Dry cleaning of graphene by downstream H_2 plasma

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Adsorbents have a huge impact on the properties of atomically thin layers such as graphene. For example, in graphene, adsorption-induced doping can decrease the sheet resistance by charge transfer between dopants and graphene sheet [1]. On the other hand, the presence of adsorbents as surface contamination such as polymer residues during the transfer process can deteriorate the electron mobility in graphene which hinders the device performance. Surface contamination is still a critical and unresolved issue during the transfer process [2]. To get a clean and damage free transfer of graphene monolayer, we used electrochemical etching method. During the transfer process, Polymethyl methacrylate (PMMA) is used as a protection layer on the graphene surface. The residues of PMMA can be absorbed on graphene surface and, therefore, it becomes more difficult to remove it completely. Even, a thin layer of PMMA residue is well known to modify the surface properties of graphene, introduces shift of the fermi level and decreases carrier mobility and hence affects the overall performance [2, 3]. In order to remove the contamination, for instance, PMMA from the surface, we aim to use downstream H_2 plasma cleaning. To the best of our knowledge, this is one of the most effective ways to manipulate the surface chemistry of wide range of materials. In this study, we show very interesting primarily results obtained before and after H_2 plasma cleaning. Fig. 1 (a, c) show 80 KeV Monochromated High-Resolution Transmission Electron Microscopic (HRTEM) images to observe the effects of downstream H_2 plasma at the atomic level. We have successfully removed PMMA from the surface of graphene without damaging the material. In this paper, the effect of plasma on graphene surface will be discussed using XPS and TEM analysis.

References

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Figures

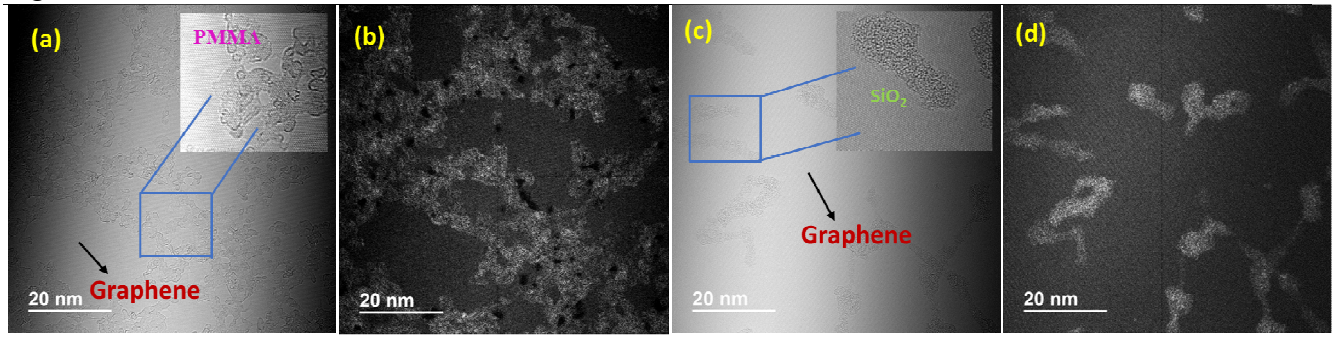

Figure 1 (a, c): 80 KeV Monochromated HRTEM images obtained before (a) and, (c) after H_2 plasma treatment. (b) and (d) showing sobel filtered images before and after plasma, respectively.