EXTENSION OF SERVICE LIFE OF DYNAMIC HEAVILY LOADED HIGH PERFORMANCE ELASTOMERS

Dr. Thomas Alshuth*, Dr. Ulrich Giese*, Dr. Manfred Klüppel*, Thorsten Brüger, Dr. Andreas Schröder***, Erich Schmidt***, Dr. Thomas Früh ***

**Deutsches Institut für Kautschuktechnologie e.V.*
*** Vibracoustic GmbH & Co. KG*
**** Rhein Chemie Rheinau GmbH*

Introduction

In modern, mobile society many areas of life depend on the safe function of elastomeric components subjected to high dynamic loads. The material characteristics of elastomers depend apon the raw material formulation, the crosslinking, imperfections (flaws) and the manufacturing processes. In addition, relevant contributions result from chemical material changes caused by complex aging processes which are unavoidable as a function of stress duration and stress conditions. In particular elastomeric parts used under severe thermal and mechanical service conditions tend to fail unexpectetly. Comprehensive knowledge of the mechanisms, particularly in relation to life expectancy, is not fully available. In order to avoid premature loss of function and complex a recall situations these parts are often overengineered, which contradicts optimum use of raw materials and energy. In addition this incurs various subsequent costs for the national economies of Europe. Thus, a better forecast of the life span of elastomeric parts is urgently needed. In order to reach this goal all factors within the entire process chain from the raw materials to the finished article have to be taken into consideration [1]. This work summarizes substantial results of the multilaterale BMBF-Projekt „Verbesserung der Lebensdauer von dynamisch beanspruchten Hochleistungselastomeren" and shows strategies to transfer these results into industrial practice.

In order to achieve a better life time prediction all elements from raw materials to finished parts must be considered. In addition thermal, thermal oxidative and mechanical damage mechanisms have to be examined seperately and analyzed with respect to the quality of dispersion even of substances used in low concentrations in elastomers mixtures. Thus, guidelines on the influence of primary particle size, melting point of additives and appropriate manufacturing processes could be derived within the scope of the above mentioned project. The figure below shows life time simulations of components made from natural rubber (NR) and a synthetic Ethylene-propylene-diene-terpolymer rubber (EPDM). Depending on the initial crack length or flaw size a lifetime improvement of the final part from 3 to 10000 is achievable.

Literature

[1] Final Report, "Umweltentlastung durch Verlängerung der Lebensdauer von dynamisch beanspruchten Hochleistungselastomeren, Förderkennzeichen: 01RC0135, BMBFFörderprogramm "Forschung für die Umwelt", Bereich "Integrierter Umweltschutz in der Kunststoff- und Kautschukindustrie"