

Abstract Submitted
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Peeling without precursors JOHN LISTER, University of Cambridge, DOMINIC SKINNER, TIM LARGE, MIT — The peeling by fluid injection of an elastic sheet away from a substrate is often regularised by invoking a thin prewetting film or a low-viscosity phase in the tip. Here we analyse fluid-driven peeling without such precursors, and consider an elastic sheet either bonded to, or simply laid on, an elastic substrate. To resolve the ‘elastic contact-line problem’ that arises from viscous flow and beam theory, we determine the near-tip behaviour from lubrication theory coupled to the full equations of elasticity and fracture. The result is a law for the tip propagation speed in terms of the remote loading and the toughness of the sheet-substrate bonding (which might be zero). There are distinct modes of failure, according to whether there is slip ahead of the fluid front. The propagation-speed law gives rise to new similarity solutions for the spread of a fluid-filled blister in different regimes.

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