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Defects, Strain, Incommensurability and Polymorphism in Graphene on Metals MICHAEL ALTMAN, KA MAN YU, FEIFEI WANG, Hong Kong University of Science and Technology — The prevalence of defects in large-area graphene fabricated on metal substrates may undermine the unique properties that are vital to its use in technological applications. Although efforts to mitigate these imperfections have met with some success, they may alternatively be harnessed to tailor graphene's properties or alter its functionality. We have studied the growth/defect structure of graphene/metals using low energy electron microscopy (LEEM) and micro-low energy electron diffraction (μ-LEED). These investigations reveal the proliferation of small-angle lattice orientational disorder and small angle grain boundaries in graphene/Ru(0001) prepared by conventional ethylene CVD at high temperature. Although orientationally uniform graphene could be produced by a hybrid CVD/segregation method, this layer exhibits significant incommensurability and polymorphism, i.e. several commensurate structures. Two-dimensional strain mapping in graphene/Ir(111) obtained from scanning μ-LEED measurements using a 250nm probe beam reveals inhomogeneous strain relaxation by wrinkles. This suggests that it may be possible to strain engineer the properties of graphene if wrinkling can be controlled to form desirable wrinkle networks . Coupling of lattice rotation and strain is also observed by the same approach in graphene on other metal substrates.

Michael Altman
Hong Kong University of Science and Technology

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