Graphene – the wonder material!

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The excitement aroused by the discovery of the phenomenal physical properties of graphene – the wonder material- has been tempered by our inability to translate these into practical devices and structures.

Herein lies the frustrating dichotomy in that pristine graphene displays the properties we crave yet is the least processable. Addition of oxygen containing functional groups to pristine graphene renders the material more processable but compromises these properties.

Over recent years we have investigated a number of strategies to tackle this dichotomy.

- Process as graphene oxide (GO): chemical exfoliation results in formation of GO with oxygen contents that render the material dispersible in water. If the GO sheets produced are sufficiently large, liquid crystalline phases are formed.[1] With subsequent control over rheological properties, GO has been used to produce GO fibres via wet spinning.[2]

- Processable reduced graphene oxide (RGO): chemical reduction of GO while controlling the pH of the media results in formation of a conducting graphene with sufficient oxygen content to improve processability e.g. forming films/membranes by LBL deposition, by air brush spraying or filtration.[3]

- Edge functionalised graphene (EFG): our more recent discovery of EFG[4] has enabled us to capture the high level physical attributes of graphene and high processability. This unusual combination of properties enables high dispersity in aqueous or organic media further extending processing options.

These approaches are providing better access to the amazing properties of the wonder material.

References

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