Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Delayed Fluid-Driven Fractures on Soft Gels MARK SCHILLACI, JOSHUA BOSTWICK, KAREN DANIELS, NC State University — A droplet of surfactant spreading on a weak gel substrate ($\sim$ 10 Pa) can produce fractures on the gel surface, which originate at the contact-line and propagate outwards in a star-burst pattern. Experiments show that the number of arms is controlled by the ratio of the surface tension differential to the gel's shear modulus. We interpret the number of fractures formed in the context of a linear elastic model arising from the uncompensated, Young-Dupre (out-of-plane) force acting at the contact-line. However, we also observe that there is an inherent variability in both the number of fractures formed and the delay for fractures to form. In the regime where single fractures form, we observe a range of delay values consistent with a thermally-activated process. The mean delay time is set by the modulus of gel substrate, decreasing for weaker substrates. In the regime where multiple fractures form, we observe that all fractures appear simultaneously and the long delays are suppressed.

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Date submitted: 09 Nov 2012 Electronic form version 1.4