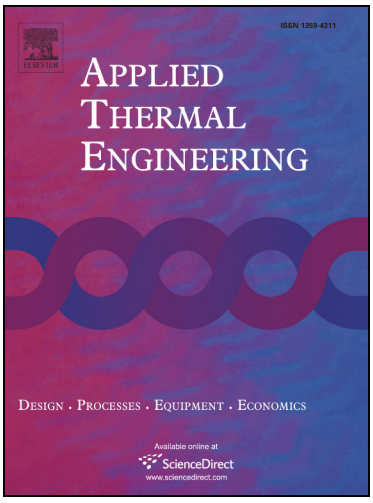

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A control method for flow distribution in fuel-cooled plate based on choked flow effect

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Abstract

The formation mechanism and control method of flow maldistribution of fuel-cooled plate were studied in this work. The experimental results demonstrated that the irreversible flow maldistribution occurs when the fuel temperature reaches about 1003 K, and led to severe local overheating as well as coke deposition. Orifices were applied as flow controllers to generate choked flow and cut off the positive feedback circle of flow rate deviation. The model of choked flow based on real gas state equations was established. Using the model, the features and triggering conditions of choked flow were analyzed. Then 3-D numerical simulation was conducted, and the detail of flow distribution and the stability of the control method were further studied. The results of simulation indicated that, the orifice with choked flow can maintain uniform flow distribution and heat transfer under asymmetric channel structure and backpressure. By means of the control method of choked flow, the fuel-cooled plate kept uniform heat exchanging when the outlet fuel temperature reached 1053 K in the electric heating experiment.