

# **INFLUENCE OF PROCESSING ON BLENDS OF LINEAR AND LONG-CHAIN BRANCHED POLYPROPYLENE AND ITS REVERSIBILITY**

Duscher Bernadette<sup>a</sup>, Schausberger Alois<sup>b</sup>

<sup>a</sup>Institute of Materials Science and Technology, Vienna University of Technology, Favoritenstraße 9-11, A-1040 Vienna, Austria

<sup>b</sup>Institute of Polymer Science, Johannes Kepler University Linz, Altenberger Straße 69, A-4040 Linz, Austria  
email for contact: Bernadette.Duscher@tuwien.ac.at

## **ABSTRACT**

Long-chain branched polymers have high melt strength and show strain hardening in the elongational flow. These characteristics are both regarded as important quantities during the foaming process as well as thermoforming or extrusion blow molding. Though, these rheological properties are strongly affected by processing time, temperature, machining method, the number of processes and, according to extrusion, even by screw configuration.

Flow behavior in melt provides information about processability and structural design and represents an essential method in polymer characterization. In this study different rheological methods and quantities (material functions in shear and elongation, flow activation energy ( $E_a$ ), relaxation time spectra) are used to determine changes in the flow behavior by process modification. By solution treatment an equilibrium state is created and modification divided into the true (reversible) part and the apparent (irreversible) part and as a result any change in the molecular and entanglement structure are determined.

A series of blends of linear (L-PP) and long-chain branched polypropylene (LCB-PP) was prepared and different processing methods (measuring mixer, twin-screw extruder with varying screw set-ups, and foaming) and varying processing parameters were used.

The decrease of dynamic moduli and flow activation energy depends on the operational demands the polymer blend has passed. By means of the relaxation time spectra (RTS), the cross-over frequency  $\omega_c$  and the cross-over modulus  $G_c$ , the influence on the rheological and structural properties can be shown more explicitly. The dependence of cross-over modulus on cross-over frequency is shown for blends and process-modified samples. With increasing efficiency of modification (or decreasing number of entanglements) the cross-over modulus increases.

After solution treatment  $E_a$  recovers totally, the dynamic moduli recover partly but superimpose in a limit function. By determining strain hardening behavior, it is shown that the smaller the strain rates are, the higher is the difference between the process-modified samples and its dissolved equivalents. As a result of this, it is assumed that process-modification does not decrease the number of entanglements but the chain's length.