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Diffuse-interface modeling of phase segregation in van der Waals fluids A.G. LAMORGESE, CTR/Stanford University, R. MAURI, DICCISM/Università di Pisa — We simulate phase separation in a van der Waals fluid that is deeply quenched into the unstable range of its phase diagram. Our theoretical approach follows the diffuse-interface model, where convection induced by phase change is accounted for via a Korteweg force, expressing the tendency of the demixing system to minimize its free energy. Spinodal decomposition patterns for critical and off-critical van der Waals fluids are studied numerically, revealing the scaling laws of the typical length scale and composition of single-phase microdomains, together with their dependence on the Reynolds number. Unlike phase separation of viscous binary mixtures, here local equilibrium is reached almost immediately after single-phase domains start to form. In addition, as predicted by scaling laws, such domains grow in time like $t^{2/3}$. Comparison between 2D and 3D results reveals that 2D simulations capture, even quantitatively, the main features of the phenomenon. For a binary mixture of van der Waals fluids, we show simulations of Marangoni migration during phase separation in a temperature gradient. Our results reproduce the large-scale unidirectional convection observed in recent experiments.

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