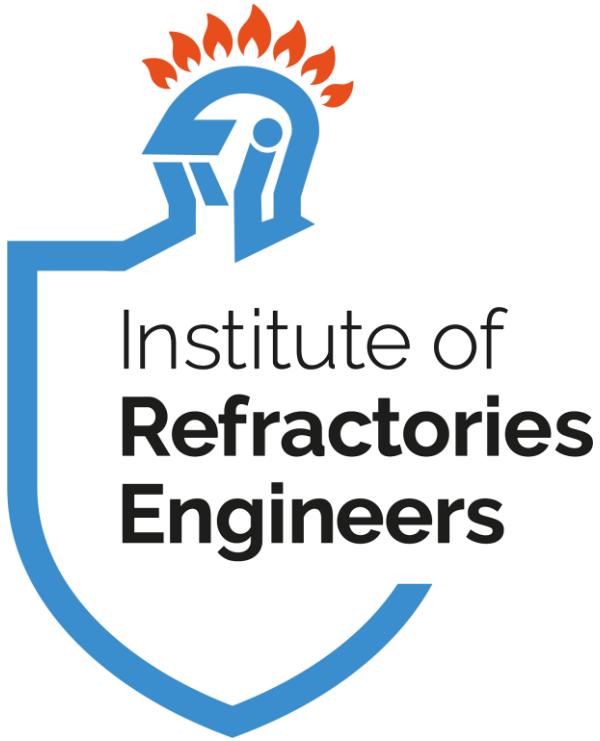


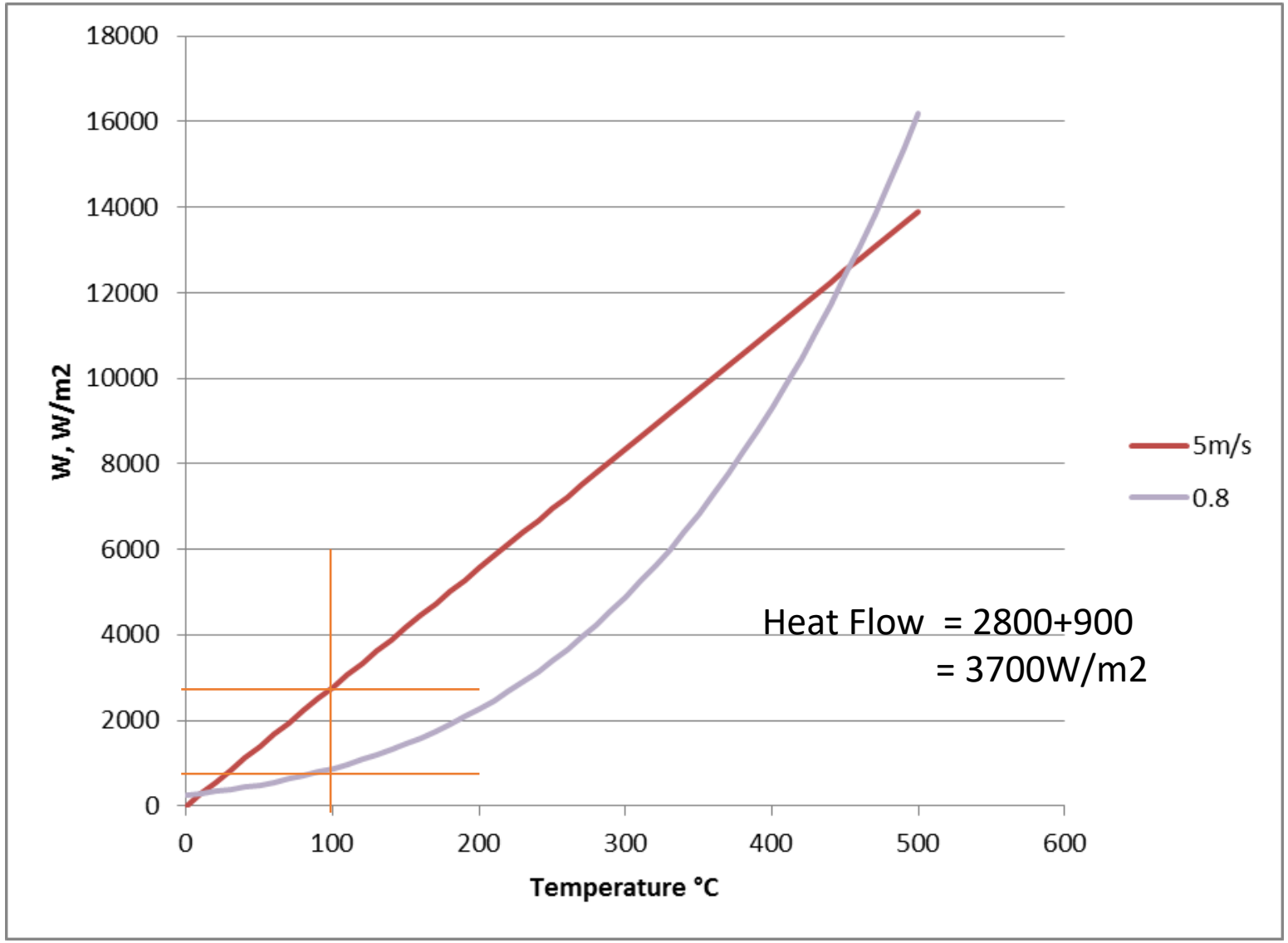
Online Training Event 2020

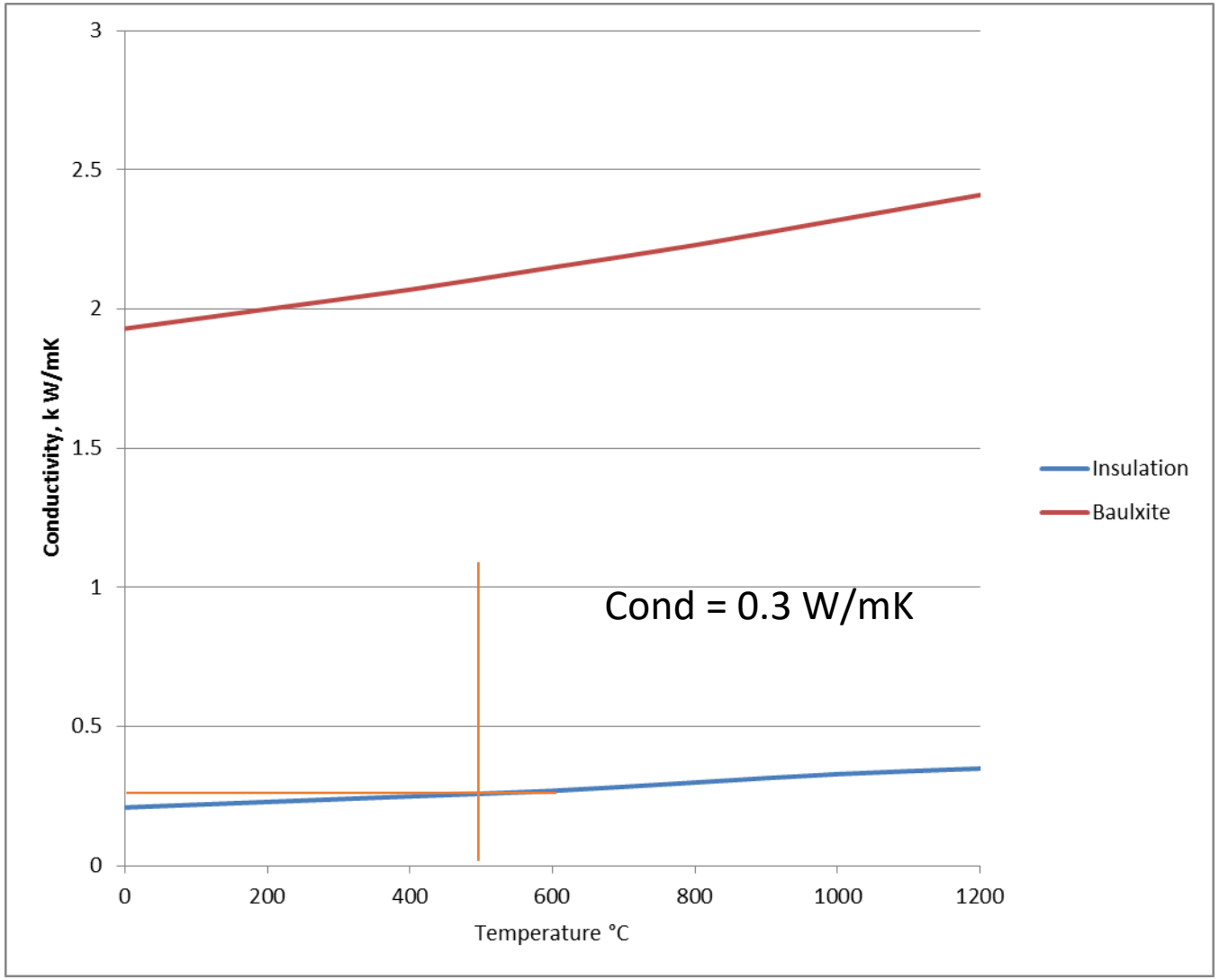
Exercise 1 – Thermal gradient

- Collect Data IN SAME UNITS
    - Hot Face (°C) – 1000°C
    - Ambient (°C) – 0°C
    - Lining Thickness (m) – 200mm = 0.2m
    - Surface Emissivity (no unit) – 0.8
    - Wind Speed (m/s) - 5m/s

- First Estimate of Shell Temp – Guess – 100°C
- Lining mean Temp = (1000+100)/2 = 550°C

-


18000
16000
14000
12000
10000
8000
6000
4000
2000
0
W, W/m2
0
100
200
300
400
500
600
Temperature °C
5m/s
0.8
Heat Flow = 2800+900
= 3700W/m2


3
2.5
2
1.5
1
0.5
0
Conductivity, k W/mK
0
200
400
600
800
1000
1200
Temperature °C
Insulation
Baulxite
Cond = 0.3 W/mK

Temp Drop Across Lining

$$W = k\ A\ \Delta T/\Delta x$$

$$\Delta T = \frac{W\ \Delta x}{k\ \ A}$$

$$= \frac{3700 \times 0.2}{0.3 \times 1}$$

$$= 2220$$

TOO HIGH
Try 50°C

- Actual answer – 40°C

- Same procedure for Bauxite case – 230°C
- Note difference in shell temperature with no insulation.

- Accuracy depends on
  - Thermal data
  - Geometry of system

This method is not precise but these models give a good indication of lining condition in many cases

Institute of Refractories Engineers

Thank you

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