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Viscoelastic instability and detachment folds in soft elastomer interfaces KOUSHIK VISWANATHAN, ANIRBAN MAHATO, SRINIVASAN CHANDRASEKAR, Purdue University — Physical contacts between a soft elastomer surface and a hard glassy polymer are largely governed by adhesion at the interface. Under application of sufficiently large tangential stress, relative motion occurs at the interface and compressive and tensile stresses develop at the leading and trailing edges of the contact respectively. This kinematic condition leads to a viscoelastic instability at the leading edge causing the elastomer surface to buckle and readhere — a process governed both by the viscoelastic relaxation time of the elastomer and the sliding velocity v. Above a critical velocity v_c, detachment folds form ahead of the indenter and propagate through the contact region at velocities much greater than v. These are commonly referred to as Schallamach waves, after their discoverer, and are considered to be precursors to failure in soft materials. While their onset can be justified using linear elasticity, not much is known about their subsequent propagation. We present high-speed images of a glass-PDMS contact, and use front-tracking to estimate surface strains and the variation of wave velocity and generation frequency with v. A model for the dynamics of the wavefronts is also discussed, showing the onset and propagation of the instability.

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