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Phase Field Model for Step Dynamics Including Elastic Interactions Between Steps and the Ehrlich-Schwoebel Barrier DONG-HEE YEON, KATSUYO THORNTON, Department of Materials Science and Engineering, University of Michigan, Ann Arbor, MI 48109, USA — Understanding the evolution of steps on a vicinal surface is crucial in many important problems involving surfaces. Elastic interactions between steps and the preferential incorporation of adatoms into the upper step due to an asymmetric energy barrier, so-called the Ehrlich-Schwoebel(ES) barrier, greatly influence the step dynamics, often generating morphological instabilities of steps. For example, in the step bunching instabilities, the elastic interactions invoke the progressive coalescence of steps, while the ES barrier has a stabilizing effect. We will present a phase-field model for step dynamics including effects of elastic interactions and the ES barrier, and its application to investigate the effects of these factors on step dynamics. The results of the linear stability analysis will also be presented and are compared with those obtained by the phase-field model. In our simulation, it is shown that the flux is an important factor limiting the growth of step bunches through the debunching process. We will also present the analyses of step meandering instabilities resulting from the interplay among the elastic interaction, the ES barrier, and the step line energy.

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