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Effect of Clay Loading on Quiescent Crystallization of Syndiotactic Polypropylene/Clay Composites

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Abstract : Rheology can be used as a tool to examine the crystallization kinetics of polymers and polymer composites, and it provides more accurate results than the commonly used conventional techniques like differential scanning calorimetry (DSC) when the crystallization kinetics are slow. Crystallization occurs when crystalline polymers are cooled below their thermodynamic melting point temperature. At the start of this process, there is a gradual change in the mechanical response of the material from the liquid to the solid state, which is due to the change at the microstructure level of the polymer and polymer composites. This is one of the main characteristics of the rheological methodology that sets it apart from the conventional DSC method. In the present work, we used both rheological and differential scanning calorimetric techniques to perform both isothermal and non-isothermal crystallization experiments on a range of syndiotactic polypropylenes/clay composites with varying doses of clay contents in order to investigate the crystallization behavior of the materials. The objective of this work is to explore the effect of clay contents on the crystallization behavior of the syndiotactic polypropylene/clay composites and to couple the rheological methods with more conventional techniques such as Differential Scanning Calorimetry (DSC). Time sweep tests at a constant heating rate of 40°C/minutes were used to investigate the crystallization kinetics using the Atomic Rheumetric Expansion System (ARES). Crystallization behavior was found to be strongly dependent on the clay contents of syndiotactic polypropylene/clay composites. Both melting point (T_m) and crystallization temperatures (T_c) were found to increase with an increase in clay contents. Excellent agreement is found between the results obtained by both the rheological and differential scanning calorimetric (DSC) methods.

Keywords : quiescent crystallization, polymer composites, rheology, differential scanning calorimetry, syndiotactic polypropylene/clay composites
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