Morphological differences of graphene nano-platelets made from the oxidative and the non-oxidative route

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Abstract

Graphene nano-platelet (GNP, a few layered graphene flakes) has greatly attracted as the most feasible graphene product with low cost in a practical application. Considering the limitation of the flake shape graphene, it can be classified to "the graphene via GO method (GNP)" and" the graphene via non-GO method (rGO)" by its preparation route. A careful examination of the structural differences between GNP and rGO is inevitable in the application of graphene materials. Although the GNP and rGO is equally considered as flake type graphene, the edge structure of GNP has very different and energetically distinguishable status from the rGO.

As was shown in Fig. 1, GNP is clearly distinguishable distribution from the rGO. The adsorptive potential distributions of the rGO (provided by Standard Graphene, Korea) are quite broad, which is indicating diverse surface heterogeneity. From previous work [1,2], it is known that the adsorption energy centred around 50-60K are generally attributed to the basal planes. Adsorption energies below 50K are related to the edge/prismatic planes, which those above 60K are related to defects. In order to demonstrate energetic differences depend on the morphological variation, lattice structure of edge and basal plane was confirmed at each method. Consequently, the non-GO graphene shows distinctive difference depending on the direction of lattice plane. Fig. 2 shows R values of graphene from the both methods which calculated from the relative intensity of G (1580cm^{-1}) and D (1350cm^{-1}) peak [3]. We will envisage the correlation between DFT result of surface energy distribution and morphological variation by using of diverse analyses.

References

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Figures

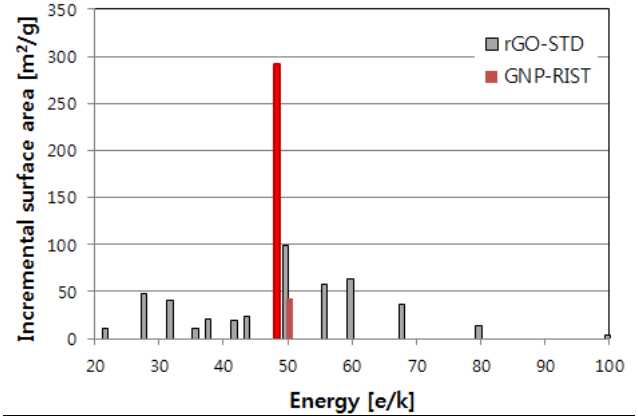

Figure 1: Incremental surface area as evaluated by a DFT analysis for GNP and rGO.

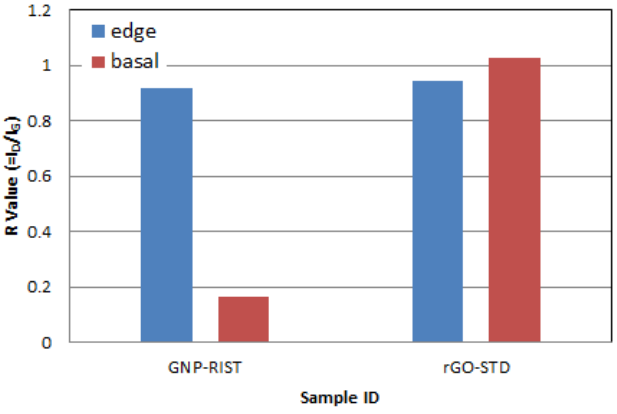

Figure 2: R values of edge and basal plane by Raman spectroscopy from GNP and rGO.