HW3_Part5

March 7, 2025

Problem 5

Equations Used:

$A_c = \% * A$
$A_v = A - \% * A$
$R_1 = \frac{\delta}{2k_1 A_c}$
$R_v = \frac{\delta}{k_f A_v}$
$R_{int} = (\frac{1}{R_1} + \frac{1}{R_v})^{-1}$

[2]:
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# Import libraries
import numpy as np
import matplotlib.pyplot as plt
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[11]:
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# Define Constants in terms of meters
percentVoids = np.array([0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9])
A = 0.02
delta = 100E-6
k_1 = 50
k_f = 0.024

# Calculate Areas
A_c = []
A_v = []

for void in percentVoids:
    A_c.append(void * A)
    A_v.append(A - void * A)

# Calculate resistances
R_1 = []
R_v = []
for x in range(len(A_c)):
    R_1.append(delta / (2 * k_1 * A_c[x]))
    R_v.append(delta / (k_f * A_v[x]))

R_int = []
for x in range(len(R_1)):
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    R_int.append(((1/R_1[x]) + (1/R_v[x])) ** -1)
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[15]:
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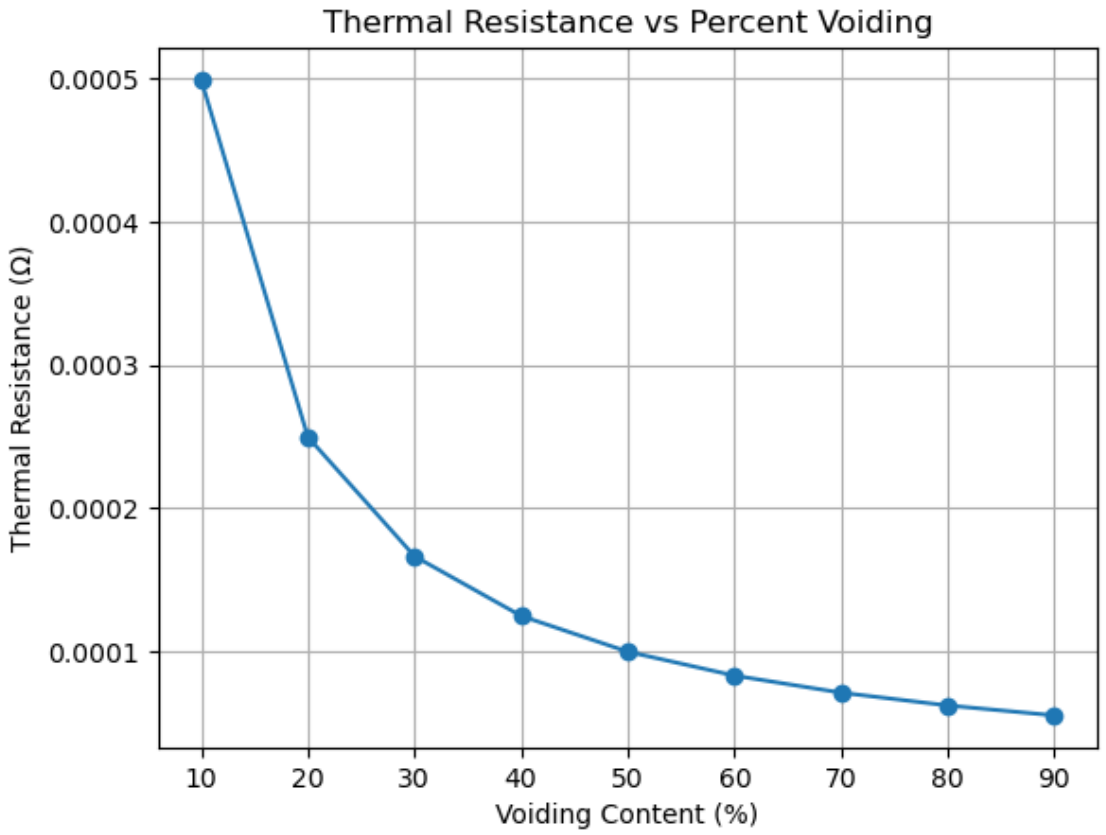
# Plot
fig, ax = plt.subplots()

ax.plot(percentVoids*100, R_int, marker='o', linestyle='-')

ax.set(xlabel='Voiding Content (%)', ylabel='Thermal Resistance (\u2126)',
       title="Thermal Resistance vs Percent Voiding")
ax.grid()
```



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