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Aging effects in shear yielding of glassy solids JOERG ROTTLER, Princeton Inst. for the Science and Tech. of Materials, Princeton University, Princeton NJ 08544, MARK O. ROBBINS, Dept. of Physics and Astronomy, Johns Hopkins Univ., 3400 N. Charles St., Baltimore MD 21218 — The shear yield stress of amorphous glassy materials is usually taken to be a function of the loading state, the temperature and the strain rate. Since glasses are out of equilibrium systems, yielding is additionally influenced by the material's own intrinsic aging dynamics. We study the role of aging in the well-known generic Lennard-Jones glasses through molecular dynamics simulations. For temperatures not too far below the glass transition temperature, the (transient peak) yield stress increases logarithmically with the waiting time in the glassy regime. The rate dependence is directly related to the age of the system. If the waiting time is much larger than the time to reach the yield point, the yield stress follows a universal logarithmic rate dependence, but in the opposite limit the system behaves like a system in steady shear that is constantly "rejuvenated." These effects disappear at very low temperatures where the aging dynamics is frozen out. Implications for phenomenological models of plasticity in glassy materials are pointed out.

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