

Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Simplified conditions holding at the gas–liquid interface during evaporation S.J.S. MORRIS, Mechanical Engineering, University of California, Berkeley — We show that on the gas side of the interface between a pure liquid and a binary mixture of its vapour with an insoluble gas, the normal derivative of vapour partial pressure p_v satisfies $\frac{\partial p_v}{\partial n} + \frac{\alpha c}{2\pi p D}(P - p_v)(p - p_v) = 0$. Constants α , c , D denote the dimensionless accommodation coefficient, a molecular speed and the diffusivity. Provided the continuum approximation holds within the gas, and $\alpha = O(1)$, this boundary condition implies that evaporation can take one of two forms. (a) If the coexistence pressure P evaluated at the interface is less than the constant total gas pressure p , liquid at the interface is in local thermodynamic equilibrium with its vapour, and the evaporation rate is determined by diffusion through the gas. (b) Conversely, if $P > p$, gas at the interface consists of pure vapour, and the evaporation rate is determined by processes within the liquid. In the Wayner theory of the heated evaporating meniscus, such as that in a heat pipe, case (b) is assumed. As an application of our result, we show that some of the published experiments intended to test the Wayner theory instead operate under conditions in which case (a) holds. As a result, they do not perform the test intended.

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Date submitted: 01 Aug 2017

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