

Alterations of Molecular Characteristics of Polyethylene under the Influence of External Effects

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Abstract : The influence of external effects (γ -, UV-radiations, high temperature) in presence of air oxygen on structural transformations of low-density polyethylene (LDPE) have been investigated dependent on the polymers' thickness, the intensity and the dose of external actions. The methods of viscosimetry, light scattering, turbidimetry and gelation measuring were used for this purpose. The comparison of influence of external effects on LDPE shows, that the destruction and cross-linking processes of macromolecules proceed simultaneously with all kinds of external effects. A remarkable growth of average molecular mass of LDPE along with the irradiation doses and heat treatment exposure growth was established. It was linear for the mass average molecular mass and at the initial doses is mainly the result of the increase of the macromolecular branching. As a result, the macromolecular hydrodynamic volumes have been changed, and therefore the dependence of viscosity average molecular mass on the doses was going through the minimum at initial doses. A significant change of molecular mass, sizes and shape of macromolecules of LDPE occurs under the influence of external effects. The influence is limited only by diffusion of oxygen during -irradiation and heat treatment. At UV-irradiation the influence is limited both by diffusion of oxygen and penetration of radiation. Consequently, the molecular transformations are deeper and evident in case of -irradiation, as soon as the polymer is transformed in a whole volume. It was also established, that the mechanism of molecular transformations in polymers from the surface layer distinctly differs from those of the sample deeper layer. A comparison of the results of these investigations allows us to conclude, that the mechanisms of influence of investigated external effects on polyethylene are similar.

Keywords : cross-linking, destruction, high temperature, LDPE, γ -radiations, UV-radiations

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