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Toughening of Cyclic Olefin Copolymers by Blending with SEBS Block Copolymers and SBR

M. Krumova (a), V. Seydewitz (a), G.H. Michler (a) and S.C. Kim (b)
(a) Department of Materials Sciences, University of Halle, D-06099 Halle, Germany
(b) Korea Advanced Institute of Science & Technology (KAIST) Taejon 305-701, Korea

Cyclic olefin copolymers (COC) form a new class of thermoplastic materials with excellent optical, thermal and permeation properties. However, some of the mechanical characteristics are not optimal. COC are known to break in a brittle manner, comprising elongation at break of only few percent. For some engineering applications it is desirable to enhance their toughness, but this should not affect significantly their optical transparency. In this study COC was blended with SEBS block copolymers and SBR in various amounts - 5, 10 and 20%. The pure COC used was Topas 6013. Here we present the morphology and the microdeformation behaviour of the blends and correlate them with the macroscopic mechanical characteristics. Blending with 10% SBR or SEBS cause multiple crazing and in the case of SBR even transition to more ductile deformation modes. These observations correlate well with the strong increase in the notched Izod impact strength. In addition to commercial SEBS block copolymers, new SEBS modifier were used. The amount of polystyrene was reduced from 60 to 30% and its molecular weight was varied. Transmission electron micrographs show for the SEBS with low molecular weight polystyrene a transition from traditional hexagonal to lamellar morphology. A tendency to particle size reduction and better particle distribution with decrease of the molecular weight was observed.