Efficiency Evaluation of Electrical Conductivity of Simple PCB Copper-based Microheaters

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Abstract

This project aimed to investigate the electrical conductivity performance of a copper printed circuit board (PCB) microheater fabricated with a serpentine geometry. The voltage divider method was employed to characterize the electrical properties of the microheater because direct resistance measurement was impractical. In the experimental setup, the microheater was connected in series with a reference resistor and powered by a constant voltage source. The measured voltages were used to calculate the current, resistance, and power dissipation of the microheater. The effects of three geometric parameters, line width, line length and copper thickness were systematically investigated. The results showed that Increasing the line width or copper thickness decreased the power electrical power, with the narrowest width and the thinnest line producing the highest electrical power. increasing the line length increased the power dissipation, with the longest microheater exhibiting the highest power output. These results demonstrate that the electrical performance of the microheater is strongly influenced by its geometry. A microheater with a narrow line width, long line length, and thin copper layer provides the highest power dissipation and consequently, the greatest heating capability. Moreover, the voltage divider method offers a reliable and practical approach for characterizing microheaters when direct resistance measurement is not feasible.

Keywords: Microheater, copper PCB, Serpentine Geometry, Voltage Divider