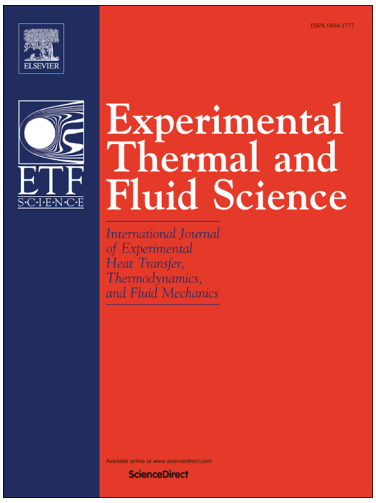

SPRAY CHARACTERISTICS OF LIQUID-LIQUID PINTLE INJECTOR

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SPRAY CHARACTERISTICS OF LIQUID-LIQUID PINTLE INJECTOR

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ABSTRACT

Liquid-liquid cross flow Pintle injector studies are of renewed interest due to their flow control characteristics. In Pintle Injectors, the interaction is between a thin annular sheet and radial jets of liquid. The cause of breakup of this liquid element and the formation of the spray are effectively brought out in this study. The spray pattern is investigated for different momentum ratio and its influence on the droplet formation and size distribution is demonstrated. Two configurations of Pintle injector were subjected to cold flow trails, ie., Type-I and Type-II. Laser shadowgraphy investigation was carried out on two momentum ratios of ξ=1 and ξ=0.7 for Type-I injector. The geometry of liquid before the formation of the spray is a hollow conical sheet. Radial impinging jets generate wave instabilities on the surface of the conical sheet. Instabilities grow in amplitude and the amplitude growth is a function of Weber number and λ/a (wavelength to sheet thickness ratio). Lower momentum ratio flows lead to better atomization as compared to higher momentum ratio flows. The D32 values obtained are 840μm and 650μm for ξ=1 and ξ=0.7 respectively. The influence of liquid sheet thickness and Weber number on the instability waves generated and the droplet size distribution is understood. The sheet thickness for the two cases of ξ=1 and ξ=0.7 were estimated by applying inviscid solution theory and the sheet thickness are 172μm and 65μm respectively. Type-II injector was designed based on the analysis of the Type-I injector test results. The annular gap in Type-II injector was reduced to 95 μm to achieve smaller sheet