



FRONTIERS IN MICRORHEOLOGY



A thermodynamic view of jamming as a new form of Bose-condensation

Kevin Lu & H. Pirouz Kavehpour

UCLA

Abstract:

Material ranging from sand to fire-retardant to toothpaste are considered fragile, able to exhibit both solid and fluid-like properties across the jamming transition. Here, we quantify jamming as a path-dependent transition definable at different athermal equilibrium states. Experimentally, we show that for dry sand undergoing shear flow, its density relaxation can be quantified by the Kalrauch-William-Watts equation, typical of the ageing of glassy liquids. Analytically, the equation of jamming also fits well to the thermodynamic quantities of supercooled fluids in viscosity, specific heat and configurational entropy. The likeness between sand and glass is astonishing. As the evidence show, when subjected to cooling, particles/molecules jam collectively as to preserve a positive configurational entropy (the Kauzemann paradox) by settling into the ground state of a potential energy phase space. Furthermore, without any free parameters, the proposed equation-of-state governs the mechanism of shear-banding and the associated features of shear-softening and thickness-invariance.



The Frontiers in Microrheology Workshop
February 6 - February 9, 2008
at the CNSI, UCLA

<http://www.cnsi.ucla.edu/conferences/microrheology/>

