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Overaging and rejuvenation in a polymer glass subjected to shear deformation[1] MATTHEW L. WALLACE, BELA JOOS, University of Ottawa, Ontario, Canada — When applying a transient shear on a jammed substance, one can induce both rejuvenation and overaging in the system, as the relaxation times are altered in a non-trivial way. We induce the overaging of a polymer glass by instantaneous, one-time shear deformations, and follow its evolution for long waiting times t_w. After each deformation, the characteristic relaxation time of the system $\tau_{1/2}$ increases. We find in our molecular dynamics simulations two distinct regimes, primarily based on how the system evolves after a waiting time t_w following one deformation. In the low-shear regime, both the energy of the inherent structure of the system and $\tau_{1/2}$ change very little with t_w, and there are no apparent structural changes in the system. In the high-shear regime, we see an initial combination of rejuvenation and overaging in the system and $\tau_{1/2}$ has a well-defined logarithmic dependence on t_w. Furthermore, it is found that when successive deformations are applied, no memory effect or directional preference arises from the previous shearing. Finally, we investigate the signatures of the overaged state. The polymer glass is obtained by compressing isothermally a melt of short freely jointed chains interacting with van der Waals interactions.

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