MAR15-2014-020185

Abstract for an Invited Paper
for the MAR15 Meeting of
the American Physical Society

Modifying polymer rheology by using nanofillers: applications in additive manufacturing

DILIP GERSAPPE, Stony Brook University

The ability to control the flow properties of polymers is critical to developing materials that can be used for additive manufacturing. In this talk, I discuss the effect of adding nanofillers in polymeric matrices on the flow and rheological properties. We use Molecular Dynamics simulations to examine the role nanofillers have on polymer melts and polymer blends. In homopolymer systems, our results indicate that above a critical concentration of filler particles, the network structure formed between the fillers and the polymers strongly affects the dynamics of the nanocomposite under shear. However, we also find that low concentrations of filler particles leads to a large increase in chain orientation (relative to the pure polymer case) when shear is applied. Our results indicate that the ability of fillers to maintain the network during shear results in the enhancement of the shear thinning effect at high concentrations of filler particles, while the ability of fillers to induce high degrees of orientation in polymer chains results in shear thinning being present even at lower concentrations of fillers. In polymer blends, we show that the nanofillers can reduce the slip at the interface between the two components. We also examine the role of the aspect ratio of the nanofiller on the rheological properties of polymer nanocomposites.