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Epitaxial Graphene: A New Material for Electronics

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Graphene multilayers are grown epitaxially on single crystal silicon carbide. This system is composed of several graphene layers of which the first layer is electron doped due to the built-in electric field and the other layers are essentially undoped. Unlike graphite the charge carriers show Dirac particle properties (i.e. an anomalous Berry's phase, weak anti-localization and square root field dependence of the Landau level energies). Epitaxial graphene shows quasi-ballistic transport and long coherence lengths; properties that may persists above cryogenic temperatures. Paradoxically, in contrast to exfoliated graphene, the quantum Hall effect is not observed in high mobility epitaxial graphene. It appears that the effect is suppressed due to absence of localized states in the bulk of the material. Epitaxial graphene can be patterned using standard lithography methods and characterized using a wide array of techniques. These favorable features indicate that interconnected room temperature ballistic devices may be feasible for low dissipation high-speed nano-electronics.