THE IMPORTANCE OF THERMAL RADIATION TRANSFER IN LAMINAR DIFFUSION FLAMES AT NORMAL AND MICROGRAVITY

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ABSTRACT. The importance of radiation heat loss in laminar and turbulent diffusion flames at normal gravity has been relatively well recognized. There is currently lack of quantitative understanding on the importance of radiation heat loss in relatively small scale laminar diffusion flames at microgravity. The effects of radiation heat transfer and radiation absorption on the structure and soot formation characteristics of a coflow laminar ethylene/air diffusion flame at normal- and micro-gravity were numerically investigated. Numerical calculations were conducted using relatively detailed combustion chemistry and complex thermal and transport properties, an acetylene based soot formation model, and a statistical narrow-band correlated-k non-grey gas radiation model. Radiation heat transfer and radiation absorption in the microgravity flame were found to be much more important than its counterpart at the normal gravity.