

Abstract Submitted
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Random to ordered granular sphere packings through cyclic shear

ANDREEA PANAITESCU, ANKI REDDY, ARSHAD KUDROLLI, Clark University — We investigate the structure of a dense granular packing submitted to quasi-static cyclic shear deformations using a fluorescent liquid refractive index matching method. This technique allows us to obtain the three dimensional position of 1mm glass spheres in the bulk during each cycle. The granular packing is observed to evolve towards crystallization over hundreds of thousands of shear cycles and the packing fraction is correspondingly observed to increase from loose packing fraction, 0.59, to above random close packing, 0.634. The appearance and the propagation of the crystalline order was studied using the orientational order metric, Q_6 . In the early stages of nucleation the particles belonging to the nucleating crystallites are predominantly in hexagonal close packed configuration. When the packing volume fraction approaches a value close to random close packing, a rapid increase of the global Q_6 and the number of particles with local face centered cubic order is observed. Following the evolution of the crystallites, we find the critical nuclei size to be between 10-50 particles, surprisingly consistent with transitions observed with thermal elastic frictionless spheres. A detailed description of the crystalline clusters and their development will be presented.

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