Melt compounding of different grades of polystyrene with organoclay. Part 2: Rheological properties

Polystyrene-based nanocomposites (PNC) were prepared using three grades of polystyrene (different molecular weights). The resin was melt-compounded with 0 to 10 wt% of commercial organoclay in a co-rotating twin-screw extruder. Owing to thermo-oxidative degradation the degree of dispersion was poor. The rheological properties of PNC were determined under dynamic and steady state shear as well as under extensional flow conditions. At the higher clay content, dynamic strain sweep demonstrated that the storage and loss moduli decrease continuously with an increase of strain. To characterize this nonlinear viscoelastic behavior, the Fourier-transform rheology, was applied. The low strain frequency sweep showed that the storage and loss moduli increase with organoclay content. The extracted zero-shear viscosity data were used to calculate the intrinsic viscosity and then the aspect ratio of dispersions. In spite of nonlinear viscoelastic behavior, the time-temperature superposition was observed in the full range of concentration. The horizontal and vertical shift factors were found to be almost independent of organoclay content and molecular weight of PS. For comparison, PNC was also prepared by the solution method. A high degree of dispersion was obtained, reflected in the aspect ratio: \( p = 269 \), to be compared with \( p = 16 \) calculated for the melt-compounded.

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