Experimental Validation of a Viscoelastic Material Model for Numerical Simulation of the Extrusion Process of Rubber Blends

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The dimensioning of injection heads for the extrusion of rubber profiles is exclusively based on empiric knowledge of the non-linear viscoelastic flow behavior of elastomers. Thus, the design of injection heads is carried out with subject to the used rubber blend, whereas the geometry of the appropriate profile is achieved by empiric adaptation of the extrusion die. The non-reproducible process technology affects the capacity of the running production relevantly. This work was performed in cooperation with Semperit Technische Produkte GmbH, which provided the rubber blends as well as the experimental devices.

An important task of a constitutive material characterization is the determination of a viscosity function, which can be used for arbitrary parts of instruments for the production of rubber profiles. Till now, capillary-rheometry is the most important method for the determination of the viscosity of common rubber compounds as well as rubber blends. Due to application problems for the investigated rubber blends, new concepts were developed for the identification of its viscoelastic properties without using correction methods [1].

From numerical simulations with variable power law constants material independent diagrams are obtained. For the validation of the new parameter identification a comparison between performed measurements and the numerical simulations of the corresponding situation is chosen. The simulations have been performed with the commercial CFD program POLYFLOW.

Therefore, all important state variables have been discussed, as experimental quantities like melt pressure and die swell measurements. The experimental validation of various capillary experiments shows good agreement between the results of the characterization methods [1] and the numerical simulations.

[1] H.W. Müllner, J. Eberhardsteiner, K. Hofstetter: Viscosity Characterization for Rubber Blends from Die Swell Data by Means of Genetic Algorithms. PAMM, Vol. 6 (2006): accepted.