Impact and Dynamic Jamming in Dense Suspensions of Particles

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ABSTRACT

We discuss experiments investigating the propagation of transient jamming fronts in dense suspensions of particles in a liquid [1,2]. We focus on suspensions of cornstarch particles (diameter around 20 microns, elastic modulus around 5GPa) in water. At packing fractions close to jamming, a cornstarch suspension behaves liquid-like at rest but dynamically turns into a solid when impacted, sheared or subjected to tensile stress at sufficiently high speed. We show that driving this behavior is a solidification front that propagates in both axial and transverse direction from the point of impact, with a constant ratio between the two directions of propagation. Inside the jammed solid, we observe an additional compression, which results from the increasing stress as the solid grows. During the initial growth of the jammed solid, we measure a force response that can be accounted for by added mass. Only once the jamming front reaches a boundary, the added mass cannot account for the measured force anymore [2]. Both two- and three-dimensional systems will be discussed in which a combination of high-speed video, x-ray and fast ultrasound techniques was used to obtain information about the front propagation and the properties of the jammed solid.

REFERENCES

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