Task 1: In you own words (which means in your own words) write a summary of the topics about radiative heat transfer we went through including the definitions of emissivity, absorptivity and reflectivity, the view factor, the heat exchange betweeen two black surfaces,the heat exchange between the two gray surface and finally the definition of radiative resistances

Radiative Heat Transfer

Emissivity: At the same temperature,the ratio of the radiation flux emitted per unit area on the surface of an object to the radiation flux emitted by the black body

Emit in surface in all directions into the hemisphere above the surface.The ratio of the radiation emission of an object to that of an absolute black body at the same temperature and wavelength. The radiance of the black body is equal to 1, and the radiance of other objects is between 0 and 1.The specific emissivity varies with the dielectric constant, surface roughness, temperature, wavelength and observation direction,conclution of those,it can be influenced by the surface object type.temperature,wavelength,be changed by the measured radiant energy wavelength.

Absorptivity:

To judge the substance's ability to absorb light with given wavelength.

For a medium with selective absorption in the visible light region, it represents the sensitivity of a certain color reaction. For the same measured element, the greater the sensitivity, the more sensitive the color reaction will be. For the same color reaction, the sensitivity is related to the measured concentration. The absorption coefficient usually refers to the molar absorption coefficient at the maximum absorption wavelength.

The size of the molar absorption coefficient is related to the properties of the substance to be measured, the solvent and the wavelength of light.

The same substance of the molar absorption coefficient is different.The absorption coefficient of light varies with the wavelength of light. The higher the purity of monochromatic light, the larger the molar absorption coefficient.

Reflectivity:

As a percentage of the total radiant energy by the amount of radiant energy reflected with an object is called reflectivity.

The reflectivity of different objects is also different, which mainly depends on the nature of the object itself,as well as the wavelength of incident electromagnetic wave and incident Angle.The range of reflectivity is always less than or equal to 1, and the reflectivity can be used to judge the nature of the object

View Factor:

The view factor, is a geometrical quantity corresponding to the fraction of the radiation leaving surface which intercepted by the surface

Heat Exchange (between two Black Surfaces):

The heat exchange between two black surfaces refers to the process in which one black surface emits radiation to another black surface and is completely absorbed, while the other black surface also emits radiation and is also completely absorbed by the first black surface. Can be

expressed by a formula: $A_1E_{b1}F_{1\text{-}2}$- $A_2E_{b2}F_{2\text{-}1}$, (A represents the area of the black surface, Eb represents the amount of radiation emitted per unit area per unit time, F represents the view factor), and applying the reciprocity relation: $A_1F_{1\text{-}2}$= $A_2F_{2\text{-}1}$, so $\dot{Q}_{1\to2} = A_1 \times F_{12} \times \sigma\,(T_1^4 - T_2^4)$.

Heat Exchange (between the two Gray Surface):

Unlike black surface, the heat exchange between two gray surfaces absorbs and reflects only partly portion of the radiation.A gray surface emits radiation to another gray surface J,Tradiation leaving the entire surface i that strikes surface j subtracts radiation leaving the entire surface j that strikes surface i. Can be expressed by a formula: $A_iJ_iF_{i\text{-}j}$- $A_jJ_jF_{j\text{-}i}$, (A represents the area of the black surface,the J represents the amount of radiation emitted per unit area per unit time, F represents the view factor), and applying the reciprocity relation: $A_1F_{1\text{-}2}$= $A_2F_{2\text{-}1}$, so $\dot{Q}_{\mathrm{i}\to\mathrm{j}} = A_{\mathrm{i}} \times F_{\mathrm{i}-\mathrm{j}} \times (\mathrm{J_i} - \mathrm{J_j})$.

Radiative Resistances:

The radiative resistance is a value used to measure the loss resistance energy, and the loss energy is converted into heat radiation

Task2: Solve the last example you solved in the class (radiative heat exchange between two parallel plates) awhile considering the two emissivities to be 0.1, what can you conclude from the result?Find the net heat exchange between the surface 1 and 2 where A1 = 1.5 m2, F12 = 0.01, T1 = 298 K, T2 = 308 K, ϵ_1=0.1, ϵ_2=0.1, σ=5.67*10-8$\frac{W}{m^2 \cdot K4}$. Solve the last example in the class (radiative heat exchange between two parallel plates) awhile considering the two emissivities to be 0.1, what can you conclude from the result?

$\dot{Q}_{1\to2} = \frac{A_1\sigma\,(T_1^4 - T_2^4)}{\frac{1}{\epsilon_1}+\frac{1}{\epsilon_2}-1} = \frac{1.5*\mathbf{5.67}*10^{-8}*(308^4 - 298^4)}{\frac{1}{0.1}+\frac{1}{0.1}-1}$ = 4.98W

$F_{12} = \frac{1}{\frac{1}{\epsilon_1}+\frac{1}{\epsilon_2}-1} = \frac{1}{\frac{1}{0.1}+\frac{1}{0.1}-1}$ = 0.0526

The example solved in the class:

F_{12} = 0.01

$\dot{Q}_{1\to2} = A_1 \times F_{12} \times \sigma\,(T_1^4 - T_2^4)$ =1.5*0.01*5.67*10-8*(2984-3084) =-0.95 W

$\dot{Q}_{2\to1} = -\dot{Q}_{1\to2} =$ 0.9466 W

From the result, we get that when the value of emissivity increases, the view factor will increase more,and the value of radiative heat transfer will also increase significantly.