EXPERIMENTAL STUDY ON HEAT TRANSFER ENHANCEMENT IN MINICHANNEL HEAT SINK WITH WATER-BASED SUSPENSIONS OF AL_2O_3 NANOPARTICLES AND MEPCM PARTICLES

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Abstract - The thermal performance of minichannel heat sink with water-based suspensions of Al_2O_3 nanoparticles and MEPCM particles was examined experimentally in details. The minichannel heat sink made from copper consisted of 10 rectangular minichannels, with a length of 50 mm, depth of 1.5 mm and a width of 1 mm. A uniform heat flux was used for heating the minichannel heat sink and the Reynolds numbers were in the range of 133 to 1515. The concentration of the MEPCM particles scattered in the water varied from 0 to 10 wt%. The experimental data showed that the wall temperature highly relied upon the Reynolds number and the increment of Reynolds number lead to the reduction of wall temperature for the coolant with or without MEPCM suspension in the minichannel heat sink. Moreover, the wall temperature got reduced for a coolant with MEPCM, compared to that without MEPCM especially at lower Reynolds numbers. Interestingly, the measured results revealed that the coolant with MEPCM particles was effective in cost performance than the pure coolant. The best cooling performance compared to that of pure water was observed for 2% MEPCM concentration within the considered range of flow rates.

Keywords - MEPCM particles; Cooling performance; Minichannel heat sink; Wall temperature; COP; Thermal resistance