

Effects of the Gap on the Cooling Performance of Microchannels Heat Sink

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Abstract : Due to the improved performance of electronic systems, the demand for electronic cooling devices with high heat dissipation has increased. This research evaluates plain microchannel cold plates with a gap above the microchannels. The present study examines the effect of the gap above straight fin microchannels in the cold plate using the dielectric Novec 7000 as a working fluid. The experiments compared two transparency cover with the same geometry and dimension for the test section. One has a gap above the microchannels (GAM) 1/3 of fin height, and another one with no gap above the microchannels (NGAM); the mass flux ranges from 25 to 260 kg/m²s, while the heat flux spans from 50 to 150 W/cm². The results show quite an improvement in performance with this space gap above the microchannels. The test results showed that the design of the GAM shows a superior heat transfer coefficient (HTC), up 90% than that of NCBM. The GAM design has a much lower pressure drop by about 7~24% compared to the NGAM design at different mass flux and heat flux at the fully liquid inlet. The proposed space gap of 0.33% of fin height above the microchannels enables the surface temperature to decrease by around 3~7 °C compared to no gap above the microchannels, especially at high heat fluxes.

Keywords : microchannels, pressure drop, enhanced performance, electronic cooling, gap

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