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Elastic yielding of melt-stretched glassy polymers below glass transition temperature[1] ZHICHEN ZHAO, YEXIN ZHENG, MESFIN TSIGE, SHI-QING WANG, Department of Polymer Science, University of Akron — We have recently shown how effects of melt deformation on mechanical behavior of glassy polymers may be understood in terms of a molecular model [1], which can explain why melt-stretched polystyrene becomes completely ductile at room temperature. In our further investigation along this line, we uncovered a phenomenon that appears unknown in the literature. Mechanical tests reveal that melt-deformed PS and PMMA exhibit a sizable elastic retractive stress when annealed at temperatures that are still significantly below their glass transition temperatures. This work systematically investigates how characteristics of this elastic yielding, e.g., induction time and magnitude of the tensile stress, change as a function of the temperature at which melt stretching is carried out, the degree of melt stretching, the annealing temperature, composition of the glassy polymers, and aging history. [1]Wang, S. Q., Cheng, S., Lin, P., & Li, X. (2014). A phenomenological molecular model for yielding and brittle-ductile transition of polymer glasses.The Journal of chemical physics, 141(9), 094905..

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