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Shear induced diffusion in hard sphere glasses NICK KOUMAKIS, GEORGE PETEKIDIS, FORTH & Univ. of Crete, Creece, JOHN BRADY, Chemical Engineering, Caltech, USA, FORTH TEAM, CALTECH TEAM — The response of dense hard sphere suspensions is examined during the application of steady and non-linear oscillatory shear using Brownian Dynamics (BD) simulations and experimental Light Scattering echo coupled with rheology. At rest, volume fractions around the glass transition exhibit long or infinite relaxation times. However, non-linear shear induces out of cage motions of comparable time scale to the applied rates. We found two distinct regimes in terms of stresses and dynamic response under shear. One regime for lower rates or frequencies of oscillation, governed by Brownian activated diffusion, and a second for higher rates related to shear activated diffusion. A linear dependence with rate was found for the diffusivity in the high rate regime, mirroring the viscous loss due to shear activated particle rearrangements, while diffusivities in the Brownian activated regime showed a power law exponent of less than unity. The exponent was found to increase with volume fraction. For applied rates inducing diffusivities above the in-cage diffusivity at rest, we find a time window of super-diffusive behavior, between the short time (in-cage) and long time (out-of cage) diffusivities under shear, a signature of a dynamic breaking and reforming of the cage.

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