Radically stabilized liquid phase exfoliated few layer graphene.

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Abstract

Graphene nanocomposites has huge potential to create the next generation of materials, ranging from uses such mechanical reinforcement to thermal composite applications [1]. The potential market for these materials is vast and would require large quantities of single or few layer graphene to be produced, so a scalable production method is require. Liquid phase exfoliation of graphite can be used to produce single and few layer graphene on a large scale. This can be done with the use of shear to delaminate the graphene layers, but require stabilising using organic solvents or surfactants. It has been found that Triton-x can be used to produce single-layer graphene from graphite as confirmed via Raman spectroscopy. For the use in nanocompsiite applications there needs to be a good interaction between the graphene and the matrix that it is dispersed in. Many of these functionalization routes use dangerous conditions [2] or they reduce the properties of the graphene. Therefore a scalable safe functionalization route is required. It has been found that it is possible to stabilise graphene dispersions in organic solvents with the use of radical initiators. These radicals are generated over time and is able to create meta-stable graphene dispersions without damage to the basal plane as conformed via Raman spectroscopy.

References

[1] - Chen, WF , Hu, WM, Li, DJ,Chen, SN, Dai, ZX,SCIENCE AND ENGINEERING OF COMPOSITE MATERIALS, volume 25(2018), pages 1059-1073.

[2] - John Greenwood, Thanh Hai Phan, Yasuhiko Fujita, Zhi Li, Oleksandr Ivasenko*, Willem Vanderlinden, Hans Van Gorp, Wout Frederickx, Gang Lu, Kazukuni Tahara, Yoshito Tobe, Hiroshi Uji-i, Stijn F. L. Mertens, and Steven De Feyter, *ACS Nano, 9 (5) 2015, pages 5520–5535*

[3] - William S. Hummers Jr., and Richard E. Offeman, *J. Am. Chem. Soc, 80 (6) 1958, page 1339-1339*

Figures

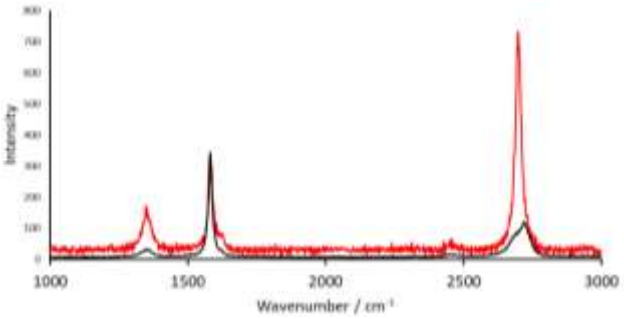

Figure 1: Raman spectra of triton-x exfoliated graphene (red) with graphite control (black)

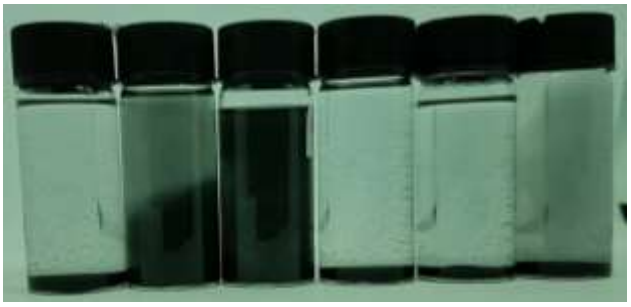

Figure 2: A photograph of graphene dispersions via radical stabilization