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Experiments on ordering transitions in mechanically stable structures of granular rods VIKRANT YADAV, Clark University, JEAN-YONNEL CHASTAING, Ecole Normale Suprieure de Lyon, ARSHAD KUDROLLI, Clark University — We investigated the evolution of granular rods from mechanically stable disordered to crystalline states in response to vibrations. We obtained positions and orientations of the rods in three dimensions using micro-focus X-ray Computed Tomography. Above a critical aspect ratio, we find that rods align vertically in layers with hexagonal order within a layer, independent of the shape of the container and details of the form of vibration. We also quantitatively study the evolution of local and global ordering using density pair correlation function $g(r)$ and orientational order parameter q_6 as a function of aspect ratio. As the system compacts, local structures emerge and grow, their size and orientation being dependent on volume fraction. Although the initial nucleation of order occurs along the boundaries, we show that the geometry of boundaries have little overall effect on the observed ordering transition. Finally we show that configuration entropy arguments do not play a significant role in the observed ordering, and the system evolves towards increasing stability under small perturbations.

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