N-Graphene Nanowalls Via Plasma Nitrogen Incorporation and Substitution

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Incorporating nitrogen (N) atom in graphene lattice is considered a key technique for tuning its electrical properties. Plasma assisted treatment techniques are considered as a simple method to fabricate N-graphene with different nitrogen configurations [1]. However, this is still a great challenge to build N-graphene with controlled nitrogen concentrations and desired nitrogen configurations. The influence of structural defects in graphene for incorporating N-atoms has been explained by DFT theories. Nevertheless, there is a lack of experimental evidence to bridge the DFT theories for explaining the influence of structural defects for nitrogen incorporation in graphene. Herein, we report a systematic study on the effect of different nitrogen-containing gaseous plasma post-treatment on graphene nanowalls (CNWs) to produce N-CNWs with incorporated and substituted nitrogen. The structural and morphological analysis describes a remarkable difference in the plasma surface interaction, nitrogen concentration, and nitrogen configurations in CNWs by using different nitrogen-containing plasma. Electrical conductivity measurements revealed that the conductivity of the N-graphene is strongly influenced by the concentration and different configurations of C-N bonding. These findings indicate that the plasma post-treatment can be used as an effective approach for the synthesis of N-graphene with controlled concentration and specific configuration of incorporated nitrogen for application-oriented properties [2].

References

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Figures
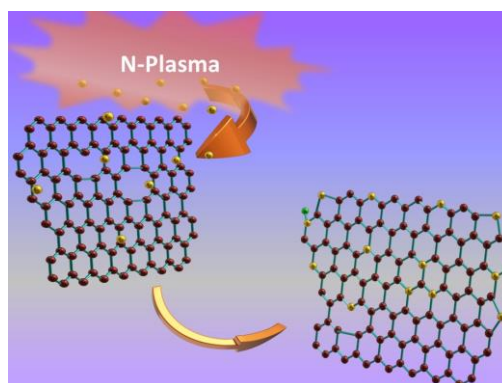
Figure 1: Conversion of graphene nanowalls to N-graphene nanowalls using plasma