

Structure-property relationships for high performance thermoplastic elastomers containing modified ground tire rubber

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High performance thermoplastic elastomers (TPEs) containing ground tire rubber (GTR) modified by bitumens, reclaimed polyolefins (HDPE, LDPE, PP) and olefinic type rubbers (EPDM) have been produced by using method of dynamic vulcanization, and their structure-property relationships were investigated. The TPEs produced show outstanding mechanical properties and met the requirements with thermoplastic rubbers. It was established that the conditions of the GTR treatment with bitumen strongly affect the performance of the TPEs. Structure-property relationships were investigated using thermogravimetric analysis (TGA), rheological measurements, differential scanning calorimetry (DSC), dynamic mechanical thermal analysis (DMTA) and scanning electron microscopy (SEM) techniques, as well as mechanical testing. It was found that thermal behavior of TPEs containing modified GTR in the temperature region up to $\sim 340^{\circ}\text{C}$ is similar to the polyolefin/EPDM/GTR TPEs, in the temperature region of $340^{\circ}\text{C} \div 460^{\circ}\text{C}$ some depression by $\sim 28\text{--}33^{\circ}\text{C}$ of thermal stability is observed for TPEs containing modified GTR. The rheological measurements have shown that bitumen acts as an effective plasticizer. SEM results revealed a good adhesion between the GTR particles and the surrounding matrix. DSC measurements have fixed some depression of the melting temperature (T_m) values of the polyolefin matrix in the TPEs that evidences of increasing blend components compatibility. Based on DMTA measurements it was concluded that bitumen acts as an effective devulcanizing agent for GTR, and further, in TPEs as active modifier providing covulcanization of rubber components (EPDM/GTR) and blend components compatibilizer.