Mechanical cleaning of graphene using an atomic force microscope and chemical cleaning by Cl-based solvents

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Being essentially two surfaces and no bulk, graphene is easily affected by its environment. To achieve clean graphene devices with controlled doping is in many cases essential in order to bring graphene from the lab to real devices. Surface adsorbents play an important role on the properties of a graphene device. Polymers used in microfabrication are one of the dominant sources of such adsorbents. Traditional solvents are not sufficient to completely remove those contaminants. In order to efficiently remove them, we use two different approaches. First, we use the tip of an atomic force microscope (AFM) to mechanically clean graphene devices and obtain atomically smooth graphene. By appropriate choice of the AFM cantilever and contact force, a root mean square roughness of around 0.1 nm, less than that of our pristine SiO_2, can be achieved. In addition, we observe a shift of the Dirac voltage towards zero and improved carrier mobility. This method is convenient for single devices of limited size. For cleaning large area graphene cleaning we investigate a second approach, the use of Cl-based solvents, such as chloroform and dichloroethane. The result is highly dependent on the polymer used and the baking conditions. We compare the results of mechanical- and chemical cleaning approaches.

References

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