Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Significantly reduced size separation of mixing cohesive highly-bidisperse particles under gravity. GUO-JIE JASON GAO, Dept. of Mathematical and Systems Engineering, Shizuoka University — Mixing particles of various sizes, ranging from several microns to hundreds of millimeters, is a widely used strategy to achieve super-compact packings in the industry. However, it is well-known that separation of sizes between particles occurs if a system is cohesionless and subject to external disturbance such as shearing and shaking. Presumably, inter-particle cohesive interactions, for example, attractive van der Waals forces can prevent size separation. However, a thorough analysis in this regard is still lacking. Using molecular dynamics simulation, we investigate a system of a 2D box containing highly-bidisperse circular particles with a dispersity of 10 under gravity. There is cohesive interaction between particles of different dispersities, while particles of the same dispersity are mutually repulsive. We systematically change the range of the cohesive interaction and detect if size separation happens when the system is recursively subject to quasistatic shear deformation. Our results show that even a very short range of inter-particle cohesion (1% of the average diameter of small and large particles) can effectively prevent size separation. Besides, we increase the number of small particles while keeping that of large particles fixed. We observe large particles can steadily acquire more small cohesive neighbors as the system gradually loses its flowability.

Guo-Jie Jason Gao
Dept. of Mathematical and Systems Engineering, Shizuoka University

Date submitted: 12 Nov 2016 Electronic form version 1.4