9-5

$d = 20\ cm$

$p = 100\ kPa$

$t = 120°C$

$w = 10\ m/s$

vzduch

$\alpha = ?$

$pV = nRT \qquad n = \frac{m}{M}$

$pV = \frac{m}{M}RT$

$p \cdot M = \frac{m}{V}RT = \varrho RT$

$\varrho = \frac{p \cdot M}{R \cdot T} = \frac{100 \cdot 10^3 \cdot 28.84 \cdot 10^{-3}}{8.314 \cdot (273.15+120)}$

$\varrho = 0.8823\ kg/m^3$

$\eta = 22.548 \cdot 10^{-6}\ Pa \cdot s$ (e-tabulky)

$\lambda = 0.0333\ W/m.K$ —"—

$c_p = 1.013\ kJ/kg.K$ —"—

$Re = \frac{w \cdot d \cdot \varrho}{\eta} = \frac{10 \cdot 0.2 \cdot 0.8823}{22.548 \cdot 10^{-6}}$

$Re = ~~369125~~\ 78260$

$Pr = \frac{c_p \cdot \eta}{\lambda} = \frac{1.013 \cdot 10^3 \cdot 22.548 \cdot 10^{-6}}{0.0333}$

$Pr = 0.6859$

$Nu = 0.023 \cdot Re^{0.8} \cdot Pr^{0.4} = ~~548.58~~\ 162.58$

(proudění v turbulentní oblasti na hranici platnosti vztahu, ale lepší odhad nemáme)

$Nu = \frac{\alpha \cdot d}{\lambda}$

$\alpha = \frac{Nu \cdot \lambda}{d} = \frac{~~548.58~~\ 162.58 \cdot 0.0333}{0.2} = ~~99.7~~\ 27.1\ W/m^2.K$