Abstract Submitted
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Twinkling Fractal Theory of the Glass Transition: Applications and Insights[1] RICHARD WOOL, University of Delaware — The new perspective on the Glass Transition of amorphous materials offered by theTwinkling Fractal Theory (TFT). [R. P. Wool, J. Polym. Sci, Part B: Polym Phys. 46, 2765 (2008)] is examined in several applications. The TFT describes Tg in terms of the autocorrelation relaxation function for the spatio-temporal solid-liquid fluctuations which are related to the vibrational frequencies ("twinkles") described by the Orbach vibrational density of states for a fractal. The twinkling frequencies for solid-liquid interchange are due to Boltzmann energy populations of interatomic oscillators interacting through anharmonic potentials U(x) with energy D_o of order 1-5 kcal/mol. T_g occurs when the activation energy for the solid-liquid transition goes to zero at the inflection point of U(x) and is given by $T_g = 2D_o/9k$. The applications include: (a) group contributions to Do, (b) the rate and temperature dependence of yielding and fracture, (c) shear thickening fluids, (d) rate dependence of dynamical mechanical properties, particularly the tan delta damping peak used to measure Tg, (e) derivation of the empirical WLF time-temperature superposition empirical relation, (f) thermal expansion and (g) physical aging.

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Richard Wool
University of Delaware

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