Film Condensation

The circumstance of film condensation on a vertical plate as sketched in figure 1 allows an analysis that is precisely parallel to that for film boiling detailed in section (Nig). The obvious result is a film thickness, $\delta(y)$ (where y is now measured vertically downward) given by

$$\delta(y) = \left[\frac{4k_L(-\Delta T)\mu_L}{3\rho_L(\rho_L - \rho_V)g\mathcal{L}} \right]^{\frac{1}{4}} y^{\frac{1}{4}} \tag{Nii1}$$

a local heat transfer coefficient given by

$$\frac{\dot{q}(y)}{\Delta T} = \left[\frac{3\rho_L(\rho_L - \rho_V)g\mathcal{L}k_L^3}{4(-\Delta T)\mu_L} \right]^{\frac{1}{4}} y^{-\frac{1}{4}} \tag{Nii2}$$

and the following overall heat transfer coefficient for a plate of length ℓ:

$$\left(\frac{4}{3} \right)^{\frac{3}{4}} \left[\frac{\rho_L(\rho_L - \rho_V)g\mathcal{L}k_L^3}{(-\Delta T)\mu_L \ell} \right]^{\frac{1}{4}} \tag{Nii3}$$

Clearly the details of film condensation will be different for different geometric configurations of the solid surface (inclined walls, horizontal tubes, etc.) and for laminar or turbulent liquid films. For such details, the reader is referred to the valuable review by Collier and Thome (1994).

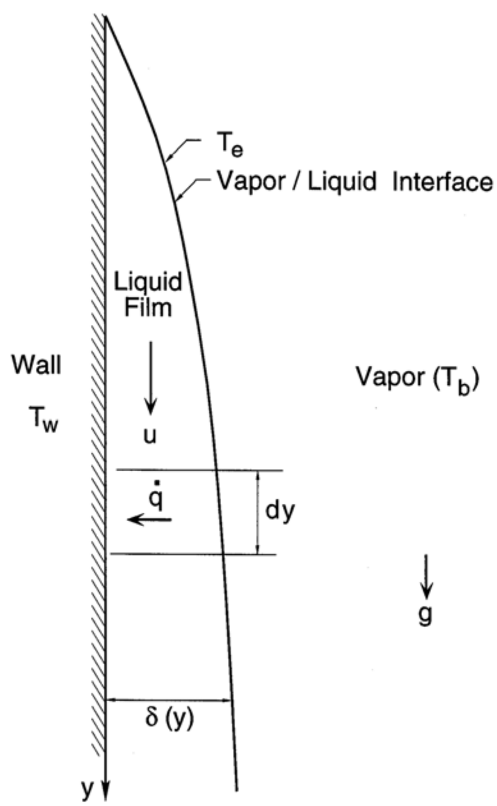

Figure 1: Sketch for the film condensation analysis.