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Effects of Stress on Exfoliation of Organoclays

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Stress is needed to exfoliate clay in polymers, but excessive stress may break organoclay platelets resulting in loss of aspect ratio. The goal of this work was to determine what effect different stress levels had on nanocomposite systems. Polypropylene (PP) and polystyrene (PS) nanocomposites have been prepared using a 20-layer feed block and sheet die. Master batches containing 25 wt% organoclay were initially prepared by twin screw extrusion. The master batches were let down to 5 wt% organoclay in the final samples. PP and PS and their respective master batches were fed by single screw extruders into separate halves of the 20-layer feed block, resulting in 10 evenly distributed layers each. The shear stress applied in the sheet die has been determined for each of the 10 layers. Melt rheology, thermal expansion, diffusion barrier, and mechanical tests were used to assess dispersion and to compare results to theoretical predictions. TEM microscopy was used to compare particle aspect ratio to expected values based on the theories. Additionally, 640-layer samples were considered using multiplication dies before the sheeting section.