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Thermal Performance of Dual Flame Impinging Normally on to a Flat Surface

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Abstract : An experimental study has been conducted to evaluate the thermal performance of the CNG/air dual flame impinging normally on to a flat surface. The stability limits for the dual flame under both impinging and free conditions have been evaluated to select experimental operating range. Dual flame shape and structure have been explained with direct flame image and schematic diagram indicating modification in recirculation zone in presence of inner flame. Effects of various operating parameters like H/Dh, Re(o), Φ(o), and θ(o) on heat transfer characteristics have been discussed. Inner non-swirling flame Reynolds number (Re(i)) and equivalence ratio (Φ(i)) were kept constant. Heating patterns in the impingement region around the stagnation point have been altered significantly with change in the values of H/Dh, Re(o), Φ(o), and θ(o). The axial flow of inner flame has been notably effected with increase in Re(o). Heating was most favorable near stoichiometeric conditions of the outer swirling flame. However, the effect of change in swirl intensity (expressed in terms of θ(o)) on overall heat transfer efficiency was not as significant as in the case of other parameters. It has been inferred that best performance (higher uniformity and efficiency) of the dual flame impinging on a flat surface can be achieved at moderate value of separation distance (H/Dh of 2-3) and outer swirling flame Reynolds number (Re(o) of 7000-9000) under stoichiometeric conditions.

Keywords : dual flame, heat transfer, impingement, swirling insert, transmission efficiency
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