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Distortion of chain conformation and reduced entanglement in polymer-graphene oxide nanocomposites MICHAEL WEIR, Department of Physics and Astronomy, University of Sheffield, STEPHEN BOOTHROYD, DAVID JOHNSON, RICHARD THOMPSON, KARL COLEMAN, Durham University, NIGEL CLARKE, University of Sheffield — Graphene and related two-dimensional materials are excellent candidates as filler materials in polymer nanocomposites due to their extraordinary physical properties and high aspect ratio. To explore the mechanism by which the filler affects the bulk properties of these unique systems, and to build understanding from the macromolecular level upwards, we use a combination of small-angle neutron scattering (SANS) and oscillatory rheology. Where a good dispersion is achieved in poly(methyl methacrylate)-graphene oxide (PMMA-GO) nanocomposites, we observe a reduction in the polymer radius of gyration with increasing GO concentration that is consistent with the predicted behavior of polymer melt chains at a solid interface. We use concepts from thin-film polymer physics to formulate a scaling relation for the reduction in entanglements caused by the GO interfaces. Using these scaling arguments, we utilize SANS results to directly estimate the changes to the elastic plateau modulus of the network of entangled polymer chains, and find a correlation with the measured bulk rheology. We present a direct link between interfacial confinement effects and the bulk polymer nanocomposite properties, whilst demonstrating a model system for measuring thin film polymer physics in the bulk.

Michael Weir
Univ of Sheffield

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