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Step Permeability on the Pt(111) Surface MICHAEL ALTMAN, MICHAEL MAN, Hong Kong University of Science and Technology — Surface morphology will be affected, or even dictated, by kinetic limitations that may be present during growth. Asymmetric step attachment is recognized to be an important and possibly common cause of morphological growth instabilities. However, the impact of this kinetic limitation on growth morphology may be hindered by other factors such as the rate limiting step and step permeability. This strongly motivates experimental measurements of these quantities in real systems. Using low energy electron microscopy, we have measured step flow velocities in growth on the Pt(111) surface. The dependence of step velocity upon adjacent terrace width clearly shows evidence of asymmetric step attachment and step permeability. Step velocity is modeled by solving the diffusion equation simultaneously on several adjacent terraces subject to boundary conditions at intervening steps that include asymmetric step attachment and step permeability. This analysis allows a quantitative evaluation of step permeability and the kinetic length, which characterizes the rate limiting step continuously between diffusion and attachment-detachment limited regimes. This work provides information that is greatly needed to set physical bounds on the parameters that are used in theoretical treatments of growth. The observation that steps are permeable even on a simple metal surface should also stimulate more experimental measurements and theoretical treatments of this effect.

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