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Surfactant-driven fracture of gels: Growth KAREN DANIELS, MARK SCHILLACI, JOSHUA BOSTWICK, NC State University — A droplet of surfactant spreading on a gel substrate can produce fractures on the gel surface, which originate at the contact-line and propagate outwards in a star-burst pattern. Fractures have previously been observed to initiate through a thermal process, with the number of fractures controlled by the ratio of surface tension differential to gel shear modulus. After the onset of fracture, experiments show the arm length grows with universal power law $L = t^{3/4}$ that does not scale with any material parameters (Daniels et al. 2007, PRL), including super-spreading surfactants (Spandangos et al. 2012, Langmuir). We develop a model for crack growth controlled by the transport of an inviscid fluid into the fracture tip. While treating the gel as a linear material correctly predicts power-law growth, we find that only by considering a Neo-Hookean (incompressible) material do we obtain agreement with the experiments.

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