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Single-phase-field model of stepped surfaces

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Abstract— We formulate a phase-field description of step dynamics on vicinal surfaces that makes use of a single dynamical field, at variance with previous analogous works in which two coupled fields are employed, namely, a phase-field proper plus the physical adatom concentration. Within an asymptotic sharp interface limit, our formulation is shown to retrieve the standard Burton-Cabrera-Frank model in the general case of asymmetric attachment coefficients Ehrlich-Schwoebel effect . We confirm our analytical results by means of numerical simulations of our phase-field model. Our present formulation seems particularly well adapted to generalization when additional physical fields are required.

Index Terms— Theory and models of crystal growth; physics of crystal growth, crystal morphology, and orientation, Interface structure and roughness, Molecular, atomic, ion, and chemical beam epitaxy,….

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