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Diffusion in jammed particle packs[1] DAN S. BOLINTINEANU, Sandia National Laboratories, LEONARDO E. SILBERT, University of Southern Illinois, GARY S. GREST, JEREMY B. LECHMAN, Sandia National Laboratories — Diffusive transport in jammed particle packs is of interest for a number of applications, as well as being a potential indicator of structural properties near the jamming point. To this end, we report stochastic simulations of equilibrium diffusion through monodisperse sphere packs near the jamming point in the limit of a perfectly insulating surrounding medium. The time dependence of various diffusion properties is resolved over several orders of magnitude. Two time regimes of expected Fickian diffusion are observed, separated by an intermediate regime of anomalous diffusion. This intermediate regime grows as the particle volume fraction approaches the critical jamming transition. The diffusion behavior is fully controlled by the extent of the contacts between neighboring particles, which in turn depend on proximity to the jamming point. In particular, the mean first passage time associated with the escape of random walkers between neighboring particles is shown to control both the time to recover Fickian diffusion and the long time diffusivity. Scaling laws are established that relate these quantities to the difference between the actual and critical jamming volume fractions.

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