EFFECT OF MODEL RUBBER POWDER BASED ON ETHYLENE-PROPYLENE-DIENE ELASTOMERS ON RHEOLOGICAL BEHAVIOR OF THERMOPLASTIC ELASTOMERS

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Waste rubber, like plastic waste, is becoming a world-wide waste disposal problem. Worn rubber tires and other rubber waste produced from mold flashings and rejects can be longer be easily reclaimed. An application that has potential to utilize large volumes of waste rubbers is the use of this material as a filler in plastic compounds which retain processability and physical properties after incorporation of significant proportions of rubber.

The preparation of rubber powder (RP) by grinding is a general trend of rubber wastes treatment. Thermoplastic vulcanizates (TPVs) containing RP are very perspective materials from the point of view of using of RP as elastic fillers. In this work, the effect of RP prepared by the method of high-temperature shear deformation (HTSD) from EPDM rubbers with different crosslink density on the rheological and mechanical properties of thermoplastic elastomers (TPEs) and dynamically cured TPVs based on iPP and EPDM was investigated. This method is based on the degradation of a material in a complex strained state by the action of uniform compression pressure and shear forces under elevated temperatures. This method is available for the production of finely rubber powder.

The polymers used in this study were iPP, commercial oil-free ethylene-propylene-diene rubber EPDM Dutral TER 4044 and oil-extended EPDM Dutral TER 4334 (Polimeri Europa, Italy).

Rubber vulcanizates of different crosslink densities were obtained by varying the amount of sulfur in the recipes, changing the ratio of sulfur to accelerator system. Blends were prepared in a Brabender plasticorder mixer at room temperature.

RP was obtained by the method of HTSD from the initial vulcanizates with different crosslink density were subjected to grinding by four repeated passing through a rotary disperse.

The particle size distribution of the rubber powders was determined by the method of vibratory sieving. Sieve analysis showed that for all types of RP had a majority of particle size of $0.315<d<0.63$ mm. The increasing of sulfur concentration in the rubber vulcanizate decreased percent of particles size of $d>0.63$ mm, while percent of particles size of $d<0.315$ mm increased. The RP particles have an asymmetrical shape. Two characteristic regions with a distinct boundary are observed at the surface of particles: a region of plastic fracture with highly developed surface and the region of brittle fracture with a smooth surface. The increasing of sulfur concentration in the original rubber vulcanizates leads to a decrease in the plastic fracture on the RP surface.

The rheological behavior of TPEs and dynamically cured TPVs with RP was determined by capillary rheometer. It is found that the addition of rubber powder into rubber phase of TPE increases its viscosity, and a partial replacement of EPDM on RP results in a significant decrease in the viscosity of blends in TPV. The viscosities of TPE and TPV depend on the content of rubber powder and crosslink density of vulcanized EPDM. Blends EPDM/rubber powders, PP/rubber powders were also studied. It is shown that the performance of rubber powder in TPE and TPV depends on particle size, surface area, and composition.