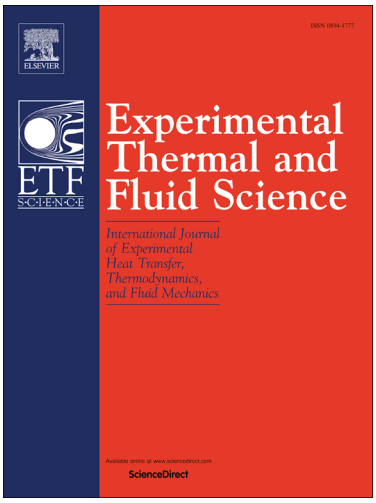

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Experimental heat transfer study of confined flame jet impinging on a flat surface

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Abstract

An experimental heat transfer study has been conducted for a confined turbulent impinging flame jet. The flame jet was subsonic or supersonic depending on the operating conditions. The impinged target was the flat surface of a water-cooled calorimeter, custom designed to sustain high heat fluxes and high surface temperatures. In order to influence the surface temperature of the target and to observe for the first time its effect on the heat transfer when impinged by the same flame jet, two calorimeters, made of different materials, were applied. Additionally, the heat transfer study presents the influence of process parameters on recorded heat flux for firing rates between 23 and 54 kW, dimensionless nozzle-to-target distances between 5 and 14 and exit nozzle diameters of 7.9 and 12.1 mm. The maximum recorded surface temperature was 600 °C and the maximum recorded heat flux was 10.5 $\frac{MW}{m^2}$. The obtained results were in agreement with heat transfer studies of unconfined impinging flame jets presented in literature. The results showed that if the target surface temperature was increased from around 170°C to around 530°C it did not influence the heat transfer coefficient considerably. Also, it was concluded that the influence of the confinement was mostly reflected in preventing the underexpansion of supersonic flame jet.

Keywords: impinging flame jet, heat flux sensor, calorimeter, underexpanded jet, confined jet, heat transfer

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