300 words)

Although the electronic transport properties of graphene have been widely researched, systematic studies on the effect of structural disorder on electronic transport remain crucial to an understanding of this contemporary material and yet are still lacking. We present a comprehensive analysis of the role of defects in thin graphene-like layers grown through laser-ablation assisted chemical vapor deposition. The level of disorder, determined through Raman spectroscopy was controlled through the variation of synthesis parameters such as temperature, laser fluence, flow rate, and sample position. Transport measurements were performed at low temperatures. Combined with the Raman data these results showed the activation energy (equal to half the bandgap) to be directly related to the level of disorder, thereby demonstrating the formation of localized states due to defects. A tight binding transport model, incorporating bond length disorder in the sp2 phase, was applied to understand the origin of the disorder induced bandgap and localization in the films. Analysis of the transmission coefficient as well as the calculated localization length as a function of the disorder parameter within this model allows for interpretation of the effects of structural disorder. Similar analysis can be applied to disordered graphene. To this end graphene has been grown by Chemical Vapor Deposition (CVD) where the process has been optimized to reduce the level of disorder. This work will provide crucial information regarding the understanding and control of disorder in graphene; a prerequisite for nano-electronic applications.

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