Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Dynamic transition of dendrite orientation in the spinodal decomposition of viscous binary mixtures under a thermal gradient. ROBERTO MAURI[1], ANTONIO BERTEI[2], University of Pisa — In this study, spinodal decomposition of a very viscous regular binary mixture bounded within two walls cooled at different temperatures is simulated by using the diffuse interface model. Under a temperature gradient, phase separation starts from the cooler wall forming dendritic structures growing anisotropically with time. Two remarkably different dynamics are identified depending on whether heat propagates slower or faster than mass. For small thermal conductivity (i.e., small Lewis number), dendrites grow parallelly to the temperature gradient, keeping such an alignment until the steady-state. On the other hand, for large Lewis number, during the early stages phase separation proceeds within stripes oriented along iso-temperature lines, i.e., with dendrites aligned perpendicularly to the temperature gradient, which, however, gradually shift their orientation parallel to the temperature gradient as the steady-state is approached. Such a dynamic transition of dendrite orientation upon a temperature gradient when heat propagates faster than mass is found to hold also for non-equimolar mixtures and for different species thermal conductivities. These results shed light on the dynamics of phase separation in constrained systems and anisotropic conditions.

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Date submitted: 25 Jul 2019 Electronic form version 1.4