

Thermal performance of ammonia-cooled micro channel heat sink

Abstract :

The minimization of integrated circuits in powerful electronic devices generates a large amount of heat that has to be removed effectively and efficiently. One of the methods applied is to use a micro channel heat sink. Past optimization attempts have looked at the micro channel geometry, material, and coolant types using various models to represent the heat sink. This paper reports the analytical study on the optimization of the thermal resistance and pressure drop of a rectangular micro channel heat sink using a new coolant, ammonia gas which has never been reported before. The applicability of ammonia gas as a new coolant was investigated and showed excellent performance. The effect of different channel aspect ratio, fin spacing ratio, different structural materials and Reynolds number was investigated. Significant reduction in thermal resistance was obtained with $0.213^{\circ}\text{K}/\text{W}$ for ammonia gas compared to that of $0.266^{\circ}\text{K}/\text{W}$ for air under the same operating conditions. The total pressure drop achieved was 4.82 mbar and 9.52 mbar for ammonia and air respectively. The results indicate promising potential for ammonia gas as a coolant for rectangular micro channel heat sink.