CHARACTERIZATION OF P-PHENYLENEDIAMINE CONSUMPTION IN RUBBERS DURING OXIDATIVE AGING

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The perdurability of an elastomer depends to a large extent on the thermal oxidative aging processes. Antioxidants are added to rubbers in order to improve the durability by reducing the effects of ageing. Especially primary antioxidants like types of p-phenylenediamines or diphenylamines show high efficiencies. From the scientific-technologic point of view it is of interest to know how and how long they act, as well which reaction mechanism they follow. Under special concern is the efficiency of intermediates of p-phenylendiamines from oxidative degradation mechanisms. The knowledge will be used to improve the overall product quality as well as the compounding and to reduce costs in rubber manufacturing. In the present study the consumption of 6PPD as a typical antioxidant used in polydienes is characterized in BR and IR rubber. Reaction products of 6PPD are identified in dependency of aging time and temperature. The used methods were extraction, FTIR, HPLC, GC-NPD, GC-MS and chemiluminescence (CL) or artificial aging in circulating air.

Introduction

The thermal oxidative aging processes are described in a generic form by a radical mechanism [1-3]. Several investigations show a correlation between the structure and efficiency of PPDs, where the ability of the ab-straction of hydrogen from the aryl-aryl-nitrogene-atom plays an important role during the radical reaction mechanism caused by peroxo radicals [4-5]. Different reaction products of PPD`s are described like hy-droylamine- and N-formyl-derivates. Unclear is the effect of such intermediates as antioxidants as well a complete spectrum of all reaction products.

Results and Discussion

The consumption of 6PPD obeys to a reaction's rate equation of first order. The studies of OIT-values by means of chemiluminescence (CL)and the coupling between CL, extraction and GC-NPD-analyses show at which times and temperatures the consumption of 6PPD is complete. Using the artificial ageing in an oven it could be observed, that after 5 weeks at temperatures of 60°C, 70°C and 80°C the 6PPD is not completely consumed. GC-MS analyes of extracts of oxidative aged 6PPD/BR-compounds result in reaction products with higher mol masses than 6PPD itself, like formaldehyde-adducts of 6PPD.

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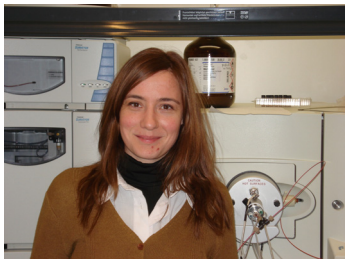

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- Verbrauch von p-Phenylendiaminen bei thermisch-oxidativen Alterungsprozessen
- Chemilumineszenz, IR, GC-MS, LC-MS