Properties of nano-islands formation in nonequilibrium reaction-diffusion systems with memory effects

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We have studied dynamics of islands formation of the adsorbate using generalized approach including persistent motion of particles having finite speed at initial stages and diffusion kinetics at final ones. It was found that stabilization of nano-patterns in such class of reaction-Cattaneo models is achieved by noneqilibrium chemical reactions. It was found that during the system evolution pattern selection processes are realized. We have shown that possible oscillatory regimes for islands formation are realized at finite propagation speed related to nonzero relaxation time for the diffusion flux.

Our results can be used to describe formation of nano-islands at processes of condensation from the gaseous phase. Despite we have considered a general model where relaxation time τ_J for the diffusion flux is small but nonzeroth value, one can say that condensation processes with formation of metallic islands can be described in the limit $\tau_J/\omega_D^{-1} \lesssim 10^{-3}$ (here ω_D is the Debye frequency), whereas nano-islands formation with $\tau_J/\omega_D^{-1} \sim 10^{-1} \div 10^{-2}$ is possible for soft matter condensation (semiconductors, polymers, etc.).