Erratum: Theoretical Analysis of Mound Slope Selection during Unstable Multilayer Growth [Phys. Rev. Lett. 95, 256101 (2005)]

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In a recent Letter, we analyzed mound slope selection during unstable multilayer growth. We claimed that a discrepancy existed between the prediction for the selected mound slope from our step dynamics model incorporating downward funneling (DF) and that based on standard phenomenological continuum theory (PCT). For the latter, one balances an uphill lateral mass current, J_{DIFF}, due to surface diffusion in the presence of inhibited interlayer transport with a downhill current, J_{DF}, due to DF [1–4]. However, the discrepancy arose from using a simple approximation for J_{DIFF}. It is removed by precise analysis of the relevant currents (calculated from the mean lateral distance traveled per depositing atom).

Consider atoms depositing at rate F on a perfect staircase increasing in height from left to right, with step height b and terrace width L. In our model, atoms depositing within a distance c above the descending steps funnel down to those steps. The remainder attach to ascending steps to the right with probability $P_+ = P_+(L)$, and at descending steps to the left with probability $P_- = P_-(L)$. The fraction of atoms deposited in step regions is c/L, and mean lateral distance traveled due to DF is $c/2$, so one obtains

$$J_{\mathrm{DF}} = -Fb(c/2)(c/L) = -Fbc^2/(2L). \tag{1}$$

For the remaining fraction, $(L-c)/L$, of atoms deposited outside of step edge regions, those attaching to ascending steps travel an average distance of $(L-c)/2$. Those attaching to descending steps travel an average distance $c+(L-c)/2 = (L+c)/2$ accounting for the extra nondiffusive motion across the step region. This implies that

$$J_{\mathrm{DIFF}} = Fb[(L-c)P_+/2 - (L+c)P_-/2](L-c)/L = Fb(L-c)\Delta/2 - Fbc(L-c)/(2L), \tag{2}$$

where $\Delta = P_+ - P_-$. Setting $J_{\mathrm{DIFF}} + J_{\mathrm{DF}} = 0$ yields a selected slope $m_s = b/L$ exactly matching that obtained from the step dynamics modeling. For example, for constant $P_\pm$, one has that $m_s \approx (b/c)\Delta$, for small Δ, crossing over to $m_s = b/(2c)$, for $\Delta = 1$.

Finally, our Letter should have also distinguished more clearly between two related but distinct quantities. PCT assumes the existence of a coarse-grained lateral mass current, $J_{\mathrm{PCT}} = J_{\mathrm{DIFF}} + J_{\mathrm{DF}} + \cdots$, which vanishes identically for stationary mound profiles. Our step dynamics modeling introduced a precisely defined microscopic total lateral mass current, J_{TOT}, by summing across one side of a mound all fluxes for atoms attaching to steps from the right and subtracting all fluxes for attachment from the left. This quantity oscillates during growth, but vanishes on average for selected mound shapes.

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