EFFECTS OF WATER VAPOUR ADDITION TO THE AIR STREAM ON SOOT VOLUME FRACTION AND FLAME TEMPERATURE IN A LAMINAR COFLOW ETHYLENE FLAME

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ABSTRACT. The effects of adding water vapour to the air stream on flame temperature and soot volume fraction were investigated numerically in a laminar coflow ethylene diffusion flame at atmospheric pressure using a detailed C2 reaction mechanism including PAH. Thermal radiation was calculated using the discrete-ordinates method and a statistical narrow-band correlated-*k* based wide band model for the absorption coefficients of CO2 and H2O. Soot formation was modeled using a PAH based inception model and the HACA mechanism for surface growth and oxidation. The added water vapour affects soot formation and flame properties through not only dilution and thermal effects, but also through chemical and radiation effects. Addition of water vapour significantly reduces radiation heat loss.