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Linking structure and dynamics in polymer-graphene oxide nanocomposites MICHAEL WEIR, The University of Sheffield, STEPHEN BOOTHROYD, DAVID JOHNSON, Durham University, RANA ASHKAR, Oak Ridge National Laboratory, ERKAN SENSES, NIST, STEVEN PARNELL, TU Delft, MADHU SUDAN TYAGI, ANTONIO FARAONE, NIST, RICHARD THOMPSON, KARL COLEMAN, Durham University, NIGEL CLARKE, The University of Sheffield — Graphene and related two-dimensional materials are excellent candidates as fillers in polymer nanocomposites due to their extraordinary physical properties and high aspect ratio. The effect of the added nanoparticle upon the structure and dynamics of the polymeric host material has a critical influence upon the final performance and properties of the composite material. High specific surface area nanomaterials in the graphene family alter the properties of the bulk polymer at very low concentrations. Our previous structural measurements on poly(methyl methacrylate)-graphene oxide (PMMA-GO) nanocomposites have shown reductions in polymer chain dimensions in the presence of graphene oxide and associated reductions in chain entanglement at around 0.5 per cent by volume of GO. We now extend our studies to the dynamics of the PMMA using quasi-elastic neutron scattering and neutron spin echo spectroscopy. We discover changes in PMMA dynamics that do not vary linearly with GO concentration. We observe an increase in the segmental relaxation time at low GO concentration and a decrease at high GO concentration, reflecting the non-monotonic trends seen in the structural data. We now explore simple scaling arguments to link the structural and dynamical interpretations of our system.

Michael Weir
The University of Sheffield

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