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Recent advances with generalized entropy theory of glass-formation in polymers[1]

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The generalized entropy theory (GET) of glass-formation in polymers is a combination of the lattice cluster theory (LCT) for the configurational entropy density with the Adam-Gibbs (AG) theory for the structural relaxation time. A greatly simplified form of the GET (whose expression for the free energy is roughly double that of Flory-Huggins theory) accurately reproduces the four characteristic temperatures of glass-formation (the onset, crossover, glass transition, and Kauzmann temperatures) of the full GET to within 4K for a series of models of polymers composed of semi-flexible chains having the structure of poly(n-alpha olefins). The theory is now simple enough to be used in courses in polymer physics. Although the successes of the GET provide a strong validation of the final form of the AG theory provided the configurational entropy is used, the physical basis of the AG theory has remained an enigma. Hence, we have developed a new, more general, statistical mechanical derivation of AG theory that explains the previously perplexing observations that the string-like elementary excitations have the mass and temperature dependence of systems undergoing equilibrium self-assembly.

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