Dynamics of spinodal decomposition in the Ising model in frame of Dynamic Lattice Liquid model

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Phase separation process during a phase transition have been investigated for many years. This phenomenon is of a great importance to materials engineering. When a single phase binary system, being initially in homogeneous (disordered) phase, is rapidly quenched into the two-phase inhomogeneous (ordered) region, small inhomogeneities evolve into macroscopic network of domains of the equilibrium phases. The unique pattern occur. The length scale of the ordered regions increases with time to achieve the equilibrium state. This phenomenon is known as a spinodal decomposition. There are several approaches to numerical simulation of this process: Cahn-Hilliard (CH) equation and its modifications [1], molecular dynamics and Monte Carlo (MC) methods. The last group of methods allows us to investigate relatively big systems and long times. The typical model used in MC simulations is the Ising model, which represents mixture consisting of two types of particles on a lattice with nearest neighbor interaction. In most common investigations two sorts of movement mechanism have been used: Kawasaki (direct exchange of two particles) [2] and vacancy dynamics (empty sides are present on the lattice) [2,3]. Nevertheless those methods have weak representation in real systems. In our case we have used Dynamic Lattice Liquid algorithm [4]. It allows to simulate dense systems with all lattice sites occupied and parallel treatment of all particles. This algorithm was successfully used in diffusion limited aggregation simulation, polymer dynamics and reaction front evolution investigation. Our results were carried out on two dimensional triangular lattice (128x128) with periodic boundary conditions. The number of particles was constant and particle exchange probability followed the Metropolis rule. We focused on the scaling regime that develops at diffrent times after the quench (size of domains follows Lifshitz scaling law) and local concentration field.

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