Institute of Refractories Engineers

Training Day 2022

The Role of Refractories in Achieving Energy Saving

Institute of Refractories Engineers

Heat loss and Thermal Coductivity

Sheffield
10th November 2022

Ian Spicer

Heat Loss

Stefan-Boltzmann law

$q = \varepsilon \sigma (Th4 - Tc4) Ah$

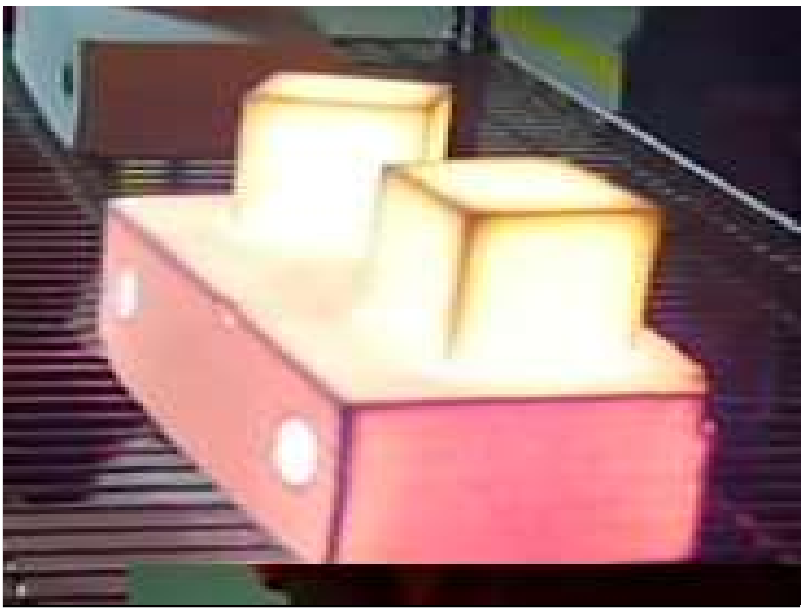
q = heat loss per unit area
σ = 5.6703 10-8 (W/m2K4) - The Stefan-Boltzmann Constant
Th4 surface temperature in degrees kelvin raised to the 4th power
Tc4 external temperature in degrees kelvin raised to the 4th power
Ah is area in m2
ε is emissivity

Energy Loss ambient at 20ºC

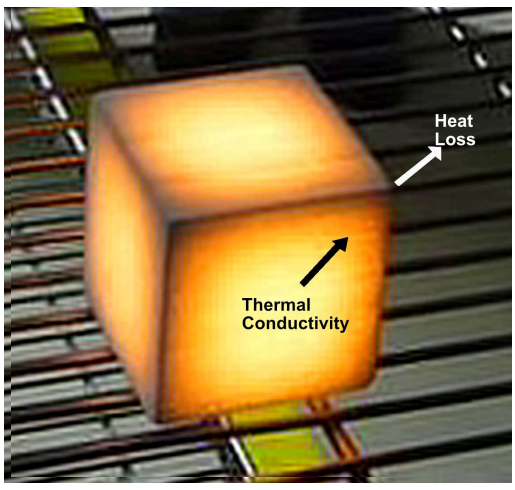
1,700ºC	**750,000w/m²**
1,000ºC	**135,000w/m²**
500ºC	**20,000w/m²**
200ºC	**3,200w/m²**
150ºC	**1,950w/m²**
120ºC	**1,340w/m²**
100ºC	**1,160w/m²**
60ºC	**450w/m²**

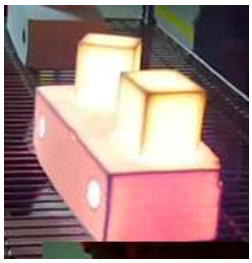
Thermal Conductivity

Material	W/mK
Air	**0.02**
Perlite	**0.03**
Calcium Silicate	**0.063**
Insulating brick	**0.28**
Bassalt	**1.5**
Alumina	**2.5**
Refractory castables	**1.0 to 3.5**
Silicon carbide	**30 to 120**
Aluminium	**230**
Copper	**400**
Diamond	**2200**
Graphene	**5000**

