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Elastic modulus of solid-like microsphere heaps CARLOS ORTIZ, KAREN DANIELS, ROBERT RIEHN, North Carolina State University — We study the elastic modulus of heaps of repulsive microspheres to gain insight into the nature of the rigidity of the material. The heaps are initially created by flowing a colloidal microsphere suspension towards a flat-topped ridge placed within a quasi two-dimensional microfluidic channel. The suspension flow-rate determines the heap size via the angle of repose. Using fluorescence video microscopy, we measure the fluorescent heap size until it reaches steady state. We directly visualize the elastic recoil of these steady state heaps in response to controlled changes in the fluid flow rate. We change the flow rate by an amount Δv in a step-like fashion, and measure the amplitude of the bulk heap deformation ΔA. We investigate both compressions and decompressions of varying amplitudes with respect to the steady state. Three deformation regimes are observed. No deformations are observed below a critical perturbation magnitude Δv_c. Above Δv_c, deformation amplitudes are linear with Δv. However, for large perturbations, nonlinear deformation amplitudes are observed, and their relationship is asymmetric with respect to compression and decompression.

Carlos Ortiz
North Carolina State University

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