Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Jamming and Plasticity for Granular Materials[1] TRUSH MAJMUDAR, MATTHIAS SPERL, BOB BEHRINGER, Duke University — We describe experiments, using quasi-2D photoelastic particles, that characterize the jamming transition for isotropic compression and that explore the microscopic origins of plastic failure for shear deformation. The experiments were carried out in a biaxial tester that allowed us to generate precise states of deformation. We use photoelasticity to extract the vector forces at contacts and to reliably obtain contacts. Regarding jamming, we find that near the jamming point, there is a rapid increase in the contact number, Z. Above the transition, Z continues to increase as a power law in $\phi - \phi_c$, where ϕ is the packing fraction. The critical exponent is 0.55 within experimental error. Above jamming, the pressue, P, varies as a power law with exponent 1.1. In a different set of experiments, we applied pure shear to a sample with ϕ near the jamming value. We find a series of localized failure events, which lead to energy dissipation and decreases in the stress. Failure occurs in a shear band that is dominated by vortex-like flow. On cycling the shear deformation, there is a substantial change in the background structure of force chains.

[1]Work Supported by NSF DMR0555431, and the Binational Science Foundation.

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Date submitted: 05 Aug 2006 Electronic form version 1.4