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Glassy dynamics in randomly pinned particle systems ANH PHAN, KENNETH SCHWEIZER, University of Illinois at Urbana-Champaign — We generalize the force-level, microscopic Elastically Collective Nonlinear Langevin Equation theory of activated relaxation in bulk hard sphere and thermal liquids to address the role of internal quenched disorder. So-called neutral confinement is considered where a subset of particles are randomly pinned and there is no change of equilibrium pair structure. As the pinned fraction grows, the cage scale dynamical constraints are intensified, resulting in the mobile particles becoming more localized, a larger glassy shear modulus, and an enhanced cage scale barrier. However, based on an approximate analysis of how quenched disorder modifies collective elastic field fluctuations, random pinning is predicted to effectively screen or localize the strain field associated with the longer range elastic component of the activation barrier, leading to an overall reduction of it with pinning fraction. The different response of the cage and elastic barriers to quenched disorder results in subtle predictions for how the alpha relaxation time varies with pinning fraction and system volume fraction. A semi-quantitative comparison with recent simulations of a pinned-mobile water model are consistent with the theory. Predictions are made for thermal molecular liquids.

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