NEW ASPECTS OF LIFETIME PREDICTIONS FOR INELASTIC AND ANISOTROPIC MATERIALS

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Common lifetime predictions of technical rubber products are based in most cases on the data of cyclic long-time fatigue loading till failure of the samples. Hereby the loading usually is initiated with an uniaxial deformation whereby the amplitude of the load is the parameter which is to be varied in the course of the experiments. However, in the majority of cases the dominant loading condition in rubber-parts is not uniaxial but a mixture of many different loading conditions and the loading direction in one material point often changes its direction throughout the deformation process. Regarding the method with which the data for the evaluation of the lifetime has been obtained, it is obvious that this approach does not lead to reliable results for inelastic and anisotropic materials under the described loading conditions. On laboratory scale there is a possibility to decouple the two effects: the dependence of the material on the loading amplitude and the dependence of the material on the change of the loading direction. In order to achieve the decoupling of the two aspects, an experimental rig according to Gent [1960] has been developed, which allows lifetime investigations for simple shear deformations with rotary axes. Simulations of the so called stirring experiment show that further investigations are required to discover and understand new aspects of lifetime predictions for parts made out of inelastic and anisotropic materials. With the help of the experimental results of the stirring experiment a more precise prediction of the lifetime will be possible. However, the objective is not to develop new models for the evaluation of the lifetime of rubberlike materials but to offer an extension to existing models which considers the change of the loading direction in the lifetime prediction.

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