WEEK 5 YANG DICHENG

2019年11月4日 星期一 下午1:01

Summary

Emissivity

Emissivity is measure of the ability of a surface to radiate energy, represented by " ε ". showing the ratio of energy radiated by a particular material to energy radiated by a blackbody at the same temperature.
The higher the similar with blackbody, maximum by 1.

Absorptivity

The property of absorbed radiation of one material to the total incident radation from all directions. Represented by " α ".

Reflectivity

Represented by " ρ ". The property of energy comes from the wave reflected from the surface to the energy possessed by the wave hits the surface.

View Factor

Represented by " F ", it means the proportion of the radiative energy that is left from every $1m^2$ area of surface A absorbed by every $1m^2$ area of surface B to the total radiation emitted by $1m^2$ area of surface A .

Heat Transfer Between Two Black Surfaces

An ideal black surface that have no resistance on surface, In that case the radiosity will be equal to the power be emitted.

$$\dot{Q}_{i-j} = A_i F_{i-j} \sigma \left(T_i^4 - T_j^4 \right)$$

Radiation Heat Transfer Between Two Gray Surfaces

Gray is not an ideal surface compare with black surface, It can not achieve full capacity while they emits, neither with the Thermal radiation they absorbed. In this case:

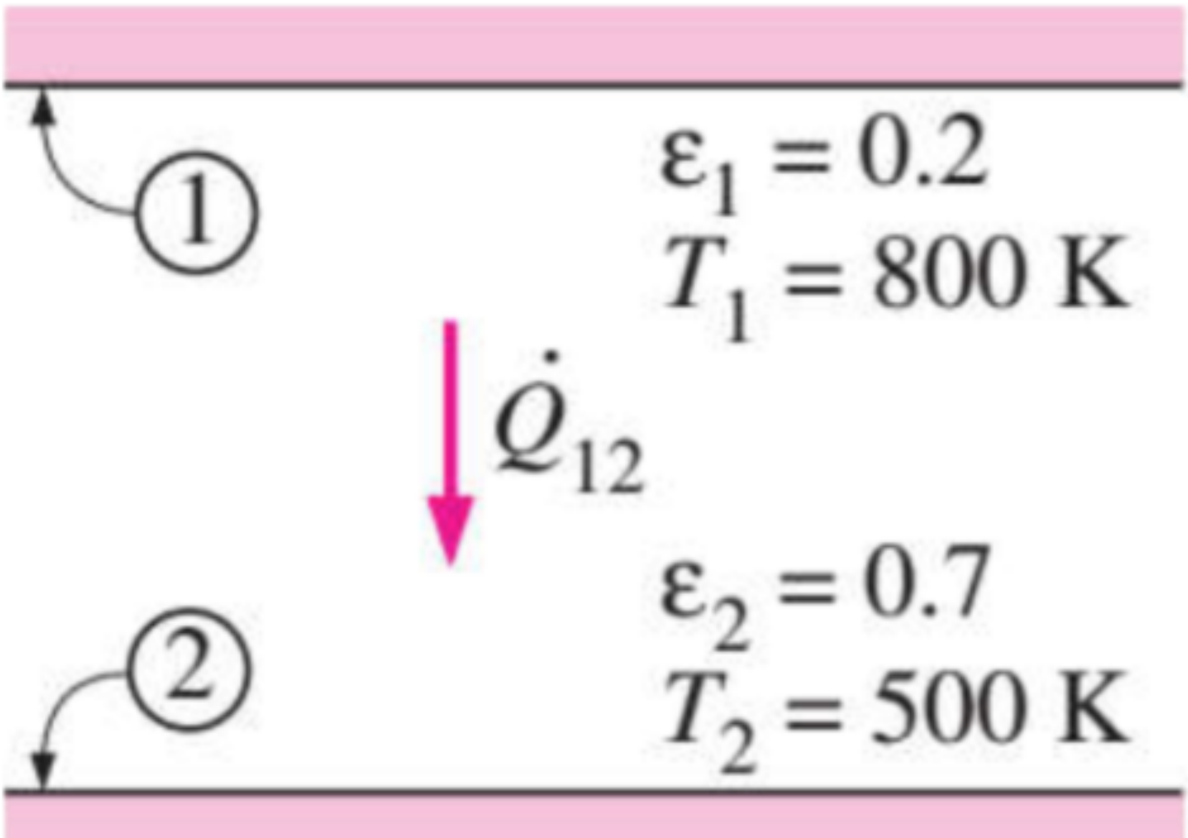
$$J_i = \varepsilon_{1E_{bi}} + \rho_{1G_1}$$

Radiative Resistances

The radiative resistance is the value to measure the energy depleted by loss resistance which is converted to heat radiation and the energy lost by radiation resistance is converted to electromagnetic waves.

