Fast Synthesis of Large Grain Size Single Crystal Graphene for Nanoelectronics

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Abstract: We demonstrate that the preparation of large-size single crystal monolayer and bilayer graphene. Single crystals monolayer with diameter up to 5.9 mm, have been successfully obtained using a controlled seeded method, which allows us to reduce the nucleation density which lead to increased grain size for graphene. For bilayer growth, our main strategy is to maximize the duration that is controlled by the absorption-diffusion mechanism. Electron transport measurement on those produced graphene has shown carrier mobility that is comparable with that of mechanical exfoliated graphene, indicating the high quality of our graphene sample. In addition, we will also overview our recent progress in graphene chemistry.

12: COMPLEX STRUCTURED MATERIALS, INCLUDING GRAPHENE (DCMP)

12.1.1: Graphene: Synthesis, Defects, Structure, and Properties (DMP) (DCMP)

Graphene has been proposed for a range of applications that exploit it's unique chemical, mechanical, and electronic properties. However, a great deal of science remains to be done on the path to practical technologies. Keys to progress are the synthesis of high-quality materials, the understanding and control of defects, and the characterization of both intrinsic properties and those stemming from interfaces with other materials. Scalable growth techniques for single-layer and few-layer graphene, such as epitaxial growth on SiC and chemical vapor deposition on a variety of substrates, are of growing interest. Meanwhile, the creation of nearly ideal nanostructures through templated or bottom-up growth promises new science beyond the quantum limit. This graphene focus topic will cover:

- experimental, theoretical, and computational studies illuminating various aspects of the growth process including, e. g., layer number and stacking geometry control, the formation of topological and structural defects, grain size and grain boundary control, and the effect of substrate chemistry, crystallography and strain
- methods of doping
- templated or bottom-up growth of nanostructures and integration with other materials
- characterization and modeling of the structural, mechanical, electronic, and optical properties of the synthesized graphene, and methods for transferring synthesized graphene to other substrates and the impact of the transfer process

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