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HIGH ENERGY EFFICIENCY MICRO-JET HEAT EXCHANGER

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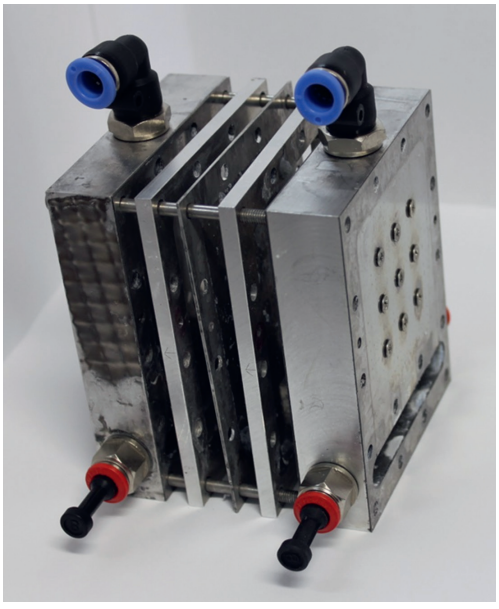
Abstract – The purpose of the present study is an experimental investigation of microjet array heat exchanger performance. Impinging jet cooling technique has various advantages such as one of the highest known single phase heat transfer coefficients, high heat flux removal rates with small surface-to-coolant temperature differential, possibility of its regulation, and direct contact with the cooling surface. Jet impingement is widely used in industrial applications for drying paper and textiles, quenching metals, turbine blade cooling, and is described as one of cooling methods, that can meet increasing requirements of electronic devices. In the experimental part, heat exchanger, instrumentation and method were described. Heat exchanger with four diaphragms with 364 inline round orifices of diameter 160μm, ratio of jet area to heater area Ar = 0.0019 and ratio between jet-to-jet spacing and their diameter s/d = 19 was used. Water was used as the investigated fluid. Volumetric flow rate was changed manually in the rage of 12.8 ÷ 133.3 mL/s which corresponds to Reynolds number values in the range of 145 ÷ 2275. Liquid water jet impingement cooling was investigated experimentally in four different configurations – standoff between nozzle exit and heat exchange surface was changed by spacers of thickness 1, 3, 5 and 7 mm. Experimental results were used in calculation of experimental heat transfer coefficient k_{exp}. Experimentally determined coefficients of this investigation were compared with values predicted by three different correlations given by Meola, Robinson and Schnitzler and Womac. Results of present experimental investigation may be used to establish optimal parameters for this type of heat exchangers, and provide relevant information about their performance.

Keywords – Experimental research; heat transfer



Micro-jet Heat Exchanger