Probing the interfacial region in polymer-graphene oxide nanocomposites

MICHAEL WEIR, Department of Physics and Astronomy, University of Sheffield, STEPHEN BOOTHROYD, DAVID JOHNSON, RICHARD THOMPSON, Durham University, NIGEL CLARKE, University of Sheffield, KARL COLEMAN, Durham University — Graphene and related two-dimensional materials are excellent candidates as filler materials in nanocomposites due to their extraordinary physical properties and high aspect ratio. We are studying graphene oxide (GO), a highly functionalized form of graphene, due to its relative ease of dispersion within polymer matrices. Interruptions to the pristine two-dimensional carbon network by oxygen-containing groups, which provide functionality, also make GO rather flexible. In this paper we show that GO is wrinkled and rough over a hierarchy of length scales from a few nanometers to a few microns, when it is incorporated in composites with poly(methyl methacrylate) (PMMA) and polystyrene (PS). Small-angle neutron scattering measurements, highlighting individual polymer chains, show a decrease in polymer radius of gyration with increasing GO concentration in PMMA/GO nanocomposites. The decrease is consistent with models of a solid interface in a polymer melt. The interface influences the polymer matrix within an interfacial volume stretching on the order of one polymer radius of gyration from the surface. This work is a direct measurement of the effect of the nanofiller upon the polymer matrix and progresses our understanding of interfacial interactions within nanocomposites.

Michael Weir
Department of Physics and Astronomy, University of Sheffield

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