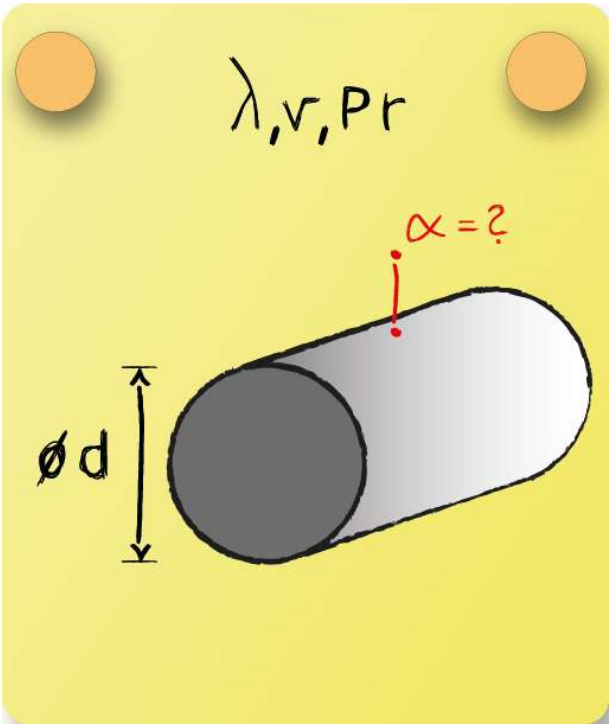
Heat Transfer Correlation 17



A cylinder with a constant temperature stands in non-moving ideal gas. Calculate the mean heat transfer coefficient $\bar{\alpha}$.

Coefficient of volume expansion for an ideal gas:

$$\beta = \frac{1}{T_\mathrm{F}} = \frac{1}{(T_\mathrm{W} + T_\infty)/2} = 0.0031 \ \mathrm{K}^{-1}$$

And thus:

$$\mathrm{Gr_d} \cdot \mathrm{Pr} = \frac{g \cdot \beta \cdot (T_\mathrm{W} - T_\infty) \cdot d^3}{\nu^2} \cdot \mathrm{Pr} = 5.78 \cdot 10^{10}$$

Nusselt number:

$$\overline{\mathrm{Nu_d}} = 0.13 \cdot (\mathrm{Gr_d} \cdot \mathrm{Pr})^{\frac{1}{3}} = 502.71$$

Heat transfer coefficient:

$$\bar{\alpha} = \frac{\overline{\mathrm{Nu_d}} \cdot \lambda_\mathrm{f}}{d} = 364.47 \ \mathrm{W/m^2K}$$