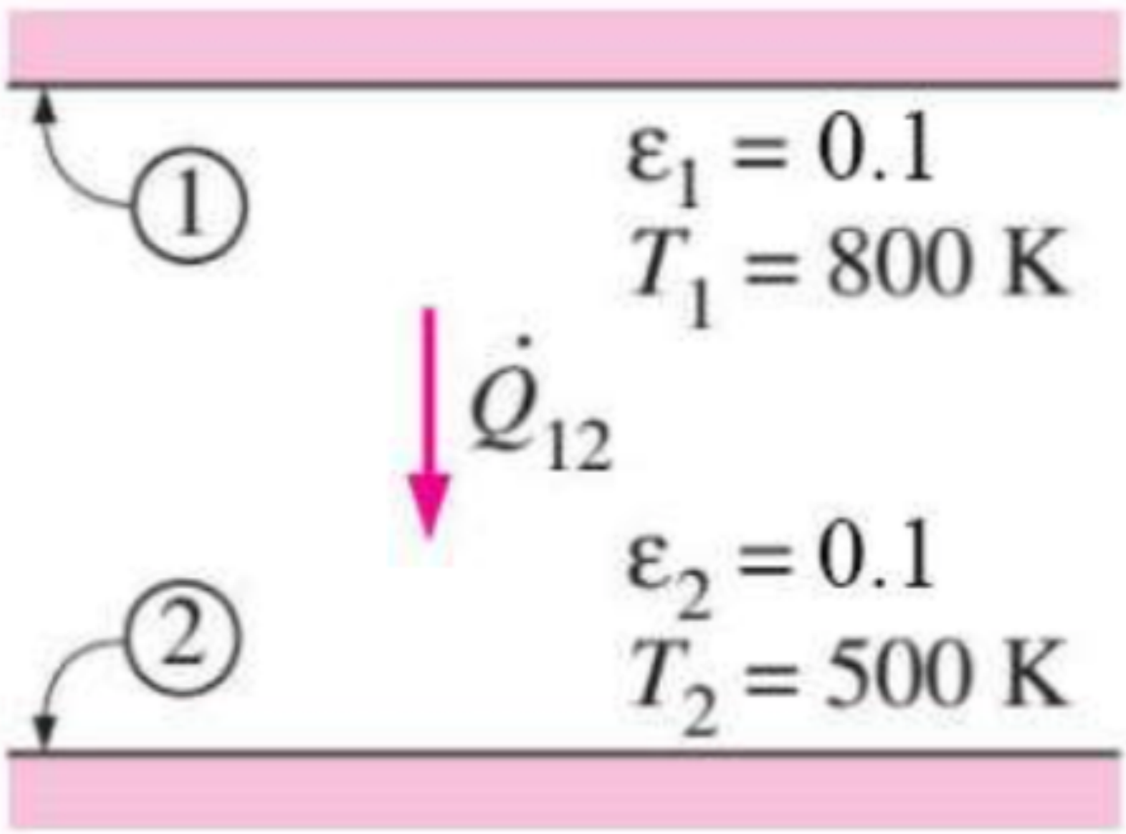
Question 2

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?



While $\varepsilon_1 = 0.2 \;\; \varepsilon_2 = 0.7$

$$\dot{Q}_{1\,2} = \frac{A\sigma(T_1^4 - T_2^4)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1} = 1.5 * 5.67 * 10^{-8} * \frac{800^4 - 500^4}{\frac{1}{0.2} + \frac{1}{0.7} - 1} = 3625.37\,W$$



While $\varepsilon_1 = 0.2 \;\; \varepsilon_2 = 0.7$

$$\dot{Q}_{1\,2} = \frac{A\sigma(T_1^4 - T_2^4)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1} = 1.5 * 5.67 * 10^{-8} * \frac{800^4 - 500^4}{\frac{1}{0.1} + \frac{1}{0.1} - 1} = 1035.81\,W$$

According to the significant change when we declined the emissivity value of both parallel plates, the radiation heat transfer could be reduced by decreases the emissivity values.