Special Feature
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Novel Field Theory of Polymer Melts

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Using techniques of functional integration, we can describe the physics of polymer melts using a time-dependent Landau-Ginzburg field theory. The time in the theory is simply the location of a given segment along the extent of a polymer chain. With this model, one can show that the limit of infinitesimal concentration of polymer melts corresponds to a *dynamic* critical phenomenon, analogous to the theory of phase transitions. The behavior of chains in this regime is studied in the limit of both small and large separations, with different exponents in each case. For larger concentrations, when the role of fluctuations is reduced, a mean field approximation is justifiably employed to show the existence of tube-like structures reminiscent of Edwards' tube model. An analytic estimate of the tube radius shows an inverse square root dependence on the number concentration.

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