Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Oscillatory response of a gel to wave-induced velocity gradients in the context of marine oil spill remediation[1] RICHARD CUNNNINGHAM, GREGORY LAWRENCE, University of British Columbia — The use of gellants as an oil-spill remediation technique is challenged by a lack of academic literature on the interactions between marine surface gels and their environments. This study adopts an experimental perspective to investigate the stretching of a gel in wave-induced spatial velocity gradients, the product of orbital particle motion in linear waves. Analytical models were developed to describe the response of a viscoelastic gel to such a forcing for Kelvin-Voigt and Maxwell materials. Bottom-of-tank experiments were designed to isolate wave-induced velocity gradient stretching from bending effects. The experiments were conducted in the 4.7 meter wave tank at the University of British Columbia using gelatin as a model gel. Applying monochromatic, linear waves to the system resulted in an observable oscillatory strain in the gel; and, for the longer gels, breakage. Analytical models under-predicted strain by a constant factor. Incorporating this factor shows a close match between data and model results. Breakage occurred where peak stress across the gel's cross-section exceeded a threshold value. This threshold stress (5 Pa) was considerably less than the oscillatory yield stress of the material (35 Pa), indicating that breakage was due to fatigue.

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Date submitted: 31 Jul 2020 Electronic form version 1.4