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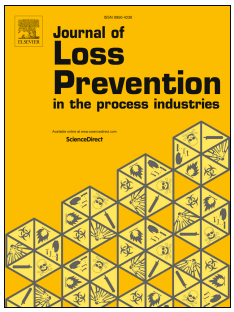

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Radiative Fraction of Dust Entrained Turbulent Premixed Flames

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Abstract:

The aim of this paper is to estimate the radiative fraction of heat released by methane-air-dust turbulent premixed flames and to study the effect of dust particles (75-90 µm) on the radiative heat released. Radiative heat flux measurements were captured from burner stabilized methane-air-dust premixed flames at different equivalence ratios (ϕ_g = 0.8, 1.0, 1.2), and turbulent intensities (u'_{rms} = 0.65, 0.72, 0.88 m/s) using different dust types (coal, sand and sodium bicarbonate) and dust concentrations (λ_p = 25, 50, 75 g/m^3). The effect of these parameters on the resulting radiative fraction of heat released (X_r) was investigated. It was identified that the addition of dust particles increase the radiative fraction irrespective of the dust type due to the radial and axial extension of flame. An increase in the turbulent intensity decreases the radiative fraction. Addition of coal dust results in the maximum value of radiative fraction of heat released, whereas sand and sodium bicarbonate results in approximately similar average radiative fraction values. With the addition of coal dust, the radiative fraction of premixed methane-air flames become comparable to that of methane-air diffusion flames. The range of radiative fractions of methane-air gaseous turbulent premixed flame is found to be 2.7% - 6%, whereas the addition of coal, sand and sodium bicarbonate results in an increased range of X_r values of 10.5% - 17.5%, 7.6% - 11.5%, and 8.5% - 12.7% respectively.

Keywords: Radiation; Radiative fraction; Dust; Premixed Flame; Turbulent.