Multiple Shape-Memory Effect Polymers on the Basis of Peroxide Crosslinked Binary and Ternary Polyethylene Blends

Radusch Hans-Joachim, Kolesov Igor S.

In our prior investigation was shown that shape-memory (SM) polymers can be successfully produced on the basis of peroxidic crosslinked ethylene-1-octene copolymers (EOC) and high density polyethylene (HDPE) using the melting temperature of the specific crystalline phases as switching temperature for starting recovery, and the covalent network in the amorphous phase as the essential element of driving recovery forces. Binary and ternary blends from different branched EOCs and/or linear polyethylene (HDPE) were produced by melt mixing and crosslinked subsequently by peroxide. By blends generation a multiple SM behavior is aspired. The SM behavior of the different blends was evaluated by the characteristic parameters "SM recovery strain", "strain fixity ratio" and "recovery strain rate" in dependence on temperature. The SM experiments have been carried out in tensile mode at different programming temperatures at constant programming strain. In dependence on branching degree of the EOC used and the cross-linking degree generated by the peroxide the single EOCs and HDPE exhibit a very good SM behavior with high values of strain fixity ratio and strain recovery ratio of up to 99% at suitable programming temperatures. On the basis of these results binary and ternary blends were generated for creation of the multiple SM effect. The results of investigation had shown that multiple SM behavior appears at sequential stepwise application of good fitted values of programming deformation and programming temperature for each blend component and crystalline phase, respectively. The results will be discussed in connection to the blend morphology.