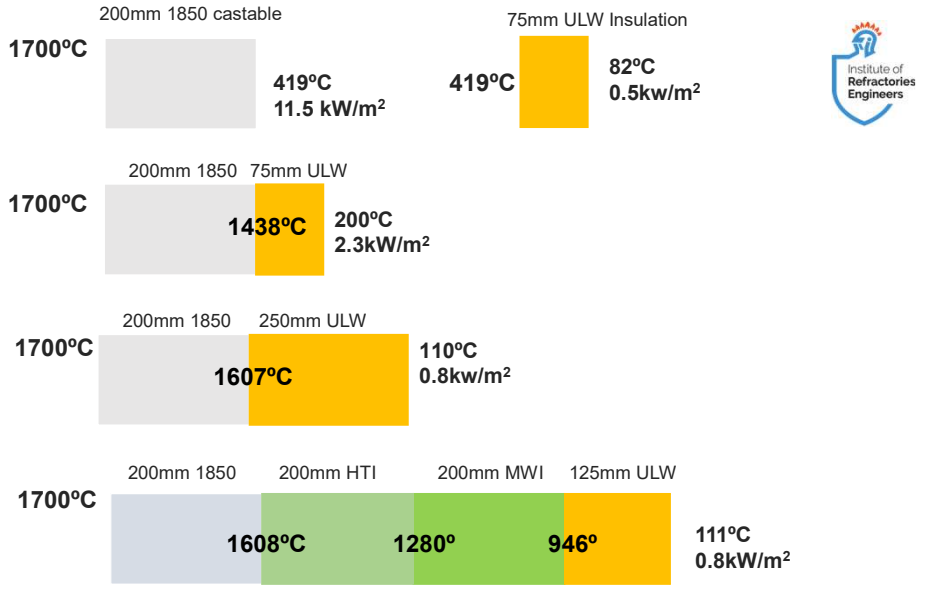


Heat loss and Thermal Conductivity

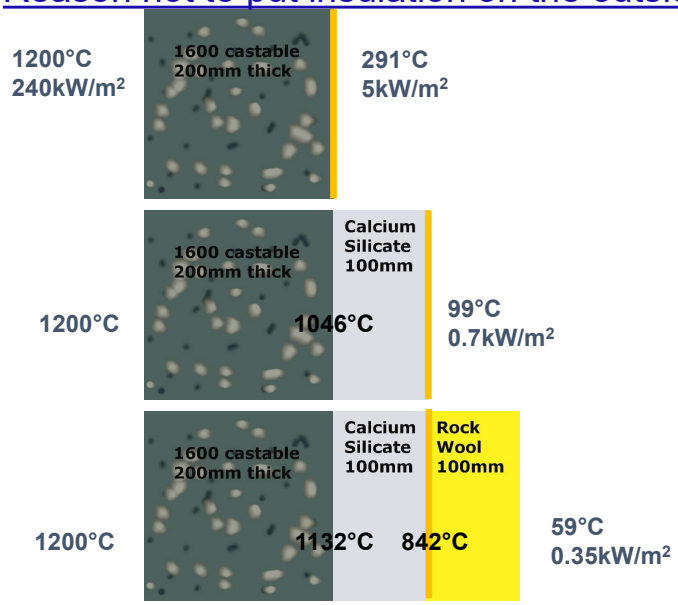


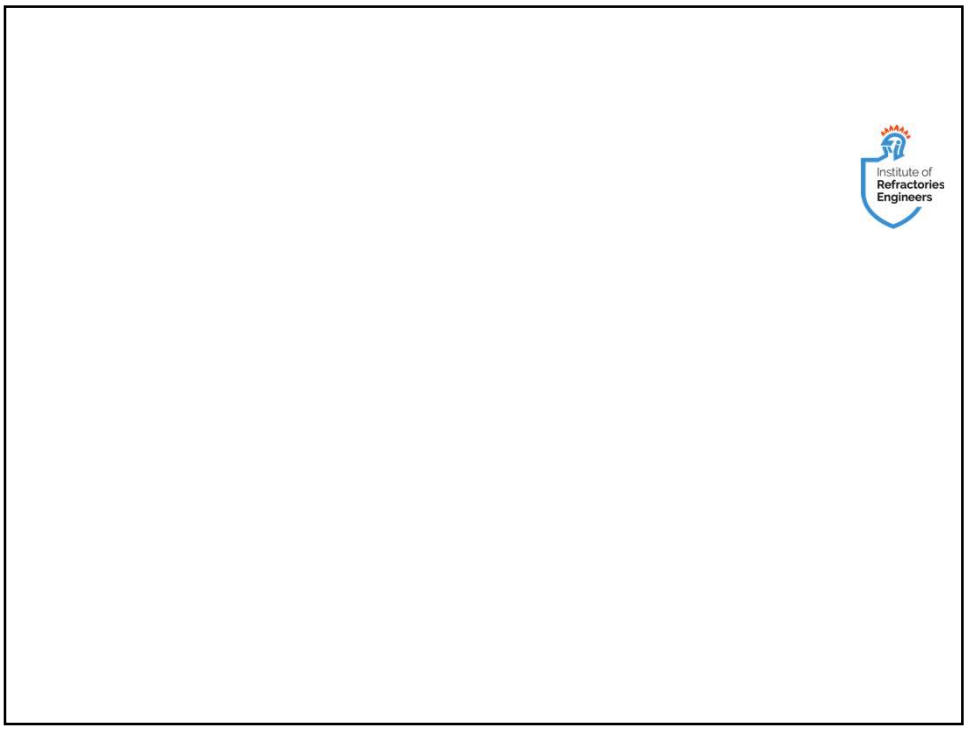


Worked example of a thermal calculation



Reason not to put insulation on the outside of the shell

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