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Shear-induced size segregation and crystallization in an annular geometry[1] J.P. GOLLUB, Haverford Coll., N. TRAVERS, Haverford Coll., J.C. TSAI, Univ. of Penn. — In previous experiments [1] on slow shearing of a mono-disperse annular layer of granular material by a rotating lid at constant pressure, we showed that the material crystallizes after a sufficient accumulated displacement, and that the rheological properties of the material (e.g. the flow profile and shear force) are then substantially different. Here, we extend this work to the case of a bi-disperse mixture of 0.6 mm and 1.0 mm particles. We find that when the layer is sufficiently thick, the material first separates into two mono-disperse layers, and the separate layers then crystallize. The boundary between the two layers remains somewhat disordered. For layers thinner than about 15d, where d is the small particle diameter, complete segregation is not observed. We also discuss the trajectories of individual particles, and the velocity profile of the segregated system.
[1] J.C. Tsai and J.P. Gollub, Phys. Rev. E. 70, 031303 (2004)

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