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Thermal performance of optimized interrupted microchannel heat sink (IMCHS) using nanofluids

Abstract :

An interrupted microchannel heat sink (IMCHS) using nanofluids as working fluids is analyzed numerically to increase the heat transfer rate. The rectangular IMCHS is designed with length and width of 10mm and 0.057mm respectively while optimum cut section number, n c=3. The three dimensional governing equations (continuity, momentum and energy) were solved using finite volume method (FVM). Parametric study of thermal performance between pure water-cooled and nanofluid-cooled IMCHS are evaluated for particle diameter in the range of, 30nm to 60nm, volume fraction in the range of, 1% to 4%,nanofluid type of Al 2O 3, CuO, and SiO 2 at Reynolds number range of 140 to 1034 are examined. The effects of the transport properties, nanofluid type, nanoparticle volume fraction and particle diameter are investigated on the IMCHS performance. It is inferred that the Nu number for IMCHS is higher than the conventional MCHS with a slight increase of the pressure drop. It is found that highest thermal augmentation is predicted for Al 2O 3, followed by CuO, and finally for SiO 2 in terms of Nu nf/Nu pw in the IMCHS. The Nu number increased with the increase of nanoparticle volume fraction and with the decrease of nanoparticle diameter.