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SHAPE RECOVERY VERSUS DROPLET BREAKUP IN POLYMER BLENDS AFTER UNIAXIAL EXTENSION

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The blend morphology induced by melt mixing is often unstable and it can change considerably after leaving the mixing device. Therefore, understanding of the droplet behavior after cessation of the flow is of great importance. This work is focused on the morphology development in PS/LLDPE 95/5 blend after uniaxial elongation at constant stress, i.e. at constant capillary number [1]. Phase structure changes after the deformation are studied in two modes – free recovery and relaxation and they are quantitatively characterized by electron microscopy and small-angle X-ray scattering. The influence of the recovery temperature on the competition between shape recovery and droplet breakup is evaluated and the relationship between the morphology development and the elasticity of the blend is discussed. Moreover, the influence of the compatibilizer on the droplet behavior was investigated.

It was found that after recovery at lower temperatures, the finer morphology was obtained, i.e. the fibril breakup was preferred instead of shape recovery. This is caused by a stronger retraction of matrix molecules at higher temperatures in early stages of recovery which suppresses the droplet breakup. The elasticity of the blend was found to be an increasing function of temperature although the elasticity of the pure PS is temperature independent. This phenomenon is explained as a consequence of the dependence of the morphology development on temperature [2].

Although no significant effect of the compatibilizer on the deformation of the droplets during the elongation was detected, pronounced differences were observed during the consequent relaxation. Whereas in the uncompatibilized blend the droplets breakups occur, in the presence of the compatibilizer the elongated droplets simply retract to their original shape. This is explained by the Marangoni stress, which stabilizes the drop against breakup and accelerates the shape recovery of the droplets.