Week2_hulinxue

1.summary about the convective heat transfer

Convective heat transfer is the phenomenon of heat transfer that occurs during fluid flow. It includes two kinds of heat transfer ,force convection and natural convection. For natural convection, Hot air rises ,cold air goes down and then create a circulation inside the building. Heat transfer from inside to the outside by wall which make a heat loss.

Rate of convective heat transfer depends on three elements. The first is temperature difference, the second is the speed of liquid or gas, the third is the kind of liquid or gas.

Convection resistance of the surface means thermal resistance of the surface. When the convection heat transfer coefficient is very large, the convection resistance becomes zero.

2.why increasing the thickness of a single pane glass does not increase the total resistane

Because the conductivity of glass(k) is 0.78W/m^2℃ which is more bigger than the conductivity of air. increasing the thickness of a single pane glass can increase convection resistance of glass ,however in total resistance ,the change can be invisible. Normally the convection resistance of air is ten times the convection resistance of glass.

3.an explanation about what mistakes you made in the class that resulted in wrong answers

In the class, I made a mistake with Unit conversion. I made 8mm equal to 0.08m.it's so stupid haha. Next time I will calculate carefully.

4.solve the same probelm as that of double pane window with with the air-gap thickness of 13 mm and glass thickness of 6 mm, commment on your results and explain why we have an optimal range for the air-gap's distance !

0.8m high, 1.5m wide, so A= 0.8*1.5=1.2

$$R_{g_1} = R_{g_2} = \frac{L_g}{\left(K_g \times A\right)} = \frac{0.006}{0.78 * 1.2} = 0.0064\,°\frac{C}{W}$$

$$R_{airGap} = \frac{L_{airGap}}{\left(K_{airGap} \times A\right)} = \frac{0.013}{0.026 * 1.2} = 0.4167\ °C/W$$

$$R_{conv_1} = \frac{1}{h_1 \times A} = (\frac{1}{10 * 1.2)} = 0.0833\,°C/W$$

$$R_{conv_2} = \frac{1}{h_2 \times A} = (\frac{1}{40 * 1.2)} = 0.0208\,°\frac{C}{W}$$

$$R_{tot} = R_{conv_1} + R_{conv_2} + 2 \times R_g + R_{airGap} = 0.0833 + 0.0208 + 2 * 0.0064 + 0.4167$$
$$= 0.5272\,°\frac{C}{W}$$

$$\dot{Q} = \frac{\Delta T}{R_{Tot}} = \frac{30}{0.5272} = 56.90W$$

$$\dot{Q} = \frac{T_{inff_1} - T_{s_1}}{R_{conv_1}} = \rightarrow 56.9 = \frac{20 - T_{s_1}}{0.0833} \rightarrow T_{S_1 = 15.26\,°C}$$

why we have an optimal range for the air-gap's distance

The convection resistance of airgap is bigger than other resistance, if the distance of airgap is too large , the total resistance will be very big even infinitely. So we should control the distance of airgap.