INCORPORATION OF REDUCED GRAPHENE OXIDE SHEETS INTO ORGANIC MEDIA FOR THE REALIZATION OF CONDUCTING AND PHOTORESPONSIVE NANOCOMPOSITES

L. Valentini[a*]

[a]Civil and Environmental Engineering Department, University of Perugia, 05100 Terni-Italy
[*]Corresponding author: *cardinali.marta@gmail.com*

Graphene, a new class of two-dimensional sp^2 carbon nanostructure, holds great promise for potential applications in many technological fields such as optoelectronics [1]. In addition to mechanical cleavage of graphite [2] and chemical vapour deposition methods [3], the most common preparation method of graphene starts from the oxidation and exfoliation of graphite to graphene oxide (GO) [4-6]. Graphene oxide consists of sheets decorated with hydroxyl, carbonyl and epoxy functional groups [7,8].
These functional groups render GO intrinsically hydrophilic and its dispersion in water is easily achieved [9]. The treatment of GO together with water-soluble groups can lead to the derivatization of both the edge carboxyl and surface epoxy functional groups; for example soluble alkylated reduced GO nanosheets can be easily used as fillers in nanocomposites with polymeric materials [10,11]. The main motivation to this method is due to the fact that from an industrial point of view, wet-chemistry approaches are the most desirable methods for the large scale integration of reduced GO-based polymeric nanocomposites. For this approach the critical issue in terms of physical properties and coating uniformity remains the reaggregation of the reduced GO sheets after the dispersant evaporation. This issue is very critical mainly when the addition of such fillers have not to be detrimental for the optical transparency and conductivity of graphene/polymer composites as in the case of the development of transparent electrodes for applications in the area of optoelectronics. Along this line, the current interest is designing new soluble polymer-modified reduced graphene oxide materials that can be directly used to fabricate graphene-based molecular photoresponsive devices.

References

[1] P. Blake, P.D. Brimicombe, R.R. Nair, T.J. Booth, D. Jiang, F. Schedin, L.A. Ponomarenko, S.V. Morozov, H.F. Gleeson, E.W. Hill, A.K. Geim, K.S. Novoselov, Nano Lett., 8 (2008) 1704.
[2] K.S. Novoselov, A.K. Geim, S.V. Morozov, D. Jiang, Y. Zhang, S.V. Dubonos, I.V. Grigorieva, A.A. Firsov, Science, 306 (2004) 666.
[3] A. Reina, X.T. Jia, J. Ho, D. Nezich, H. Son, V. Bulovic, M.S. Dresselhaus, J. Kong, Nano Lett., 9 (2009) 30.
[4] S. Park, R. S. Ruoff, Nat. Nanotechnol., 4 (2009) 217.
[5] S. Park, J.H. An, I.W. Jung, R.D. Piner, S.J. An, X.S. Li, A. Velamakanni, R.S. Ruoff, Nano Lett., 9 (2009) 1593.
[6] S. Stankovich, D.A.R.D. Dikin, K.A. Kohlhaas, A. Kleinhammes, Y. Jia, Y. Wu, S.T. Nguyen, R.S. Ruoff, Carbon, 45 (2007) 1558.
[7] A. Lerf, H. He, M. Forster, J. Klinowski, J. Phys. Chem. B, 102 (1998) 4477.
[8] H.Y. He, J. Klinowski, M. Forster, A. Lerf, Chem. Phys. Lett., 287 (1998) 53.
[9] T. Szabo, E. Tombacz, E. Illes, I. Dekany, Carbon, 44 (2006) 537.
[10] S. Bittolo Bon, L. Valentini, J.M. Kenny, Chem. Phys. Lett., 494 (2010) 264.
[11] S. Bittolo Bon, L. Valentini, R.M. Moustafa, F.M. Jradi, B.R. Kaafarani, R. Verdejo, M.A. Lopez-Manchado, J.M. Kenny, J. Phys. Chem. C, 114 (2010) 11252.