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EFFECTS OF RADIATION REABSORPTION IN C1-C6 HYDROCARBON FLAMES AT NORMAL AND ELEVATED PRESSURES

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ABSTRACT. The radiative preheating of the unburned hydrocarbon fuels by the burned combustion products in counterflow diffusion flame at pressures from 1 to 100 atm was investigated. The radiative characteristics of hot H_2O, CO_2 and cold hydrocarbon gases were calculated from HITEMP 2010, CDSD-4000 and HITRAN 2016 databases respectively. A simplified radiation reabsorption model was proposed based on the properties of the radiative reabsorption energy at T=1500-2000 K, P=1-100 atm. By using this model, the critical strain rate was calculated for eight C_1-C_6 hydrocarbon species at T=2000 K, P=1-100 atm. The results show that radiation reabsorption should be taken into account when the strain rate is less than 2.9 s^{-1} at P=100 atm. The comparison results of the radiation time and the residence time in the CH_4 counterflow diffusion flame shows that the radiation time scale would dominate at elevated pressures.