COMPOSITE MATERIALS BASED ON RECYCABLE THERMOPLASTS

KOMPOZĪTMATERIĀLI UZ RECIKLĒJAMU TERMOLPASTU BĀZES

D. Pizele, T. Ivanova, R. Merijs Meri, J. Zicāns, RTU, Institute of Polymer Materials
V. Kaļķis, University of Latvia, Faculty of Chemistry

More than a half of the century the planet Earth is suffering from increasing amount of synthetic polymer waste. The most abundant component of the plastic waste stream is packaging, from which the largest part belongs to thermoplasts, particularly low-density polyethylene (LDPE), high-density polyethylene (HDPE), and increasingly also polyolefine copolymers, such as linear ethylene-α-octene copolymer (EOC), which is synthesized by single-site metallocene catalyst, so called constrained geometry catalyst technology. This new type of polyethylene is elastomeric material, which is aimed at a variety of packaging, medical, wire and cable, automotive and consumer uses. Due to its properties consumption of this "super polyethylene" is expected to raise rapidly: it is predicted that by year 2005 the use of metallocene polyolefines will be 12 – 15 %, but by year 2010 even 25 % from the total polyethylene production rate.

Therefore recycling of both, conventional polyethylenes as well as polyolefine copolymers is of great importance. Although, due to it excellent formability, thermoplasts recycling as such is comparatively easy, the most important problem, probably, is inhomogenity of the waste stream that makes it problematic to avoid from polymer mixing. As a result drop of the exploitation properties of the materials is observed and some of the desired application possibilities are lost. One of the most important reasons, causing such behavior and hence non-predictability of the properties by additive rule, is polymer/polymer immiscibility, which is determined by a delicate balance of enthalpic and enthropic forces. However, it must be mentioned that from the practical point of view the hetero-phased systems are advantageous; while the dispersed phase can improve toughness, as well as other important characteristics of the material. In other words, it is advantageous to produce easy handling heterogeneous blends with stable and reproducible properties.

In the presented work blends of LDPE and HDPE with EOC are investigated in the wide range of mutual ratios of the components (10/90, 30/70, 50/50, 70/30, 90/10 denoted as weigth-to-weight ratios). The effect of the dispersed phase on the processability as well as stress-strain characteristics, impact behaviour and thermomechanical performance of the blends is investigated.

The results obtained, allow concluding that increase of elastic modulus, offset yield strength, ultimate tensile strength, thermorelaxation and thermosetting stress and decrease of elasticity and ultimate elongation of the investigated blends, observed along with growing LDPE content, is most possibly explained with higher chain rigidity and greater crystallinity of the polymer. Especially important conclusion, considering globality of the waste problem, is processability of the compositions of LDPE/EOC and HDPE/EOC blends regardless from it composition. From this follows that investigated blends are suitable for production of specific engineering materials with customer demanded physical properties.

Danuta Pizele, student,
RTU, Institute of Polymer Materials,
Address: Azenes 14/24, Riga LV 1048, Latvia
Phone: (+371) 708 9252
e-mail: zicans@ktf.rtu.lv