Use of Computed Tomography for the Analysis of the Mixing Quality in Polymer Blends

Mike Kornely[1], Tanja Matzerath[2], Christian Bonten[3], Marc Kreutzbruck[1]

[1]Institut für Kunststofftechnik, University of Stuttgart, Germany, [1]Institut für Kunststofftechnik, University of Stuttgart, Germany, [1]Institut für Kunststofftechnik, University of Stuttgart, Germany

Nowadays, materials have to meet high mechanical requirements while at the same time being cost-effective in production. In the plastics industry, this is realized by so-called polymer blends, a mixture of at least two polymers with different properties. The results are low-cost and at the same time tailor-made material properties for the respective application. To ensure good mechanical properties, a homogeneous melt, i.e. a uniform dispersion of the different components, must be achieved. Therefore, the mixing process in plastics processing is of great importance. However, in order to evaluate the mixing process, it has to be measurable in a suitable manner to get a thorough understanding of the mixing process depending on the material and process properties. This is the only way to design new mixing elements and ensure a homogeneous melt during processing, thus providing new materials with high mechanical requirements. A potential tool to understand the compound mixing process not only qualitatively but also quantitatively, computer tomography might be a helpful technology. However, due to the chemically similar polymer structure consisting of a few light elements (C, H, N, O, etc.), the X-rays attenuation properties of different plastics compounds are almost identical, which is why analysis by computed tomography has been hardly possible yet. In this work is shown that the problem is solved by dissolving the polystryrene component in a polypropylene-polystyrene blend with chloroform. In this way, the volumetric distribution of the two blend components can be analysed utilizing micro-computed tomography.