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Studies of near surface dynamics and filler dispersion in nanocomposites

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Polymer filler interactions and structure are challenging to measure directly, but are important to the overall material properties of composites. Particularly, filler networking and shifts in polymer dynamics toward the glassy state are of more interest, as both are proposed to be related to composite reinforcement and strain softening. Our recent work has analyzed the dispersion of nanoparticles with end-functionalized polymer and corresponding changes in rheological properties through the use of Quasi Elastic Neutron Scattering (QENS), a technique that analyses velocity shifts in scattered neutrons. We have directly measured the dynamics of polybutadiene about silica nanoparticles. A several nm thick layer of greatly inhibited motion was found near the surface of the nanoparticles, with a key feature that this layer thickness has Vogel-Fulcher-Tammann dependence with temperature. Our recent *in-situ* neutron scattering experiments have found the decrease in the glassy layer thickness with the applied strain, which supports the theory on causes of strain softening. Further work is ongoing to characterize this change in surface properties with strain and its link with rheology properties of the composite system, namely the Payne effect.

Biography

James Hart graduated from Bristol University in the year 2013 with a degree in Chemical Physics. He is currently a PhD student (STFC Global Challenge Scholarship) under Richard Thompson at Durham University.

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