

Conformational changes and chemistry of single-layer graphene oxide

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Single-layer graphenes (SLG) possess thermal and electronic conductive properties superior to those for carbon nanotubes [1], but in order to release their potential, chemical modification will often be necessary to tailor (or integrate) graphenes for a particular end purpose [2]. The type and distribution of acidic groups on SLG and oxygenated forms (SLGO) has been inferred from NMR, XPS and micro-Raman analyses, which include carboxylic, alcohol, hydroxyl / phenolic, lactone, ester, epoxy and ketones [3]. However, a conventional method of detecting the type of acidic groups on carbons through acid-base (Boehm) titrations offers both quantitative and qualitative analysis [4]. Moreover, this route can be utilized to monitor the depletion (or increase) in the number of functional groups, which directly correlates to their chemical reactivity [5,6].

When considering the chemical reactivity of SLGO, the type and conditions of the desired process can lead to degradation of the sheet structure and/or conformational changes that affect its overall reactivity. Nonetheless, elucidation of the controlling mechanisms can be exploited to develop the structure of SLGO-composites on the macroscale, promising useful applications in the field of nanomaterial capture for waste clean-up, slow drug release, material storage, etc. A number of covalent reactions have been considered and, currently, diisocyanate functionalisation proffers a useful intermediate for conducting covalent modification without dramatically altering the underlying graphene.

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