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Temperature Behaviour of Ethylene–propylene Elastomer

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Abstract

Several studies concerning thermal degradation of ethylene–propylene rubbers[1–5] have pointed out that this kind of polymer behaves like saturated hydro-carbon materials. Significant thermal stability of these elastomers was ascribed to the chemical resistance capacity of the materials to advanced action of damaging factors, such as heat, light, water and other environmental agents.

Keywords: *Temperature, light, heat, water.*

Introduction

Of course, in the case of multi-stress experiments the rate of degradation especially for oxidation, will go up. Stabilizers can hinder the damaging pro-cess.[6–8]

Degradation involves structural modifications of the polymer; their ampli- tude is often determined by the chemistry of material. The alteration of mol- ecules is influenced by the weakness of bonds that make up the polymer backbone. If the studied material is previously aged, the concentration of inter- mediates will achieve a certain oxidation rate and therefore the substrate will present specific thermodynamic behaviour.

Thermodynamic assessment on thermal degradation can evaluate the chemical consequences of changes in the basic functions, i.e., free energy and entropy during oxidation. Detailed experimental studies on thermodynamic parameters can provide useful information concerning energy involvement in oxidative degradation or other process. This paper presents some aspects of energy participation in thermal degradation of ethylene–propylene copolymer due to oxidation at various temperatures.

Experimental

Ethylene–propylene elastomer (EPR) was provided by ARPECHIM Pitesti (Romania). The main characteristics of this material are listed in a previous paper.[4] It was not subjected to any purification, because it was intended to study the behaviour of EPR in industrial applications.

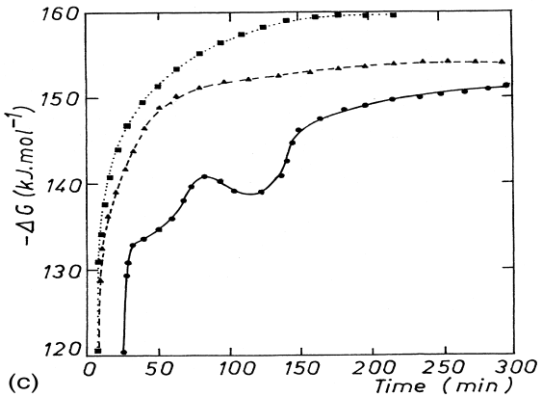
Samples were prepared as cast films after evaporation of solvent ($CHCl_3$). The volume of aliquot solution (1

cm^3) was the same for all samples. Thus, it can obtain the same thickness of the films and therefore eliminate the effect of oxygen diffusion onto the different depths of samples. Degradation was performed in an air-circulating oven by isothermal heating at 100°C for 250, 400 and 700 h. This temperature was chosen as a limit value for accidental events.

The procedure used for the calculation of Gibbs free energy is presented in an earlier paper. It used the rate constant of oxidation calculated for the smallest increases in absorbed amount of oxygen (Eyring's equation).

Conclusions

Thermodynamic evaluation of thermal stability for ethylene–propylene rubber emphasizes the oxidation resistance for a long period, even when this polymer is tested in the uncompounded state. This kind of study may be considered as a good tool for characterization of the degradation state.



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