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UV-convergent One-loop Theory of Binary Homopolymer Blends
JIAN QIN, FRANK BATES, DAVID MORSE, Department of Chemical Engineering and Materials Science, University of Minnesota — We analyze the effects of long wavelength composition fluctuations in binary homopolymer blends. We use a generalization of Wang's theory [1], in which all dependence upon short-wavelength structure is absorbed into a renormalization of an effective χ parameter χ_e and of statistical segment lengths. The theory allows us to calculate the collective correlation function $S(k)$, single chain correlation functions, and the free energy density in homogeneous mixtures. The same formalism can be used to study diblock copolymer melts. The value of $\chi_e N$ at the critical point of a binary blend exceeds that predicted by Flory-Huggins theory by an amount proportional to $1/\sqrt{N}$, though the width of the critical region is proportional to $1/N$. For strongly asymmetric blends, however, the binodal value of $\chi_e N$ is suppressed. The dimensions of individual chains decrease slightly with increasing χ or with decreasing N, even when $\chi_e = 0$. [1] Z.-G. Wang, *J. Chem. Phys.*, 2002, 117:481.

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