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Cahn-Hilliard Approach for a Precipitation Reaction–Diffusion System Exhibiting Pattern Formation

We use the Chan-Hilliard equation to study the newly reported spotted patterns in a periodic precipitation system, which is modeled via a scenario analogous to spinodal decomposition. This pattern emerges as a transition from the classical Liesegang rings to spots with square/hexagonal symmetry in a system, which consists of sulfide/hydroxide ions diffusing into a gel matrix containing dissolved cadmium(II) ions. The phase diagram delineating the onset of the transition and the regions of various patterns is presented. The transition threshold, wavelength, and size of the resulting spots are shown to be controllable by adjusting the initial concentrations of the diffusing electrolytes. We show that the Cahn–Hilliard equation, coupled to reaction-diffusion equations, is able to capture the experimental results.