Monitoring the oxygen content in graphene oxide

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Abstract

The chemical derivation of graphene oxide emerged as an easy route to obtain atomically thin carbon sheets with the aim to obtain graphene in a large scale. This graphene oxide (G-O) is decorated with different oxygen groups that disrupt the electronical properties of pristine graphene. The real structure of graphene oxide has not yet been fully understood, same as its predecessor, the graphite oxide, which has been studied over hundred years. Most of the studies, based in bulk analysis of the graphene oxide such as TGA or XPS, stated C/O ratios of 2:1 and variable oxygen contents that range from 20 to 33% [1].

We have developed a particular synthesis method to produce graphene oxide from helical ribbon carbon nanofibers (HR-CNF). Our studies of the quantification of the oxygen content comprised XPS and TGA of the bulk powder and EDS and EELS of single G-O sheets. XPS results were consistent with the literature providing C/O ratios up to 2, while the analysis of the sheets showed much less oxygen content and, therefore, a higher C/O ratio. This difference between the bulk and the sheet analysis agrees with some recent studies that state that most of the oxidation of the graphene oxide is due to some debris attached to the sheets and not to the oxygen covalently bonded [2].

This revelation indicates that the existing models of graphene oxide, based on the results of bulk analysis, should be submitted to debate. The knowledge of the structure could lead to a better enhancement of the properties of the graphene oxide.

Here, we monitor by different techniques the oxygen content in powder and exfoliated samples of graphene oxide. We tried to find the composition if a single graphene oxide sheet and compared it with the content in the all bulk.

References

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