

Abstract Submitted
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Stress enhanced shear yielding in aging polymer glasses JOERG ROTTLE, AMY Y.-H. LIU, University of British Columbia — The plastic response of polymer glasses is strongly dependent on the thermomechanical history of the material. We determine the molecular level origin of the enhancement of the shear yield stress reported in experiments of polymer glasses that undergo physical aging in the presence of a pre-stress. Molecular dynamics simulations are employed to show that the applied stress does not alter the physical aging rate, but instead induces a highly orientation-dependent mechanical response of the polymer glass. The change in yield stress with respect to polymers that have aged without pre-stress is directly proportional to the orientation of covalent bonds, which is proportional to strain and logarithmic aging time. We observe a pronounced Bauschinger effect, which amplifies or reduces the pressure dependence of shear yielding. Control simulations with a monovalent Lennard-Jones glass offer further evidence that these effects are distinct from other rejuvenation and overaging behavior reported for a broad class of amorphous solids.

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