Proceedings of the 10th International Symposium on Radiative Transfer, RAD-23
Thessaloniki, Greece, 12–16 June 2023

RAD-23 CS02

INVESTIGATION OF SOOT FORMATION OF ETHYLENE/AIR JET DIFFUSION FLAME WITH RANK CORRELATED SLW INCLUDING ETHYLENE AND ACETYLENE RADIATION

Berkay Halvaşi[1], Altuğ M. Başol, M. Pınar Mengüç, Özgür Ertunç

Özyeğin University, 34794 Çekmeköy, Istanbul, Turkey

ABSTRACT. Radiation is significant, especially in sooting flames. The interaction between radiation and soot considerably affects the combustion regime. Spectral radiation models that account for the radiative effects of sooting flames are critical. This study numerically investigates the interaction between the radiation and soot formation on a sooting jet diffusion flame. A rank correlated spectral line-based weighted sum of gray gases (RC-SLW) global model is implemented in Ansys Fluent and used for the combustion modeling of a jet diffusion flame. RC-SLW model, including ethylene and acetylene radiation, shows considerable improvement in predicting soot volume fraction compared to the domain-based with single gray gas weighted sum of gray gases (WSGG) model in Ansys Fluent. Increasing the number of gray gases in the RC-SLW model from 5 to 22 reduces the error in the maximum soot volume fraction from 30% to 1%. It was found that the effect of ethylene and acetylene radiation in the RC-SLW model has a minor effect on soot formation. Simulations without the effect of ethylene and acetylene radiation in the RC-SLW model underpredict maximum soot volume fraction by 5%.

Berkay Halvaşi: berkay.halvasi@ozu.edu.tr