

From no-slip to full slip in the matrix-fiber interface: a state-rate approach

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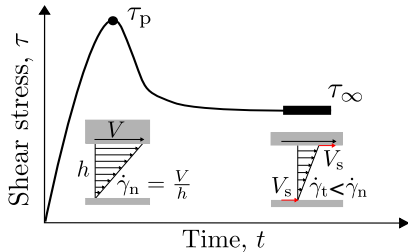
Hot Press Forming & Process Simulations for First-Time-Right Manufacturing of TPC parts



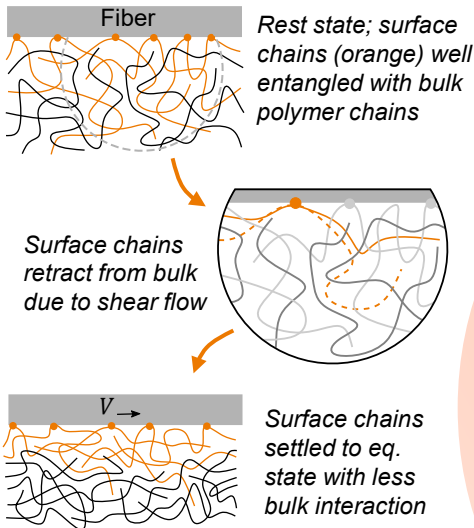
Accurate predictions require **accurate modeling** of the material behavior. Ply-ply slip is currently characterized by a single-point, steady-state friction. Hence, we developed a **transient model** to describe the **full start-up friction response**.

1 Conceptualization

The typical friction response exhibits a peak and a steady-state shear stress:



We proposed a (wall) slip relaxation effect as the underlying mechanism [1] and accurately modeled τ_p and τ_∞ [2] based on shear flow in the interface and a disentanglement process [3,4]:



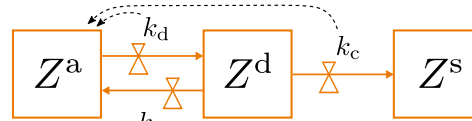
Now we just need to describe the transient disentanglement process to account for the changing BC in a VE model, such as White-Metzner [5].

References

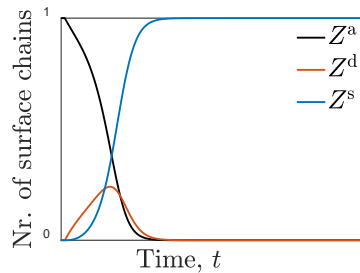
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2 Model changing BC

We propose a state-rate approach to describe the disentanglement process:

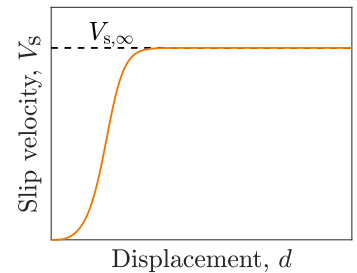


With active, disentangled and settled states, respectively. Evolution with t :



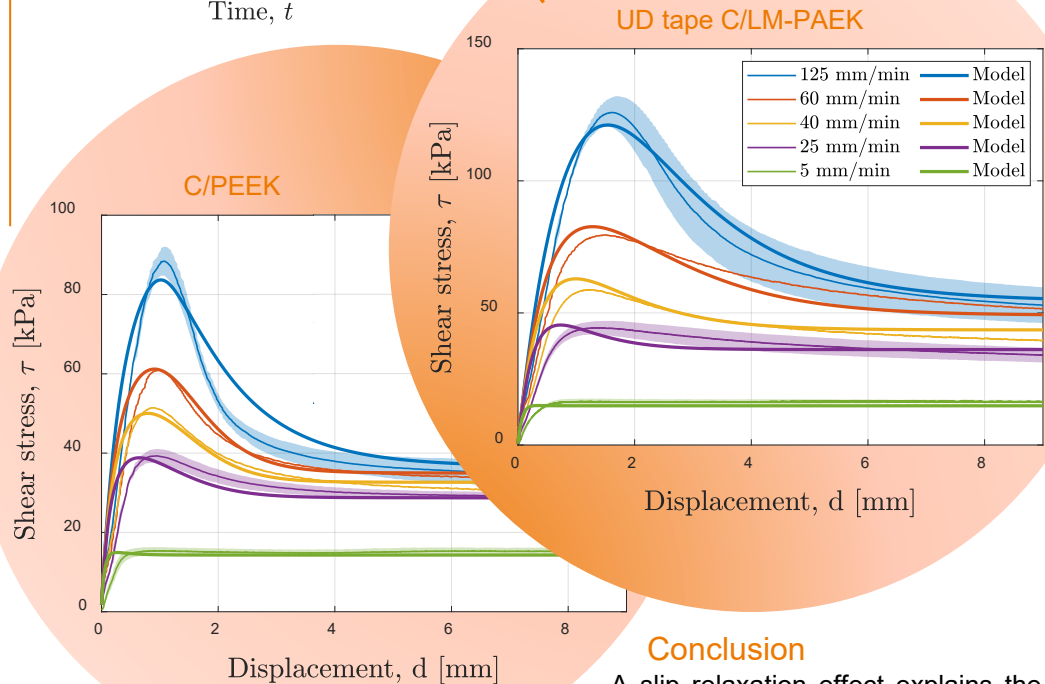
3 Implementation of slip evolution

The evolution of the settled state Z^s can be used for the slip velocity V_s :



to adjust γ_n in the White-Metzner model.

Model & Measurement



Conclusion

A slip relaxation effect explains the observed peak behavior in (start-up) friction of UD tapes, which can be described with a combined White-Metzner state-rate model.

