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NUMERICAL AND EXPERIMENTAL ANALYSIS OF A HEAT PIPE EMBEDDED PRINTED CIRCUIT BOARD FOR SOLID STATE LIGHTING APPLICATIONS

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ABSTRACT

In this study, a theoretical and experimental investigation is conducted to predict the thermal performance of a heat-pipe-embedded printed circuit board (PCB). A commercially available heat pipe is used under various experimental orientations. A theoretical study is done using commercial CFD software. Several heat-pipe models have been numerically developed for a heat pipe embedded plate. Numerical models are utilized to obtain on optimal temperature distribution due to effective heat spreading capabilities. A maximum heat flux of 76 W/cm^2 has been applied at the evaporator while forced convection liquid cooling is applied at the condenser region. The results have been validated by comparing the predictions of the numerical model with available analytical correlations and experimental data. Thermal resistances for various cases have been obtained with conventional cooling method for PCB prototypes made up of plastic and Aluminum.