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The origin of power-law rheology in foams HYUN JOO HWANG, ROBERT RIGGLEMAN, JOHN CROCKER, University of Pennsylvania — Soft glassy matter (SGM) such as foams, emulsions, and colloids, exhibit interesting rheological properties that have long defied explanation. In particular, the shear modulus of these materials displays weak power law frequency dependence. To understand the origin of this property in more depth, we have built a three-dimensional, modified Bubble Dynamics model. The bubbles interact with a purely repulsive harmonic potential and ripen according to diffusion-based governing equations. Notably, the bubble motion has a Levy flight character, in addition to being spatially correlated in the form of avalanches. Microrheology studies reveal that the power-law shear modulus is the result of constraint release driven by the bubbles' super-diffusive motion combined with simple yield of the resulting stress. The super-diffusive motion of the bubbles, in turn, is the result of the system taking a fractal path in configuration space. We shall discuss the origins of this fractal scaling.

John Crocker
University of Pennsylvania

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