Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Energy balance and the velocity gap in foam fracture SASCHA HILGENFELDT, Mechanical Science and Engineering, University of Illinois at Urbana-Champaign, PETER STEWART, School of Mathematics and Statistics, University of Glasgow — It has been shown experimentally and in simulations that a quasi-two-dimensional foam bubble layer, when driven under external stress, can display ruptures of successive films that constitute an analogue to brittle type-I fracture. Simplified discrete and continuum models from first principles of fluid dynamics capture the features of propagation, including the existence of a critical speed below which steady fracture cannot be sustained (velocity gap). In order to understand the magnitude and parameter dependence of the velocity gap, it is advantageous to strike an energy balance in the system and thus connect with continuum dynamical fracture mechanics. The crack dynamics is characteristically altered by system size (because of changes in strain energy concentration) as well as by dissipation effects in the foam. Access to an explicit analytical formalism for the modeling of all physical effects complements the simulation results and reveals general principles governing the occurrence of fracture velocity gaps.

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Date submitted: 31 Jul 2019 Electronic form version 1.4