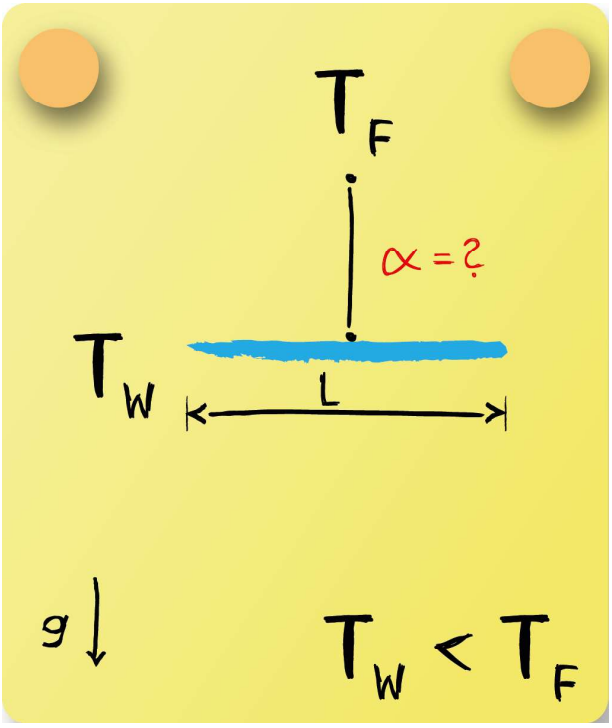
Heat Transfer Correlation 20



A horizontal plate stands in a non-moving ideal gas. Calculate the mean heat transfer coefficient $\bar{\alpha}$ on the upper surface.

Coefficient of volume expansion for an ideal gas:

$$\beta = \frac{1}{T_\mathrm{F}} = 0.0033 \ \mathrm{K}^{-1}$$

Grashof number:

$$\mathrm{Gr_L} = \frac{g \cdot \beta \cdot (T_\mathrm{F} - T_\mathrm{w}) \cdot L^3}{\nu^2} = 4.662 \cdot 10^5$$

And thus $\mathrm{Gr_L} \cdot \mathrm{Pr} = 3.053 \cdot 10^5$.
Nusselt number:

$$\overline{\mathrm{Nu_L}} = 0.27 \cdot (\mathrm{Gr_L} \cdot \mathrm{Pr})^{\frac{1}{4}} = 6.35$$

Heat transfer coefficient:

$$\bar{\alpha} = \frac{\overline{\mathrm{Nu_L}} \cdot \lambda_\mathrm{f}}{L} = 4.95 \ \mathrm{W/m^2K}$$