

# Thermal Performances of Two Different Conductivity Metal (Cu-Ag) Micro Heat Pipe of Circular Cross Section Using Different Liquids of Low Boiling Point

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## Abstract

Electronic machines are rapidly being developed with the increasing benefits but, getting smaller in sizes resulting in more thermal stress. To manage this stress, a comparative study was conducted between a two-metal (Cu-Ag) micro heat pipe (TMMHP) and the presently utilized single-metal (Cu) micro heat pipe (SMMHP). Thermal effects of TMMHP of circular cross section at steady state were experimentally investigated. Water and three low boiling point liquids – ethanol, methanol and iso-propanol – are used as working liquids. In consideration of the usage of the actual equipment, tests are conducted by placing the heat pipe at three different orientations – horizontal, vertical and at 45° inclination. To provide heat flux, SGW36 (Ni-Cr) electric heater-coil is coiled around the evaporator simulating the heat-generation of an actual device, and simultaneously the condenser section is directly cooled by water in an annular space. Internal fluid-flow is considered one dimensional. Ten calibrated K-type thermocouples are installed at different locations – five of them are to measure the temperatures of internal fluid and five are used to measure the surface temperatures of the tube at different axial locations. Temperatures are recorded by digital electronic thermometers. Unlike in the SMMHP, it is found that the boiling and super heat effects in the evaporator of TMMHP transform the two-phase flow into a single phase superheated vapor flow, which increases TMMHP's heat transfer capability to three and half times the capacity of SMMHP. Such an enhanced heat transfer coefficient may be possible from the improved convection which is developed from the different heat conductivity of metals that enables the TMMHP to reject heat at a higher rate through its condenser than the rate it can take heat in SMMHP through its evaporator.  $\alpha\beta\gamma\phi$

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