HW3_Part5

March 7, 2025

Problem 5

Equations Used:

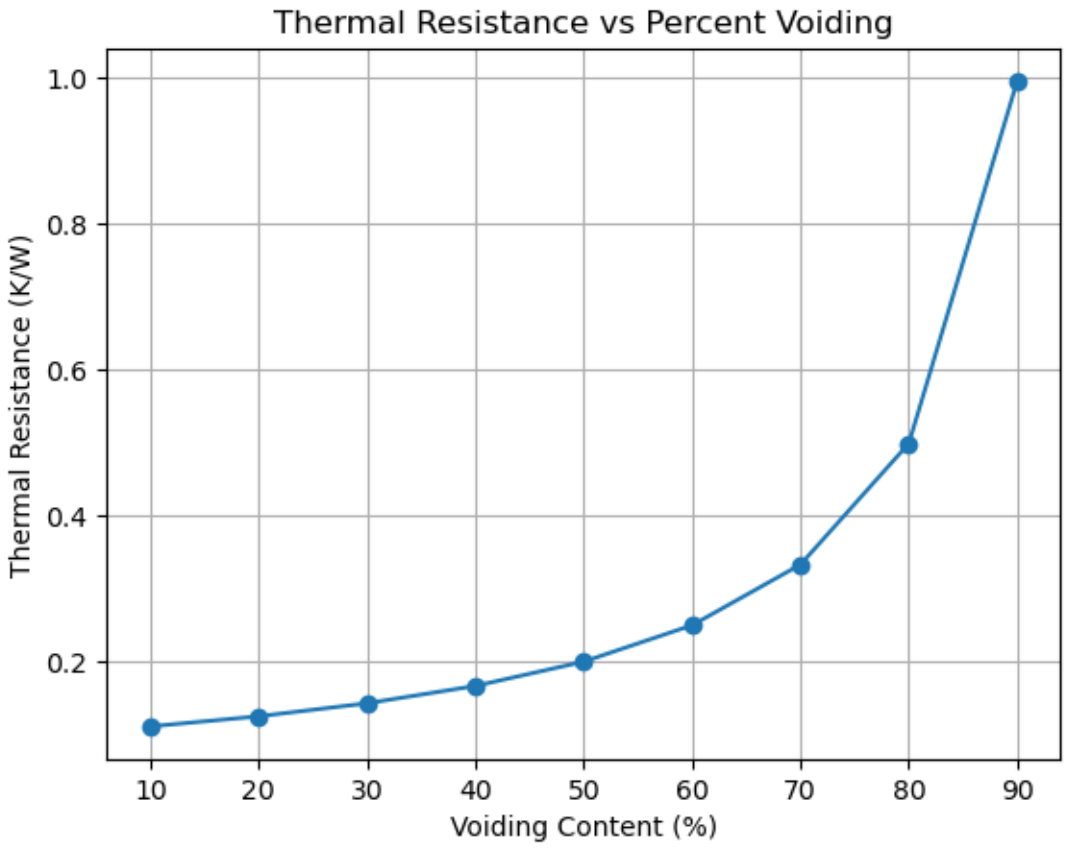
$R_s = \frac{\delta}{k_s((1-\%)*A)}$
$R_v = \frac{\delta}{k_v(\%*A)}$
$R_{int} = (\frac{1}{R_s} + \frac{1}{R_v})^{-1}$

[30]:
```
# Import libraries
import numpy as np
import matplotlib.pyplot as plt
```

[31]:
```
# 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 = 20E-6 # This was converted from mm^2 to m^2
delta = 100E-6
k_1 = 50
k_f = 0.024

# Calculate resistances
R_1 = []
R_v = []
for x in range(len(percentVoids)):
    R_1.append(delta / (k_1 * ((1 - percentVoids[x]) * A)))
    R_v.append(delta / (k_f * (percentVoids[x] * A)))

R_int = []
for x in range(len(R_1)):
    R_int.append(((1/ (R_1[x])) + (1/R_v[x])) ** -1)
```

[32]:
```
# Plot
fig, ax = plt.subplots()

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

ax.set(xlabel='Voiding Content (%)', ylabel='Thermal Resistance (K/W)',
       title="Thermal Resistance vs Percent Voiding")
```

```
ax.grid()
```


Thermal Resistance vs Percent Voiding
Thermal Resistance (K/W)
1.0
0.8
0.6
0.4
0.2
10
20
30
40
50
60
70
80
90
Voiding Content (%)