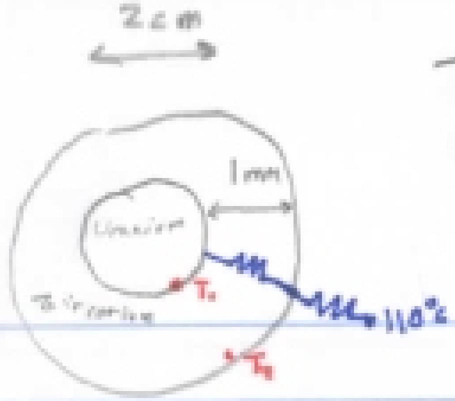
* can't use ~~~ on $\dot{q}$

Uranium
$k = 38 \frac{W}{mK}$

Zirconium
$k = 21 \frac{W}{mK}$



$T_\infty = 110\,°c$

$h \cong 20{,}000 \frac{W}{m^2 °c}$

$T_{max} = 1200\,k = 927°c$

Assume length = 1m

$A = \pi D_o L$

$$R_{conv} = \frac{1}{hA} \rightarrow \frac{1}{(20{,}000 \frac{W}{m^2 °c})(.022m)(\pi)(1m)} = 7.23 \times 10^{-4} \frac{°C}{W}$$

$$R_{cond} = \frac{\ln(\frac{r_2}{r_1})}{2\pi L k_2} \rightarrow \frac{\ln(\frac{.022}{.02})}{2\pi(1m)(21 \frac{W}{mK})} = 7.22 \times 10^{-4} \frac{°C}{W}$$

$$q = \frac{\Delta T}{R} \rightarrow \frac{T_1 - 110}{R_{cond} + R_{conv}} \quad \rangle \quad \dot{q}\left(\frac{L\pi D_i^2}{4}\right) = \frac{T_1 - 110}{R_{total}}$$

$$\dot{q} = \forall q \rightarrow \dot{q} = \left(\frac{L\pi D_i^2}{4}\right) q$$

$$T(r) = \frac{-\dot{q}}{4k} r^2 + C_1 \ln r + C_2$$

B.C. $T(0) = T_{max} = 927°c$

$T(.01) = T_1$

$$T(0) = \frac{-\dot{q}}{4k}(0)^2 + C_1 \ln(0) + C_2 \rightarrow C_2 = 927°c$$

$$T(.01) = \frac{-\dot{q}}{4k}(.01)^2 + 927 = T_1 \rightarrow T_1 = \frac{-\dot{q}}{4k}(.01m)^2 + 927$$

$$\rightarrow \dot{q}\left(\frac{L\pi D_i^2}{4}\right) = \frac{\left(\frac{-\dot{q}}{4k}(.01m)^2 + 927\right) - 110°c}{R_{total}} \rightarrow \text{solve for } \dot{q}$$

$$\dot{q} = 7.34 \times 10^8 \frac{W}{m^3}$$

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Chapter 4 — Two-Dimensional Steady State conduction

2.21 $\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} + \frac{\dot{q}}{k} = 0$ → partial differential equation

- 3 things to be able to do
  - ① derive equations for nodes (from table 4.2)
    - will be asked "case 6" on exam
  - ② put nodes together in system of equations (matrix)
  - ③ solve system of equations
    - on test, at most 3 equations & 3 unknowns