Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Understanding failure behavior of polymer glasses: a molecular viewpoint GREGORY ZARTMAN, SHIWANG CHENG, SHI-QING WANG, The University of Akron — In surveying the vast literature we note that a unified simple picture appears to be lacking to account for all the known facts on failure behavior of polymer glasses. In this work, we first apply the fresh insight we have gained from studying nonlinear extensional rheology of entangled melt to show why a melt-stretched polystyrene turns ductile. We further show that the ductile polycarbonate can also turn brittle upon pre-melt-stretching. Finally, blending oligomeric PC into an originally ductile PC also causes the mixture to become brittle. All these old and new phenomena point to the fact that the strength of the load bearing chain network dictates at a given temperature whether the polymer glass would undergo ductile failure through shear yielding or brittle fracture via crazing. This presentation will provide a description of how the entanglement structure can be altered by melt deformation or the choice of different chemical specificity (that influences the packing length) to affect the strength of polymer glasses. It is this network strength relative to the yield strength associated with the inter-segmental van der Waals interactions that determines how strain localization (shear yielding – necking vs. crazing) takes place.

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Date submitted: 21 Nov 2011 Electronic form version 1.4