Dynamic mechanical and rheological properties of polypropylene modified by gamma irradiation in the presence of polyfunctional monomers.

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Abstract

In this work isotactic polypropylene (iPP) was irradiated with gamma radiation in the presence of polyfunctional monomers. The polymeric radicals can also recombine with another macroradical and so create a crosslinked or branched structure by connecting neighbour macromolecules. The presence of crosslinking or branching will affect the average molecular weigh and will change all the physical properties as crystallinity and mechanical and rheological behaviour of the polymer. The monomers used in this study were trimethylolpropanetriacrylate (TMPTA), triallylcyanurate (TAC) and acetylene. The experiments have been carried out keeping constant the amount monomers concentration and the samples were irradiated with 10 and 20 kGy under inert and oxidative atmosphere. The viscoelastic properties, such as, the storage modulus (E') and the mechanical loss factor, damping (tan δ = E'/ E"), were record as a function of temperature and frequency. The activation energies were also calculated. On the other hand the complex viscosity (η^*) was obtained in the transient stated by oscillatory measurements in the frequency ranges of 10^{-2}-10^{3} rad s^{-1}. For all samples the presence of monomers in the polypropylene structure increases the viscoelastic properties and the activation energies of relaxations process in comparison of the pure polymer. The effects of branching or crosslinking degree estimated by gel content and also rheological measurements allow evaluating the efficiency of multifunctional monomers and the irradiation process.