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Towards the Next Generation of Polymer Nanocomposites: More Rigid, Lighter Weight, Yet Easier to Process[1]
JEONGJAE WIE, JONATHAN SEPPALA, MICHAEL MACKAY, University of Delaware, WOO JIN CHUNG, JEFFREY PYUN, University of Arizona — Polymer nanocomposites are attractive for their lightness in weight and excellent mechanical reinforcement. Current nanocomposites incorporate high aspect ratios fillers such as clays, carbon nanotubes (CNT), and graphenes. Exfoliation of clay, for example, is essential to obtain maximum mechanical reinforcement, yet this results in a 2 to 4 order of magnitude melt viscosity increase. This high viscosity leads to a reduction in the production rate and/or increased processing cost, which is undesirable. In order to obtain reduced melt viscosity without sacrificing the advantages of current nanocomposites, we prepared poly(styrene) (PS) nanocomposites by inclusion of various spherical nanoparticles using a technique that ensures good dispersion. Tensile tests demonstrated enhanced tensile modulus in the glassy state while a reduced melt viscosity was observed. The results show that nanoparticle geometry is extremely important and nanoscale effects can lead to the next generation of polymer nanocomposites.

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