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Dilatancy and Diffusion in Sheared Granular Materials

JOSHUA DIJKSMAN, Duke University

Disordered materials such as sand, foams and emulsions display a wide variety of different forms of mechanical behavior. Currently the origin of this rich dynamics is the subject of intense study. Experimentally it has proved difficult to probe the microscopic dynamics in these systems. We present an overview of experimental investigations that have been successful in giving more insight into the microstructural dynamics of disordered systems. We focus on shear induced dilatancy and diffusion in quasi statically deformed granular materials and suspensions and contrast the behavior of low and high friction particulate materials. We shall discuss the consequences of our observations in the context of shear banding and jamming phenomena.