The objective of the poster is to show physically motivated models for hydrodynamic reinforcement, stress-softening and temperature dependent behaviour in rubberlike materials. In order to achieve this goal, experimental data, like uniaxial and biaxial stress-strain-curves from S-SBR with 65 phr of Silica GR 7000 are analyzed in respect of the above mentioned phenomena to find mechanisms and explanations which are used as a starting point for further modelling. The formulation of the model is based on an extended tube-model of rubber elasticity [1,2]. The consideration of reinforcing filler-clusters leads to the Dynamic Flocculation Model [3] which is founded on elementary cluster-mechanics. It is shown that stress-softening can be modelled by modifying the stretch-ratio in the energy-density of the tube model according to the distribution of hard and soft filler-clusters and in respect of the cluster-size. In this context the factor Xmax(l) according to [4] is introduced which enable the model to describe the relation between inner and outer stretch-ratios in filled polymers, also denoted hydrodynamic reinforcement.

This context is used for the analytical description of hydrodynamic reinforcement. With the mathematical formulation of cluster-breakdown and –reaggregation and the difference of distribution between soft (broken) and hard (yet-unbroken) clusters, hysteresis and stress-softening can be simulated, obtaining very good results in respect to experimental data.