

**Task 1** In your 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 between two black surfaces, the heat exchange between the two gray surface and finally the definition of radiative resistances

### **Emissivity " $\epsilon$ ":**

Emissivity is a surface property which determines how much radiation an object emits at a given temperature compared to a blackbody at the same temperature. The emissivity of an object can have a value between 0 and 1.

### **Reflectivity " $\rho$ ":**

Reflectivity is an optical property of material, which describes how much light is reflected from the material in relation to an amount of light incident on the material. The reflection occurs always on the surface of the material, for the light-diffusing (translucent) materials also in the volume of the material.

### **Absorptivity " $\alpha$ "**

Absorptivity refers to the ratio of the absorbed heat to the total energy of the projected heat onto the object. The object that can absorb all the rays is a black body, and its absorption rate is 1. The absorption rate of the actual object is less than 1, depending on the material, roughness and temperature of the surface of the object and is related to the wavelength range and angle of incidence of the received heat rays.

### **The view factor " $F$ ":**

The view factor is the fraction of radiation leaving one surface which is intercepted by a second surface. The intensity of the emitted radiation depends on the view factor of the surface relative to the sky.

### **The heat exchange between two black surfaces:**

The two black surfaces will constantly absorb and emission all the radiation. Suppose there are two black surfaces with given area,  $A_1$  for the first object and  $A_2$  for the second object. So the energy leaving the first object and the second object are  $E_{b1}A_1$

and  $E_{b2A1}$ . The energy leaving object 1 that arrive the object 2 is  $E_{b1A1F1-2}$  and the for the object 2 in this situation is  $E_{b2A2F2-1}$ . The net energy interchange from body 1 to body 2 is  $E_{b1A1F1-2} - E_{b2A2F2-1} = .Q_{1-2}$

**Radiative resistance:** It is the resistance of a particular medium or system to the flow of heat through its boundaries and is dependent upon geometry and thermal properties of the medium such as thermal conductivity.

**The heat exchange between two grey surfaces:** The two grey surfaces will absorb and reflect a certain fraction of radiation. The reflect part will also constantly absorb by the other side for a certain fraction and reflect the other radiation, and the same thing happens in the other surface. The radiation will generally lose its power during the process.

**Task 2** Solve the last example you solved in the class (radiative heat exchange between two parallel plates) awhile considering the two emissivity to be 0.1, what can you conclude from the result

$$1.5 \text{ m}^2, \epsilon_1 = 0.2, \epsilon_2 = 0.7, T_1 = 37^\circ\text{C}, T_2 = 17^\circ\text{C}.$$

Second step: compare the results when  $\epsilon_1 = \epsilon_2 = 0.1$

$$\sigma = 5.67 \cdot 10^{-8} \text{ W/m}^2 \text{ K}^4 \quad T_1 = 37^\circ\text{C} = 310\text{K} \quad T_2 = 17^\circ\text{C} = 290\text{K}$$

According to the formula:  $.Q_{\text{net}1-2} = A\sigma(T_1^4 - T_2^4)/(1/\epsilon_1 + 1/\epsilon_2 - 1) = 1.5 \cdot 5.67 \cdot 10^{-8} (310^4 - 290^4) / (1/0.2 + 1/0.7 - 1) = 33.8763\text{W}$

$$\epsilon_1 = \epsilon_2 = 0.1, \text{ then: } Q_{\text{net}1-2} = A\sigma(T_1^4 - T_2^4)/(1/\epsilon_1 + 1/\epsilon_2 - 1) = 1.5 \cdot 5.67 \cdot 10^{-8} (310^4 - 290^4) / (1/0.1 + 1/0.1 - 1) = 9.6789\text{W}$$

So, it's obvious that the value of emissivity will significantly change the total number of radiative between two grey surfaces.