SL 9.13

Elongational Flow of Polystyrene/Polyethylene Blends and its Influence on Morphology Development

M. Heindl (a), H. Münstedt
Institute of Polymer Materials, University Erlangen-Nürnberg,
Martensstr. 7, D-91058 Erlangen, Germany
(a) Now: Süddeutsches Kunststoffzentrum (SKZ),Friedrich-Bergius-Ring 22,
D-97076 Würzburg, Germany

The rheological behaviour and the morphology development of polystyrene/polyethylene blends were studied at different capillarity numbers and different temperatures under defined uniaxial elongational flow conditions.
The blends investigated consist of low-density and linear low-density polyethylene particles dispersed in a polystyrene matrix. By analysing the morphologies of the samples via scanning electron microscopy, the particle size distribution functions were determined.
All rheological experiments were conducted using a Münstedt tensile rheometer (MTR). The morphologies of the elongated samples were frozen in by quenching the specimens in liquid nitrogen after deformation.
It was found, that the elongational properties of the polystyrene matrix strongly dominate the flow behaviour of the respective blends. Using the measured transient elongational viscosity of the polystyrene matrix, the true hydrodynamic stress during flow could be calculated. Thus, a modified capillarity number was obtained, which takes into account the influence of transient and nonlinear effects (e. g. strain hardening) on the morphology development. By using the capillarity number the fibril formation of the dispersed phase under all test conditions could be explained.
During elongation coalescence processes of the polyethylene particles take place leading to an increase of the particle sizes and to a broadening of the corresponding particle size distribution. Virtually no break-up processes of particles could be observed directly after the deformation. An increased residence time of the sample in the tensile apparatus at constant deformation after elongation leads to Rayleigh instabilities which cause fibril disintegration under some test conditions. This finding is in accordance with the Tomotika theory.