1020-35-217 **Michel Elie Jabbour*** (jabbour@ms.uky.edu), Department of Mathematics, University of Kentucky, Lexington, KY 40506. *A Novel Mechanism for the Onset of Step-Bunching Instabilities During the Epitaxy of Single-Species Crystalline Films.*

A thermodynamically consistent theory for single-species, step-flow epitaxy that extends the classical framework originally proposed by Burton, Cabrera, and Frank (BCF) is derived from basic considerations. In particular, a novel expression for the step chemical potential is obtained that contains an energetic contribution from the adjacent terraces in the form of the jump in the grand canonical potential, thus generalizing the standard Gibbs–Thomson relation to the dynamic, dissipative setting of step-flow growth. The stability analysis of the resulting free-boundary problem for an infinite train of equidistant rectilinear steps yields explicit criteria for the onset of step bunching in terms of the basic physical and geometric parameters of the theory. It is found that, in contrast with the predictions of the classical BCF model, both in the absence and presence of desorption, a growth regime exists for wich step bunching occurs, except possibly in the dilute limit where the train is always stable to step bunching. (Received August 28, 2006)