**Performance enhancement and comprehensive experimental comparative study of cold plate cooling of electronic servers using different configurations of mini-channels flow**

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**Abstract:**

A comprehensive experimental investigation of water cold plate with different flow configurations for electronic cooling was conducted. Serpentine, parallel and wavy channels cold plate were designed to study the hydrothermal performance of water cold plate for electronic servers cooling. Thermal resistance, pressure drop, Nusselt number, servers’ temperatures and performance evaluation criterion were measured, evaluated and compared to evaluate the hydrothermal performance of the different configurations. The results showed that the serpentine channels cold plate has a better thermal performance than both parallel and wavy channels cold plate. The serpentine channels cold plate yields a lower thermal resistance by (6.02 to 10.5%), (2.4 to 8.7%) and a higher average Nusselt number by (7.9 to 13.9%), (6.3 to 13.7%) compared to parallel and wavy channels cold plate, respectively. Also, the results indicated that the serpentine channels cold plate has a higher pressure drop and pumping power compared to parallel and wavy channels cold plates. Similarly, the results showed that the wavy channel has better thermal performance than parallel channels due to the larger flow path and the rotational flow occurred. The I-Type inlet and outlet configuration used in the wavy channel cold plate provide a lower pressure drop compared to parallel channels however the large flow path. The performance evaluation criterion showed that the wavy channels cold plate has a higher performance evaluation criterion than serpentine channels due to its lower pressure drop.

**Keywords**

Cold plate, electronic servers, flow configuration, hydrothermal performance