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Deformation-induced molecular mobility allows polystyrene glasses to flow MARK EDIGER, BEN BENDING, KELLY CHRISTISON, University of Wisconsin-Madison — Experiments on colloidal glasses show that local rearrangements occur more rapidly during deformation. For polymeric glasses, similar features are expected but cannot be directly imaged. Dye reorientation has been used to measure segmental mobility in polymer glasses during active deformation. In creep deformations, we see a hundred-fold enhancement of mobility occurring in polystyrene glasses lightly cross-linked with 2 and 4 weight percent of divinylbenzene. Qualitatively similar mobility enhancement has been previously reported for lightly cross-linked poly(methyl methacrylate). Data from all three systems superpose on a master plot of the mobility as a function of the local strain rate during creep. Additionally, in the flow regime we see a significant narrowing of the distribution of relaxation times for both the polystyrene and poly(methyl methacrylate) glasses, similar to what has been reported for colloidal systems. Because polystyrene lacks the prominent beta relaxation of poly(methyl methacrylate), we conclude that the changes in mobility during creep deformation are a result of changes in the alpha segmental relaxation time.

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