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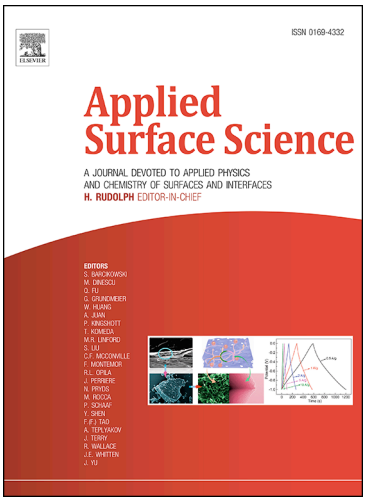

Full Length Article

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Slip trace-induced terrace erosion

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Abstract

We have investigated the interaction between slip traces and vicinal steps on the Nb(111) surface under increasing external strain. By exploiting an extended scanning tunneling microscopy analysis, we here show that emerging dislocations at the free-surface can induce the full disappearance of atomic terraces. To shed light on the observed behavior, we have modeled the elastic interaction between a screw dislocation and a vicinal step in the actual experimental configuration. After computing the adatom chemical potential, we show that strain-mediated diffusion on surface causes step erosion, possibly leading to vanishing of full terraces.

Keywords:
STM observations, plasticity, dislocations, surface diffusion, terrace evolution

1. Introduction

The study of the surface evolution of nanostructured materials is a topic of extensive researches in the fields of surface physics, materials science and metallurgy because of the numerous applications of such materials in various engineering fields such as nanoelectronics or nanophotonics. For instance, it has been observed that faceted macrosteps can deteriorate the quality of grown crystals [1] and, in the particular case of 4H-SiC, it has been reported that faceted steps perturb the performance of electric devices. It is also well-known that vicinal surfaces can be used as templates for growing layers with controlled orientation and crystallinity. Recently, the case of Ag growth on