Defect formation on graphene by Carbon Ion implantation

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Graphene deposited on SiO_2 and GaN substrate are implanted by a series of dose from 5E11 to 3E13 (total eight dose). Next, the as-implanted graphene is post-annealed at 300°C for 1hr under about 1mTorr. The quality of graphene is investigated by optical microscopy (OM), Raman spectroscopy (RS), Hall measurement (four-point measurement) and X-ray photo-electronic spectroscopy (XPS). Thus, we can get variation of the electrical property, defect density and chemical bonding after implantation and thermal treatment. We conclude that there are sputtering atoms from substrate after implantation and become dopant after annealing by comparing with the two different substrate. Moreover, the initial oxygen dopant investigated on both of graphene on SiO_2 and GaN may be formed during the wet-transferring process, and the water layer after annealing. In terms of literature, the Raman peak of $I_D/I_{D'}$ represents vacancy defect (~7) and doping (~13). In our experiments, we can show that the result agrees if implant on same one graphene/SiO_2 with increasing the dose little by little (called SG experiment in this content); otherwise, it does not have a trend if implant on different graphene/SiO2 (called DG experiment). Furthermore, we found the defect density is lower in SG experiment rather than in DG experiment). In summary, we compare the properties of graphene on SiO_2 and GaN. In SiO_2 part, we implant at same dose range on same sample (SG experiment) and different samples (DG experiment). All of them shows there are oxygen dopant. It may come from the water layer between graphene and SiO_2, sputtering atoms from SiO_2 substrate and the residue oxygen gas in annealing chamber. Moreover, the electrical property and Raman mapping will be discussed further in the content of poster.

References

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Figures

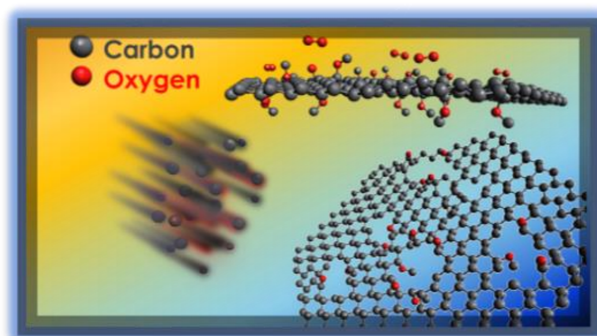

Figure 1: The scheme of ion implantation forming defect on graphene and the absorption gas