*<u>**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</u>*

SUMMARY

<u>Radiative heat transfer</u>

1. Emissivity

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 at the same temperature.

The ratio of the radiation emission of an object to that of an absolute black body at the same temperature and wavelength. The ratio of the radiation emission of an object to that of an absolute black body at the same temperature and wavelength. It shows that the actual thermal radiation of the object is close to that of the black body. It is one of the important basic factors that affect the surface temperature.

2. Absorptivity

Absorptivity is the ratio of the amount of radiation absorbed by the surface to the total radiant energy of the incident electromagnetic wave. The magnitude of absorptivity is related to the properties, solvents and wavelengths of the substance under test.

3. Reflectivity

The percentage of radiant energy reflected by an object to the total radiant energy is called the reflectivity.

The reflectivity of different objects is also different, depending on the nature of the object itself (surface condition), and the range of incident electromagnetic wave wavelength and incident angle reflectivity is always less than or equal to 1, and the reflectivity can be used to judge the properties of the object.

<u>The view factor</u>

A reflection factor is part of the energy emitted (radiated or reflected) from an isothermal, opaque, diffuse surface that is directly emitted (absorbed or reflected) to another plane.

The view factor is a geometric quantity corresponding to the fraction of the radiation from surface a intercepted by surface B. In radiative heat transfer, the apparent factor is the ratio of the radiation leaving surface a to the radiation reaching surface B. In a complex "Scene", there can be any number of different objects, which can be divided into more surfaces and surface segments in turn.

The 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: A1Eb1F1-2- A2Eb2F2-1, (A represents the area of the black surface, represents the amount of radiation emitted per unit area per unit time, F represents the view factor), and applying the reciprocity relation:

so $\dot{Q}_{1\to2} = A_1 \times F_{12} \times \sigma\left(T_1^4 - T_2^4\right)$

The heat exchange between the two gray surface

Different from the black surface, the heat exchange between the two gray surfaces only absorbs and reflects part of the radiation from one gray surface I to the other gray surface J, and the radiation leaves the whole surface I of the impact surface J minus the radiation leaves the whole surface J of the impact surface I. It can be expressed by formula:

$$J_i = \varepsilon E_{bi} + \rho G = \varepsilon\sigma T^4 + (1-\varepsilon)G$$

$$\dot{Q}_{i\to j} = A_i F_{i\to j}(J_i - J_j)$$

The definition of radiative resistances

The radiation resistance is used to measure the energy value of the loss resistance. The loss energy is converted into thermal radiation; the loss energy of the radiation resistance is converted into radio wave. From one surface to another, the total resistance is

$$R = \frac{1-\varepsilon_i}{A_i\varepsilon_i}$$

$$R_{\text{total}} = R_i + R_{i-j} + R_j = \frac{1-\varepsilon_i}{A_i\varepsilon_i} + \frac{1}{A_i F_{i-j}} + \frac{1-\varepsilon_j}{A_j\varepsilon_j}$$

Task 2 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?

$$\dot{Q}_{1\to2} = \frac{A_1\sigma\left(T_1^4 - T_2^4\right)}{\frac{1}{\epsilon_1}+\frac{1}{\epsilon_2}-1} = \frac{1.5\times5.67\times10^{-8}\times(308^4-298^4)}{\frac{1}{0.1}+\frac{1}{0.1}-1} = 4.9821\text{W}$$

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

The example solved in the class:

$F_{12} = 0.01$

$$\dot{Q}_{1\to2} = A_1 \times F_{12} \times \sigma\left(T_1^4 - T_2^4\right) = 1.5\times0.01\times5.67\times10^{-8}\times(298^4-308^4) = -0.9466W$$

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