A NUMERICAL STUDY OF THE RADIATION-CONDUCTION-DIFFUSION BINARY GAS MIXTURE PROBLEM BETWEEN TWO FLAT PLATES

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INTRODUCTION. As known, real properties are local and temperature dependent. Mohammadpour et al. [1] considered a transient diffusion-radiation binary gas mixture problem between two flat plates; in which, the diffusion coefficient depends on the pressure and temperature [2]. Here, the six cases are considered to find the best case for the averaging of properties in a medium with radiation-diffusion-conduction binary gas (a transparent gas and a gray gas) mixture between two flat plates.

1. METHODOLOGY

The energy and diffusion equations (Eqs. (1-2)) are solved by the finite volume method, and the radiation equation is angularly discretized by the modified discrete ordinates method. Ref [2] is used for the calculation of $k_{mix}(C_{p,d}(T),\mu_d(T),xm_d(T,x)),D_{AB}(T,p)$ where $C_{p,d}(T),\mu_d(T),xm_d(T,x)$ are the special heat capacity, the viscosity and the mole fraction of each gas, respectively.

$$d/dx(k_{mix}(C_{p,d}(T),\mu_d(T),xm_d(T,x))\,dT/dx) - dq_r/dx = 0 \quad where\ \ dq_r/dx = \kappa_a(T)(4\pi I_b - G) \tag{1}$$

$$d/dx\left(D_{AB}(T,P)\,d\rho_A/dx\right) = 0, where\,\kappa_a = \rho_A(T,x)\kappa_a^* \ \ with\ \kappa_a^* = cons, T(0)=T_1, T(1)=T_2, \rho_A(0)=0.3, \rho_A(1)=0.0 \tag{2}$$

2. RESULTS AND DISCUSSION

As shown, by considering the density as the boundaries average density, the greatest change are appeared on the temperature distribution for the high mass absorption 10 (Figure. 1c).

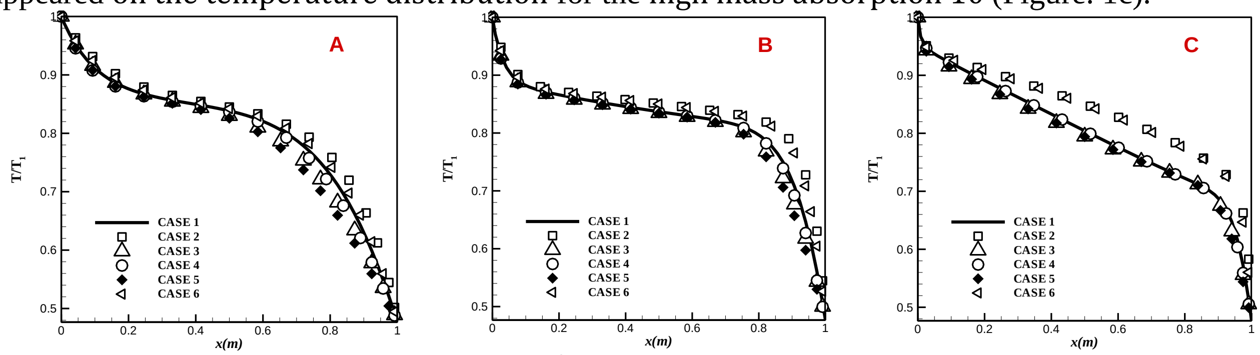

Figure1. T(x) A) $\kappa_a^*=0.1$B) $\kappa_a^*=1$ C) $\kappa_a^*=10$ for cases:1- $\rho_A(T),k_{mix}(C_{p,d}(T),\mu_d(T),xm_d(T))$ 2- $\rho_A(0.5(\rho_1+\rho_2)),k_{mix}(C_{p,d}(T),\mu_d(T),\overline{xm_d})$ 3- $\rho_A(x),\overline{D_{AB}},k_{mix}(C_{p,d}(T),\mu_d(T),xm_d(x))$ 4- $\rho_A(T),D_{AB}(T),k_{mix}(\overline{c_{p,d}},\overline{\mu_d},xm_d(T))$ 5- $\rho_A(x),D_{AB}(0.5(T_1+T_2)),k_{mix}(\overline{c_{p,d}},\overline{\mu_d},xm_d(x))$ 6- $\rho_A(0.5(\rho_1+\rho_2)),k_{mix}(\overline{c_{p,d}},\overline{\mu_d},\overline{xm_d})$

3. CONCLUSION

Due to the dependence of penetration coefficient on the temperature, the density also depends on the temperature; therefore, case 4 is the best case for averaging of properties in all mass absorption coefficients. Moreover, for low mass absorption coefficient, case 6 is valid.

REFERENCES

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