Combined effect of anisotropic surface tension and interface kinetics on pattern formation during the growth of two-dimensional crystals

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We study the combined effect of anisotropic surface tension and interface kinetics on pattern formation during the growth of two-dimensional crystals under conditions that the growth is governed by interfacial processes [1]. For sinusoidal anisotropies having fourfold symmetry, we compute numerically the trajectories of elements of the interface having constant crystallographic orientation. Our results display many of the features derived from general consideration by Angenent and Gurtin [2]. The resulting growth patterns become asymptotic to the Gibbs-Wulff shape for kinetic coefficient except that there is local rounding of what would otherwise be sharp corners.

Fig.1 Growth pattern for anisotropic interface kinetics in the absence of surface tension. The contours represent the interface at equal intervals of time beginning with zero.

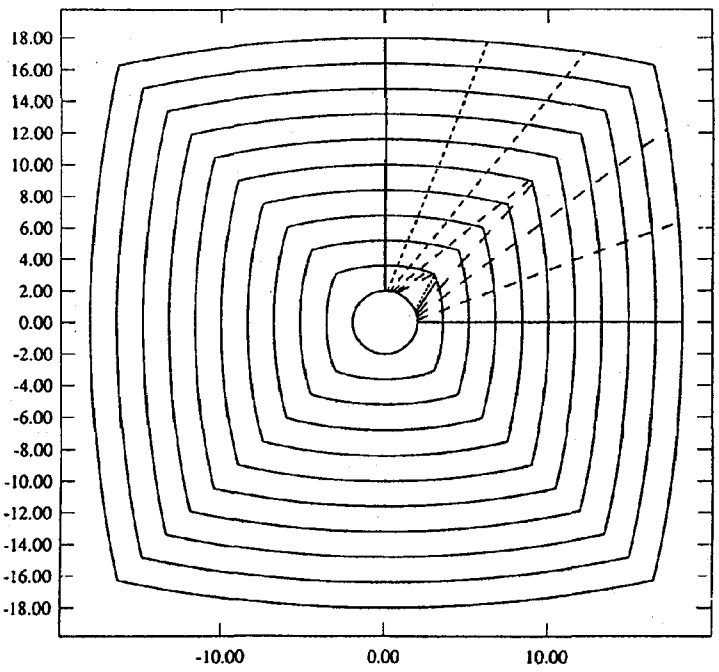


Fig.2(a) Growth pattern for anisotropic interface kinetics in the presence of anisotropic surface tension. The contours represent the interface at equal intervals of time beginning with zero.

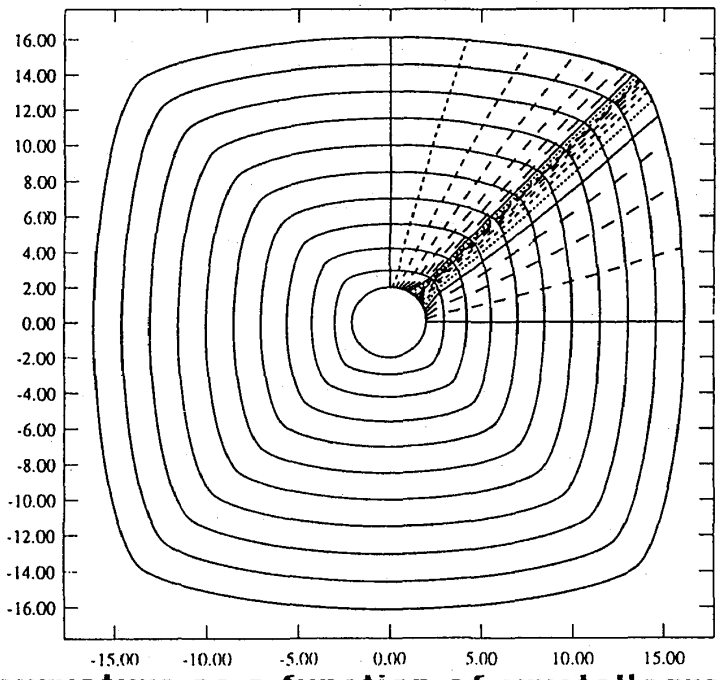
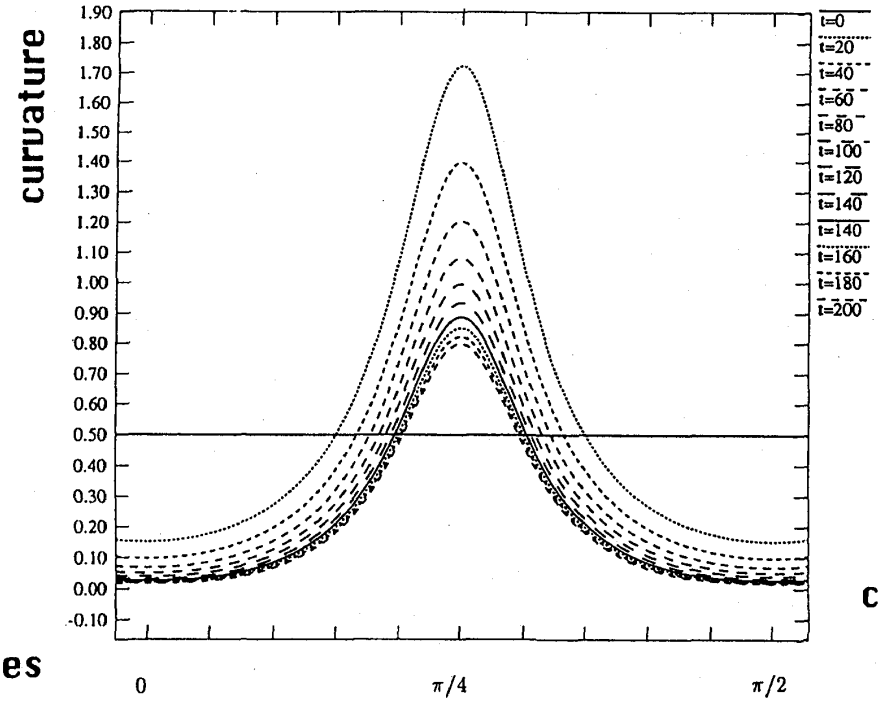


Fig.2(b) The curvature as a function of crystallographic orientation θ for each time step corresponding to Fig.2(a).



References

[1] E.Yokoyama and R.F.Sekerka, to be published in J.Crystal Growth.
[2] S.Angenent and M.E.Gurtin, Archive for Rational Mechanics and Analysis, 108(1989)323.