HIGH FREQUENCY INVESTIGATION OF ELASTOMER PROPERTIES USING ANULTRASONIC SPECTROMETER

Cristian A. Oprisoni*, Thomas Alshuth, Robert H. Schuster

Deutsches Institut für Kautschuktechnologie e.V. (DIK), Eupener Str. 33, 30519 Hannover, Germany, Cristian.Oprisoni@dikautschuk.de

The aim of this contribution is to study the high and low frequency dynamics of an array of solution polymerized styrene butadiene rubbers (SSBR) displaying a systematic variation of the styrene and vinyl content. The focus is the characterization of the interactions that occur between the elastomer and the filler. The longitudinal wave modulus of the mentioned polymers is calculated from the sound velocity and damping measurements

Introduction

The detailed knowledge of the dynamic properties of elastomers in the MHz range is important for modern product design. One method to investigate these properties uses ultrasound to evaluate the material characteristics at high frequencies. The measured properties are the velocity and the damping of the ultrasonic waves passing through the rubber samples [. These two values are used then to calculate the real and imaginary part of the longitudinal wave modulus [1, 2].

Experimental

The investigation was carried out on five solution SBR polymer systems. Each of these polymers was mixed after a common recipe with a sulfur vulcanizing system. In order to analyze the influence of fillers, the mentioned polymers were filled with carbon black N347 and silanized silica. The procedures of dynamic-mechanical and ultrasound measurements were thoroughly reviewed in [2].

Results and Discussion

The increase of the styrene and vinyl content determines higher values of the loss moduli. The glass transition is shifted to higher temperatures with increasing styrene and vinyl content. This increase is expected since the presence of side groups on a macromolecular chain induces steric hindrances that reduce its capability of free motion. Therefore, the more side groups the more energy is needed for the chain to move and, hence, the higher the maximum of the peak.

Conclusions

The increase of the styrene and vinyl content causes an increase of the glass transition temperature. This behavior is observed both at low (1 Hz) and at high frequencies (0,5 MHz). The passage from 1 Hz to 0,5 MHz determines a shift in the Tg of approximately 40°C [1].

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References

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