Abstract Submitted
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What are the microscopic origins of shear jamming?[1] BOB BEHRINGER, DONG WANG, Duke University, JIE REN, Merck Co., JONATHAN BARES, Duke University, BULBUL CHAKRABORTY, Brandeis University, LENKA KOVALCINOVA, LOU KONDIC, NJIT — Granular materials can jam by shear: shear strain applied to a stress-free state in a packing fraction range $\phi_S < \phi < \phi_J$, leads to mechanically stable (jammed) anisotropic states (Bi et al. Nature, 2011). ϕ_J is the lowest ϕ for which an isotropic state is jammed, and shear jamming ceases below ϕ_S. The process of shear jamming involves the formation of strong force networks that are initially highly anistropic 'force chains', then become become more isotropic with increasing shear. The mechanisms that lead to shear jamming are also presumably similar to those that lead to Reynolds dilatancy. What microscopic processes can account for shear jamming? Force chains, roughly linear sequences of particles experiencing average or above forces are not stable by themselves. Hence, force chain particles must form additional 'non-chain' contacts. Here, we propose micro-scale structures and their response to shear that serve as a basis to understand the formation of stable force networks and shear jamming. We identify these structures in experimental and numerical data, and track their response to shear.

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