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Coarsening in anisotropic oblique stripe patterns

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We study the coarsening of two-dimensional oblique stripe patterns after a quench from an initial disordered uniform state through a bifurcation point, by numerically solving an anisotropic Swift-Hohenberg-like equation [1, 2]

$$\partial_t \psi = r\psi - \frac{\xi^2}{k_0^2}(\nabla^2 + k_0^2)^2\psi - \frac{c}{k_0^4}\partial_y^2\psi + \frac{2\eta}{k_0^4}\partial_x^2\partial_y^2\psi + NL[\psi], \tag{1}$$

where c and η are anisotropic constant parameters, r is the main control parameter and $NL[\psi]$ is a cubic nonlinear term which determines the relaxational or nonrelaxational dynamics of the system. The coordinates x and y are related to the parallel and normal directions to a preferential orientation, respectively. For certain values of c and η, domains of oblique stripes are formed with two possible symmetric orientations with respect to the x axis, similar to zig-zag roll domains in planar electroconvection of nematic liquid crystals [3]. The oblique stripe domains are separeted by two kinds of defects: horizontal chevron boundaries and vertical or inclined stringlike arrays of dislocations. There are also some isolated dislocations within domains. We observe that dislocation and chevron densities decay as power laws of time $t^{-1/z}$, and the characteristic domain lenght scales parallel (L_x) and normal (L_y) to the prefered axis grow as power laws $t^{1/z}$ but with different relative magnitudes ($L_x > L_y$). As we increase the quench depth, defect densities decay and domain lenght scales grow in time slower than close to onset. We study analytically some nonadiabatic corrections to the amplitud equations of the two oblique stripe phases and find some evidences that the coarsening slows down due to pinning effects associated to a background periodic potential acting anisotropically along the x and y directions on the grain boundary motion. Some agreements and disagreements are found with experimental electroconvection zig-zag patterns [3, 4].

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