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Theory of spinodal decomposition assisted polymer crystallization in a binary polyolefin mixture MITHUN MITRA, MURUGAPPAN MUTHUKUMAR, University of Massachusetts Amherst — Recent experiments by Han et. al. have observed a new kind of coupling process for polymer crystallization in a binary polyolefin blend system, which originates from the fluctuation growth of a two-component phase separating system in the unstable spinodal region. A strong coupling was observed between the concentration fluctuation liquid-liquid phase separation and the nucleation of crystallization, which resulted in significant changes in the crystallization kinetics. In this paper, we propose a possible mechanism which can explain these experimental observations. The spinodal decomposition in the unstable region causes the spontaneous growth of domains of the two constituent polyolefins. It is proposed that these domains then present an interface on which heterogeneous nucleation of the crystallizable component can take place with a much reduced energy barrier. Combining the theories of heterogeneous nucleation and spinodal decomposition kinetics, we present an anaytic calculation of the nucleation rate as a function of the spinodal decomposition time. The analytic formula is found to correspond well with the experimental results for the late stage of spinodal decomposition kinetics. More detailed experiments are required to verify our prediction for the nucleation rate for early times.

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