Convective Heat Transfer

Convection occurs when particles of a fluid (Liquid or gas) with a lot of thermal energy move and replace particles of less thermal energy.

Convection has two types which are forced and natural. The natural convection occurs without external forces only affected by gravity, like boiling for example; while the forced convection occurs when an external force is exerted such as using a pump.

Rate of heat convection depends on temperature difference, viscosity of liquid or gas and kind of liquid or gas.

Increasing the thickness of a single pane glass will not increase the total resistance as the resistance does not depend on the thickness of the panel it only depends on the thickness of the air gap.

Heat convection can be used while designing buildings to maintain sustainability through optimizing the thickness of the glass panels and the air gap so that will reduce the heat transfer inside the building and thus needing less ACs and saving energy.

Example

Answer

A= 0.8\*1.5= 1.2 m2

Lg= 0.006 m2

Kg= 0.78 W/moC

H1= 10 W/m2

H2= 40 W/m2

La= 0.0013 m2

Ka= 0.026 W/moC

Rconv.1= = = 0.0833 oC/W

Rcond.1= = = 0.0064 oC/W

Rcond.2= = = 0.417 oC/W

Rcond.3= = = 0.0064 oC/W

Rconv.2= = = 0.0208 oC/W

RTotal = 0.0833 + 0.0064 + 0.417 + 0.0064 + 0.0208 = 0.53 oC/W

Q = = = 56.6 W

= 56.6

T1= 15.28 oC

The temperature is higher than that of the thinner glass and less air gap because the resistance increases as the thickness increases.

We have an optimal range for the air-gap's distance as the air’s temperature will not increase after a certain thickness because the air has so much space to move in as the air density will remain the same.

