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Combustion Characteristic of Propane/Acetylene Fuel Blends Pool Fire

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Abstract : A kind of gas-fueled burner, named Burning Rate Emulator, was proposed for the purpose of the emulation of condensed fuel recently. The gaseous fuel can be pure combustible fuel gas or blends of gaseous fuel or inert gas. However, this concept was recently proposed without detailed study on the combustion characteristic of fuel blends. In this study, two kinds of common gaseous fuels were selected, propane and acetylene, to provide the combustion heat as well as a large amount of smoke, which widely exists in liquid and solid fuel burning process. A set of experiments were carried out using a gas-fueled burner with a diameter of 8 cm. The total volume flow rate of propane and acetylene was kept at 3 liters per minute. The volume fraction of propane varied from 0% to 100% at interval of 10%. It is found that the flame height increases with propane volume fraction, which may be caused by the increase of heat release rate, as the energy density of propane is larger than that of acetylene. The dimensionless flame height is correlated against dimensionless heat release rate, which shows a power function relationship. The radiation fraction of the flame does not show a monotonic relationship with propane volume fraction. With the increase of propane volume fraction from 0% to 100%, the value of radiation fraction increases first and reach a maximum value around 0.46 at a propane volume fraction of 10%, and then decreases continuously to a value of 0.25 at the propane volume fraction of 100%. The flame radiation is related to the soot in the flame. The trend of the radiation fraction reflects that there may be a synergistic effect of soot formation between propane and acetylene which can be guessed from the significantly high radiation fraction at a propane volume fraction of 10%. This work provides data for combustion of gaseous fuel blends pool fire and also give reference on the design of Burning Rate Emulator.

Keywords : Burning Rate Emulator, fuel blends pool fire, flame height, radiation fraction
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