

Effects of Dilution on Blowout Limits of Turbulent Jet Flames

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Abstract

An extended database on blowout velocities of inert-diluted methane, propane, and hydrogen jet flames in turbulent regime was experimentally established and used to examine and verify existing blowout models. Helium, argon, nitrogen, and carbon dioxide were used as the inert diluents to generate different initial properties at the jet exit. Extension of the widely-applied premixed and large-scale blowout models by Kalghatgi (1981) and Broadwell et al. (1984) in the highly diluted regime was carefully examined using jet flames of different fuels diluted with inert of different gas properties. The results showed that among the models the blowout-velocity estimation based on the premixed model is more reliable in the extended region. On the other hand, the blowout-velocity estimation based on the large scale model can do as well after proper modification by including the Reynolds number effect Ref. Based on the experimental results, modifications to the models are proposed to accommodate the deviation of the model predictions of the blowout characteristics in the diluted regime. In addition, different from laminar jet flames, diffusive properties in terms of mass and thermal diffusivities are not the dominant parameters

of blowout
in turbulent jet flames.

Keyword : Blowout velocity, blowout limits, inert dilution, and jet flames.