

IMPROVEMENT IN THE RADIATION STABILITY OF EPDM/INCORPORATED EPDM POWDER/CARBON BLACK COMPOUND

Ludmila de Ysasa Pozzo KIYAN¹, Traian ZAHARESCU², Duclerc Fernandes PARRA¹, Ademar Benévolo LUGÃO¹

¹IPEN, Center of Chemistry and Environment, ²INCDIE ICPE CA, Department of Advanced Materials, São Paulo, Brazil, ludmilapozzo@gmail.com

The recovery of polymer wastes is a promising task, which can be done by the application of radiation processing on proper compositions. Even though radiation has a scission effect on macromolecules, the presence of a certain monomer leads to more stable systems. The most convenient procedure for polymer recycling is crosslinking under irradiation, when new intermolecular bridges promote stability.

The incorporation of EPDM powder and carbon black in the matrix of block polymer makes possible to reuse this elastomer for economical purposes.

This paper analyzes the possibility of stability improvement by the addition of acrylic acid in EPDM systems. The start materials are EPDM containing 30 and 50 phr of EPDM powder loaded with 40 phr of carbon black. After electron beam irradiation these materials gain a certain stability, which was characterized by nonisothermal chemiluminescence. The involvement of radicals in the modification of oxidability after EB exposure is revealed by the increase of activation energy as the dose enhanced by their contribution to material strengthening. The difference between the two compositions consists of the feed of free radicals from the higher content of EPDM powder.

The two stages of irradiation bring about two different effects. The first EB processing creates a relative stability of processed EPDM compounds, while γ -irradiation performed in the presence of crosslinking monomer (acrylic acid, at the load of 3 phr) improves the degree of gelation.

The resistance against oxidation is improved after the γ -treatment of composed samples because acrylic acid participates at the formation of new intermolecular bridges and the diffused oxygen amount is diminished. The presence of 0.3 phr of antioxidant (Irganox 1010) restricts the decay of radicals by their reaction with oxygen.

The Charlesby-Pinner representation reveals the similar behavior of radiation crosslinked samples, but the p/q ratios are 1.72 and 1.78 for EPDM containing 30 phr and 50 phr, respectively of EPDM powder. The analytical relationships which depict the gel accumulation are:

$$\text{for 30 phr: } S+S^{1/2} = 1.72 (1/D) + 8.59$$

$$\text{for 50 phr: } S+S^{1/2} = 1.78 (1/D) + 6.39$$

The oxidative degradation advances differently in two samples containing 30 and 50 phr powder, due the higher.

This study is a start investigation of polymer recovery using radiochemical processing, which confirms the application of nuclear energy in material conversion.