

EXPERIMENTAL INVESTIGATION OF NANOFLUID OSCILLATING HEAT PIPES

Corey Wilson

Dr. Hongbin Ma, Thesis Supervisor

ABSTRACT

An experimental investigation was conducted of oscillating heat pipes (OHP) charged with diamond nanofluid. By combining the high thermal conductivity of nanofluids with the high heat transport rate of OHPs, a new type of heat pipe was developed. The diamond nanofluid used in this experiment was a combination of 5-50 nm diamond nanoparticles and a base fluid of high performance liquid chromatography (HPLC) grade water. The nanofluid thermal conductivity was found to be 1.00 W/m-K this is a 67% increase compared to HPLC grade water. It was shown that the OHP thermal resistance decreased from 0.75 °C/W with HPLC grade water to 0.49 °C/W with diamond nanofluid at an operating temperature of 20 °C and a heat load of 50 W, which is a 34% improvement in thermal resistance. Also by increasing the temperature, the OHP performance increased substantially. However, the difference between the nanofluid and the base fluid at higher temperatures was less significant. Even so, a thermal resistance of 0.03 °C/W was achieved at 336 W and with an operating temperature of 70 °C. Fluid frequency and amplitude were observed, via neutron radiography, to increase at increased temperatures and increased heat flux. Also, for the same heat flux and operating temperature, the water OHP had a slightly higher frequency and amplitude than the nanofluid OHP. Both of these trends matched the temperature trends observed with the thermocouples.