Fabrication of Suspended Graphene Nanodevices

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Graphene has stimulated intensive research on 2D electronic transport and new paradigm for electronics/spintronics, which points to the possibilities of achieving high integration density, high mobility, band gap, and the intriguing spin polarized edge states. To this end, the ultimate graphene device would have well-defined atomic configurations. So far, most graphene devices are limited by either fabrication resolution or uncertainty in device configurations including the exact edge shape and the interactions with the substrate. The latter could have a determining effect on the device performance such as disorder induced electron localization. Here we report fabrication of suspended graphene nanodevices with aberration corrected and monochromated transmission electron microscopy (AC&MC-TEM). This approach allows us to probe electronic transport in atomically well-defined graphene nanostructures that are decoupled from unexpected interactions with the environment. With the AC&MC-TEM, the atomic configuration of the graphene nanodevice can be directly observed as it forms into a desired shape. We discuss the effect of the atomic features of our device on the transport of electrons.