INFLUENCE OF FILLER TYPE AND CONTENT AND DEGREE OF EPOXIDATION ON THE MOLECULAR MOBILITY MEASURED BY TRANSVERSAL NMR RELAXATION

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NMR techniques have become an indispensable tool for characterization of segment dynamics in entangled and crosslinked elastomeric materials. Important information about structure-property relationships result from the study of molecular motion above the glass transition temperature (Tg). The dynamical properties of chain segments in polymers depend on a variety of parameters such as chemical structure of repeating units, density and distribution of chemical and physical crosslinks. They can also be influenced by addition of fillers, aging processes and modification of polymer chains. The evolution of magnetizations separate in two directions: longitudinal (T_1) and transverse (T_2) relaxation. These components can be attributed to crosslinked chains and free dangling chain ends. The magnetization decay occurs mainly by intramolecular dipolar magnetic interactions of protons. The time constant of this magnetization is obtained by a spin echo experiment.

The ^{1}H-NMR relaxation method was used for investigation of the influence of filler type and content on the molecular motion of elastomeric materials as well as degree of epoxidation in different rubbers. ESBR and SSBR epoxidized in different degrees; non-vulcanized SBR/Bentonit and NBR/Cellulose composites and vulcanized NBR/Glass composites were measured. The measurements of T_1 and T_2 were done using the IIC XLDS-15 spectrometer. Data analysis was performed with the IIC Analysis software package Igor. For non-vulcanized SBR/Bentonit and NBR/Cellulose composites, a dependency in function of filler content is observed (Fig.1). However, for NBR/Glass composites, this dependency is not observed. Low T_2 values are observed for high degree of epoxidation and high content filler.

The Transversal NMR Relaxation is a fast method to determine molecular mobility of polimeric chains, which can be compared with other methods, such as DSC. The degree of epoxidation and the addition of fillers influence the relaxation time T_2. The higher the temperature the higher the T_2 values, independent of system analyzed.

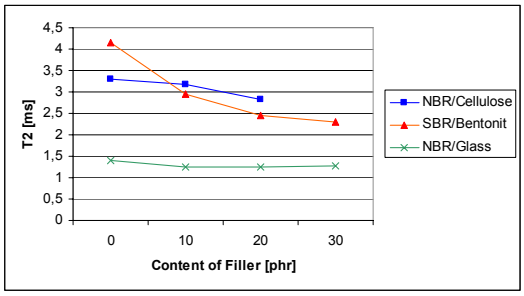

Figure 1 - Result of T_2 mono-exponential measurements at 130°C to different composites

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- Neue Schichtsilikat-Nanokomposite
- Cellulose