

Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

How plasticizer makes a ductile polymer glass brittle?¹ YUE ZHAO, XIAOXIAO LI, SHI-QING WANG, Univ of Akron — During uniaxial extension, a polymer glass of high molecular weight is ductile at high temperatures (still below T_g) and turns brittle when the temperature is sufficiently lowered. Incorporation of small-molecular additives to polymer glasses can speed up segmental relaxation considerably. The effect of such plasticization should be to make the polymers more ductile. We examined the effect of blending a few weight percent of either triphenyl phosphate (TPP) or a mineral oil to a commercial-grade PS and PMMA. Our Instron tests show that the plasticized PS is less ductile. Specifically, at 70 oC, the original PS is ductile at an extensional rate of 0.02 s⁻¹ [1] whereas the PS with 4 wt. % TPP turns brittle. Mechanical spectroscopic measurements show that the alpha relaxation time is shortened by more than two orders of magnitude with 4 wt. % TPP. On the other hand, such anomalous behavior did not occur in PMMA. We need to go beyond the conventional description to rationalize these results. [1] Li, X.; Wang, S. Q. ACS Macro Letters 2015, 1110-1113.

¹This work is supported, in part, by a NSF grant (DMR-EAGER-1444859)

Yue Zhao
Univ of Akron

Date submitted: 06 Nov 2015

Electronic form version 1.4