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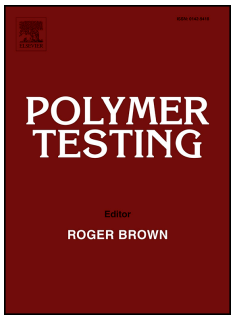

Natural rubber/styrene-butadiene rubber blends prepared by solution mixing: Influence of vulcanization temperature using a Semi-EV sulfur curing system on the microstructural properties

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Material Properties

Natural Rubber/Styrene-Butadiene Rubber blends prepared by solution mixing: Influence of vulcanization temperature using a Semi-EV sulfur curing system on the microstructural properties.

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Abstract

Blends of natural rubber (NR) and styrene-butadiene rubber (SBR) were prepared by solution mixing and vulcanized with sulfur and accelerator in a Semi-EV system at 433 K and 443 K in order to study the vulcanization kinetic and the influence of vulcanization temperature on final structure of the blends. The vulcanization kinetic studied through the variation in rheometer curves was analyzed using the Ding and Leonov model, which takes into account the reversion effect during the cure process. The average free nanohole volume and the fractional free volume of samples with different NR/SBR ratio were estimated using positron annihilation lifetime spectroscopy (PALS). Also, the crosslink density was determined by means of solvent swelling tests. For all the compounds, a correlation between the free nanohole volume and the delta torque obtained from the respective rheometer curves was established.

Keywords: NR, SBR, rubber blends, vulcanization, PALS, swelling.

INTRODUCTION

Natural rubber (NR) and styrene-butadiene rubber (SBR) have numerous technological, environmental and commercial advantages when blended together to obtain a material that optimizes the mechanical properties. Vulcanized blends of NR/SBR constitute an important set of materials in industry; in particular, when combined with fillers as carbon black or silica, they are principally used as components in the manufacture of tires [1].

The final structure, mechanical performance and thermal stability of a vulcanized elastomer formulated with a system based on sulfur and an accelerator are strongly dependent on the type (mono-, di- and poly-sulfidic linkages) and extent of the crosslinks present in the compound. Vulcanization based