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Temperature Dependence of the Step Line Tension and Island Decay on the Si(111) (1x1) Surface M.S. ALTMAN, K.L. MAN, A.B. PANG, Hong Kong Univ. of Science and Technology, T. STASEVICH, F. SZALMA, T.L. EINSTEIN, Univ. of Maryland — Atomic steps are common defects at surfaces that can play an important role in many phenomena. Advances in the fabrication of nanostructures at surfaces depend largely upon the degree to which one can understand and control factors that affect step morphology. The step line tension is a crucial element in the Gibbs-Thomson relation, which describes the dependence of the chemical potential of an surface step upon its radius of curvature. This dependence can have a notable influence on step morphology. A proper description step morphological phenomena therefore requires accurate knowledge of line tension, including its temperature dependence. The step line tension on the Si(111) (1x1) surface was determined from a capillary wave analysis of two-dimensional island edge fluctuations that were observed with low energy electron microscopy. The line tension decreases by nearly 20% between 1145 K and 1233 K. The role of desorption in island decay varies from negligible to dominant in the temperature range, 1145 – 1380K, that island decay was measured. A general model of island decay is presented that takes account of desorption. Evaluation of the island decay time with this model referenced to the temperature-dependent line tension accurately determines activation energies that are relevant to island decay and sublimation.

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