

## **The hydraulic-thermal performance of miniature compact heat sinks using SiO<sub>2</sub>-water nanofluids**

Ever since the rapid increase in both the demand for the miniature electronic devices and their applications, heat dissipation in the electronic components has been a serious issue. A miniature plate-pin heat sink model with square, circular, and elliptic pins is considered to enhance the hydrothermal performance of this kind of compact heat sink (CHS). Water and 3% of SiO<sub>2</sub>-water nanofluids of volume fraction were used with different Reynolds number ranges (100-1000). The findings show that the base temperature of heat sink reduces while the Nusselt number enhances by using nanofluids and increasing Reynolds number. The lowest value of the base temperature is nearly 25% for the square pins and circular pins CHSs compared with a plate-fin heat sink at 3% of nanofluids. Furthermore, the highest value of the Nusselt number is about 98% at 3% SiO<sub>2</sub> for circular pin CHSs compared with the plate-fin heat sink. However, the pressure drop of CHSs is higher than that of plate-fin heat sink. Moreover, the most significant hydrothermal performance value is about 1.44 for water and around 1.51 for SiO<sub>2</sub> as using the CHS with circular and elliptic pins depends on the Reynolds number. Thus, applying CHSs with nanofluids instead of the traditional heat sinks might produce a substantial enhancement in the hydrothermal performance of heat sinks.