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ON THE PARAMETER IDENTIFICATION OF VISCO-HYPERELASTIC MATERIAL MODELS FOR ADHESIVE TAPES

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Modern adhesive tapes are developed to endure high stresses and strains on a long-time scale. In order to predict the material behavior, the tape's base polymers has to be examined for their long-term relaxation behavior. Besides hyperelastic effects, the investigated polymer type shows strong viscoelastic and, especially, strain rate dependencies. Covering those effects, we present a modified Arruda-Boyce model to predict the viscoelastic material behavior of the base polymer for large deformations – including an equivalent strain rate dependency. The viscous time-dependency is implemented by a Prony-Series ansatz for the shear modulus. Here, we include the strain dependency assuming a functional dependency on the distribution of the discrete relaxation times and on their weights.

In order to obtain suitable material parameters of the model, we conduct a strategic parameter fitting. First, we take a step back assuming for the shear modulus an integral approach. Using a Tikhonov regularization to solve the Fredholm equation of first order, cf. [1, 2], we are able to predict a suitable distributions of discrete times of the relaxation spectrum for the Prony-series ansatz. Since the long-time relaxation behavior of the polymer converges for all applied strain rates, the fitting strategy for co-fits is therefore adapted.

The material model is validated via FEM-simulations on uniaxial und simple shear experiments of the investigated polymer.

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