Week5 Zhou Yuhan

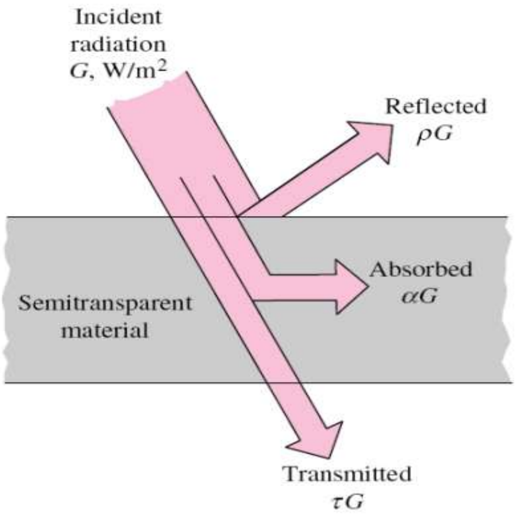
Task1: In you own words (which means in your own words) write a summary of the topics about radiative heat transfer we went through including the definitions of emissivity, absorptivity and reflectivity, the view factor, the heat exchange betweeen two black surfaces,the heat exchange between the two gray surface and finally the definition of radiative resistances

1,the definitions of emissivity, absorptivity and reflectivity,

Emissivity:Emissivity is a ratio, which related to the type of object, surface condition, temperature and so on.The emissivity ranges from 0 to 1, the closer to the black body, the closer its value is to 1. Total radiant energy projected per unit surface area per unit time（G）

Absorptivity: Percentage of objects absorbed by input radiation. The absorption capacity of the real object to the input radiation also varies according to its wavelength. Absorptivity depends not only on the condition of the object itself, but also on the characteristics of the input radiation.

Reflectivity:The reflection is divided into specular reflection and diffuse reflection, which are related to the material of the object. Black bodies absorb all heat radiation and there is no reflection. Gray body has reflection.



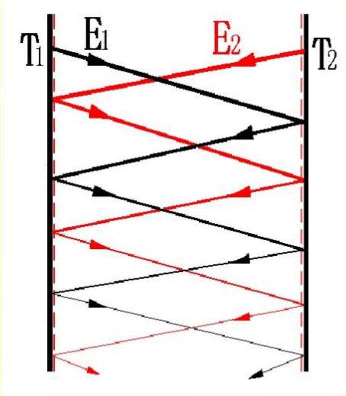
2,the heat exchange betweeen two black surfaces
T1 continuously emits electromagnetic waves to T2, and transmits radiation, Simultaneously T2 also continuously transmits electromagnetic waves to T1.All radiation reaching the black body surface will be absorbed. Q1-2=A$\sigma(T_1^4 - T_2^4)$

3,the heat exchange between the two gray surface
Gray surface:
The absorption rate A, the reflectance R, and the transmittance D of the object are determined by the nature of the object, the surface condition, the temperature, and the wavelength of the radiation. Generally, both solids and liquids are opaque, i.e., D = 0, so A + R = 1. The gas is different, and its reflectance R=0, so A+D=1. Certain gases can only partially absorb radiant energy over a range of wavelengths.

Actual objects, such as general solids, can partially absorb radiant energy from zero to all wavelength ranges. An object that can absorb radiant energy from zero to all wavelengths at the same absorption rate and is partially defined as a gray body. Gray body has the following characteristics:

(1) The absorption rate A of the gray body does not vary depending on the wavelength of the radiation.

(2) The gray body is an opaque body
Gray bodies are also ideal objects, but most engineering materials can be considered as gray bodies, which greatly simplifies the calculation of radiative heat transfer.



4,the definition of **radiative resistances**
The thermal resistance of two objects with different temperatures radiating heat to each other is called radiant heat resistance.

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 m^2,$\epsilon_1 = 0.1$, $\epsilon_2 = 0{,}1$, $F_{2-1} = 0.01$, T1 = 800 K, T2 = 500 K

$$F_{2-1} = \frac{1}{\frac{1}{\epsilon_2} + \frac{1}{\epsilon_1} - 1} = \frac{1}{\frac{1}{0.1} + \frac{1}{0.1} - 1}$$

$$\dot{Q}\ 1 \rightarrow 2 \ = \ A_1 \times F_{12} \times \sigma\,(T_1^4 - T_2^4) \ = \frac{1.5 \times (5.67 \times 10^{-8}) \times (800^4 - 500^4)}{\frac{1}{0.1} + \frac{1}{0.1} - 1} \approx 1035.82\text{W}$$

the emissivity value change, the radiative heat exchange between two parallel plates will be change too.

Infinitely large parallel plates