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Students' Annual Seminar

The yielding transition in amorphous solids under oscillatory shear deformation

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Periodically driven atomic and colloidal glasses have been studied in simulations and experiments to understand the nature and significance of the non-equilibrium transition they are found to exhibit. In particular, attention has been focused on the relationship between such a transition and yielding behavior of amorphous solids. We perform simulations of cyclic shear deformation of a model amorphous solid, the Kob-Andersen binary Lennard-Jones mixture for various system sizes and strain amplitudes. Steady states are achieved by subjecting the samples to a large number of cycles of deformation. With an increase of strain amplitude, a sharp transition is found between absorbing and diffusive states. The stress-strain relation, as well as the transition amplitude remain insensitive to the degree of annealing of the glasses unlike the case of uniform shearing. We report that the crossover transition amplitude from solid to liquid-like states is accompanied by a bifurcation of the energy-strain relation. The avalanche size distributions as functions of strain amplitude demonstrate that below the critical transition amplitude there is no system size dependence while above the yield strain, the mean size of avalanches grows with system size. We find the consistent result for the system size independence below by considering the statistics of mean clusters and the mean energy drops. We propose that cyclic shear deformation offers an appealing approach to elucidating the nature of the yielding transition.

Thursday, Apr 27th 2017

4:30 PM (Tea/Coffee at 3:45 PM)

Seminar Hall, TCIS