Bulk graphene preparation for energy and composites applications

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Abstract

The bulk graphene market will exponentially grow in the next few years. Its applications in composites will be the largest segment, followed by energy storage applications.[1]
Different synthetic methods can be used for the production of graphene and graphene related materials.[2]
However, most of the materials labeled as graphene in the market are far from the classification and nomenclature for Graphene-Based Materials[3] and there is a lot of production capacity, especially of nanographite materials in factories, but lacks a killer application.[1c]
Several reviews analyzed the applications of the different graphene and related products in energy [4, 1b] and in composites applications.[5, 1b]
In this communication, 3 different methods for the production of bulk graphene or reduce graphene oxide: liquid exfoliation, reduced graphene oxides and high expansion were compared with other production methods and products in the market.
The complete characterization of graphene and highly reduce graphene oxide using TEM, SEM, AFM, XPS, DRX, Laser diffraction, etc will be presented.
Different types of graphene materials with variation in lateral size, defects and defects concentration, thickness, etc, have been used to obtain graphene-thermoplastic and thermoset composites. The different effects of the incorporation of liquid exfoliated graphene, highly reduced graphene oxide and graphene nanoplatelets on electrical, thermal conductivity and fire retardant properties of epoxy were investigated.
Related to electrical properties, some of these composites show lower percolation threshold limits than the previously reported values, also obtaining ultralow percolation limits (Figure), opening a new range of applications and markets.
Other factors as processing technique, the compatibility between graphene and matrix and dispersion have an extremely high importance in the results.
The use of different graphene materials and decorated graphene materials in energy applications, from batteries to supercapacitors with ultrahigh energy density, will be also presented.

References

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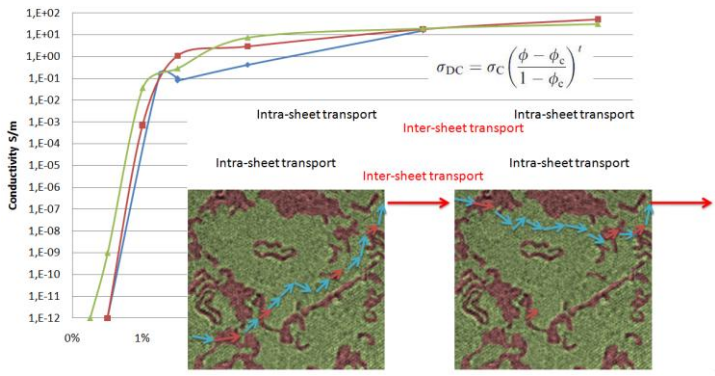
Figures



Electric percolation and Scheme of the transport in a composite