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Packing and stability of geometrically cohesive granular media NICK GRAVISH, Georgia Tech School of Physics, SCOTT V. FRANKLIN, Rochester Institute of Technology Department of Physics, DAVID L. HU, Georgia Tech School of Mechanical Engineering, DANIEL I. GOLDMAN, Georgia Tech School of Physics — Granular particles with concave shapes may entangle with neighboring particles creating an effective cohesion controlled by particle geometry. We study the packing and stability of vertical columns formed from geometrically cohesive u-shaped particles (staples) of varying barb length, l. We prepare cohesive columns by packing particles in a confining cylindrical tube under vertical vibration at fixed frequency of $f = 30$ Hz and peak acceleration (in units of g) of $\Gamma = 2$. The initial and final volume fraction vary with l and volume fraction increases for decreasing l. Once packed, the tube is removed and columns are subjected to vertical vibration at fixed f and variable Γ. We monitor column height, $h(t)$, during collapse and find that $h(t)$ is described by a stretched exponential $h(t)/h_0 = \exp[-(\frac{t}{\tau})^\beta]$. The characteristic collapse time, τ, is governed by an Arrhenius law with $\tau = \tau_0 \exp(\Gamma_0/\Gamma)$ where Γ_0 is a measure of the column's resistance to collapse. We find that Γ_0 is a non-monotonic function of l and exhibits a maximum at intermediate l. We explain this effect through a model considering packing and entanglement.

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