The spinodal decomposition analysed by a self-consistent mean-field theory

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When a solid solution is quenched from the homogeneous high-temperature phase to a two phase coexistence region, some of the fluctuations of composition in the supersaturated solid solution irreversibly increase to form the two phases. Mean field theories distinguish two kinetic regimes. One is the spinodal decomposition regime for which the supersaturated solid solution is unstable under any fluctuation of composition. The first steps of the kinetics of decomposition are studied through a linear stability analysis using a mean field theory.

Until a recent self-consistent mean-field formulation [1], the correlation effects due to the vacancy mechanism were not included in the mean-field equations and the matrix of Onsager was diagonal. We show how these correlation effects modify the kinetics of decomposition.