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Schallamach Wave Periodicity in Soft Elastomer Friction

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From the dynamics of biomaterial interfaces to the interpretation of nanoscale characterization of polymer interfaces, the friction of soft polymer layers is critical to a wide range of advanced materials. A dominant mechanism in the friction of soft material interfaces is the onset and propagation of Schallamach waves. Schallamach waves are “tunnels” of air that provide relative displacement between the slider and the substrate rather than the instantaneous interfacial failure involved with stick-slip. We present a fundamental relationship between the periodicity of Schallamach waves (λ) and the ratio of interfacial adhesion (G_c) over complex elastic modulus (E^*). This deconvolution of bulk and interfacial contributions to the friction of soft materials leads to interesting predictions that will impact material design for a wide range of applications.

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