Technical Environmental Solutions/ Submission no.5/ Leyana Altemawy

Task no.1
Summery

Radiative heat transfer: is the radiation exchange between the surfaces.

Emissivity (ε): Is the efficiency of the surface to radiate energy, and it is compared with the blackbody.

Absorptivity (α): Is the ability of the surface to absorb the radiation flux, and can be calculated by finding the ratio between the absorbed radiation and the incident radiation on the surface.

Reflectivity (ρ): Is the ability of the surface to reflect the radiation flux, and can be calculated by finding the ratio between the reflected radiation and the incident radiation on the surface.

Transmissivity (τ): Is the ability of the surface to transmit the radiation flux through it, and can be calculated by finding the ratio between the transmitted radiation and the incident radiation on the surface.

The view factor: Is the fraction of energy that is leaving one surface and intercepted in the other surface.
The view factor Fij is not equal to Fji unless the areas of the two surfaces are equal.
Ai Fij =Aj Fji

The heat exchange between two black surfaces: With this formula we can find the net radiative heat exchange between the two surfaces:
$\dot{Q}_{1\to2} == A_1 \times F_{12} \times \sigma \left(T_1^4 - T_2^4\right)$

The heat exchange between the two gray surface: can be calculated with this formula:

$$\dot{Q}_i = \frac{A_i\epsilon_i}{1-\epsilon_i} \times \left(E_b - J_i\right)$$

Radiative resistances: the surface resistance to radiation.
And can be found with the same formula:

$$\dot{Q}_i = \frac{E_{bi}-J_i}{R_i}$$

$$R_i = \frac{1-\epsilon_i}{A_i \times \epsilon_i}$$

Task no.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?

$$A = 1.5\, m^2 \quad | \quad \epsilon_1 = 0.1 \quad | \quad \epsilon_2 = 0.1 \quad | \quad \sigma = 5.67 \times 10^{-8} \quad | \quad T_1 = 298 \text{ K} \quad | \quad T_2 = 308 \text{ K}$$

$$\dot{Q}_{12} = A \times \sigma \times \frac{\left(T_1^4 - T_2^4\right)}{\left(\frac{1}{\epsilon_1}\right) + \left(\frac{1}{\epsilon_2}\right) - 1}$$

$$\dot{Q}_{12} = 1.5 \times 5.67 \times 10^{-8} \times \frac{(298^4 - 308^4)}{\left(\frac{1}{0.1}\right) + \left(\frac{1}{0.1}\right) - 1} = -4.982\ \mathrm{W}$$

In comparison to the previous result, w$hen\ \epsilon_1 = 0.2\ and\ \epsilon_2 = 0.7$
The $\dot{Q}_{12}\ was = -17.439\ W$

That means that the heat transfer between two surfaces, is largely affected by the emissivity of each surface.