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Melt-state Viscoelastic Properties of Polypropylene/Organoclay Nanocomposites

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The melt-state viscoelastic properties of nanoclay composites consisting of polypropylene and alkyl ammonium modified montmorillonite was studied. The samples were prepared by melt mixing of polypropylene with nanoclay and maleic anhydride grafted polypropylene, as a compatibilizer, in an internal mixer. The clay interlayer spacing determined by wide angle X-Ray scattering (WAXS) was increased upon melt mixing. The linear viscoelastic results obtained by rheometric mechanical spectrometer (RMS) exhibited a pronounced viscosity upturn as well as a non-terminal behavior of elastic modulus in low frequencies; the behavior which could be attributed to a three dimensional physical network formed in low frequency region. The results of nonlinear viscoelastic measurements including the transient stress in start-up of steady shear flow were found to be in agreement with formation of three dimensional network at low frequencies. These results could also suggest that the microstructure of nanocomposite samples developed through melt mixing is thermodynamically unstable. This was evidenced by the results obtained for the samples prepared with varying compatilizer content and melt mixing parameters. From these results it was demonstrated there is a close relationship between microstructure, the melt viscoelastic properties and thermodynamic parameters.