

COMPACT OSCILLATING HEAT PIPE AND DEVELOPMENT OF FUZZY COPPER FOR WICKING STRUCTURES

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ABSTRACT

A central processing units (CPU) calculation speed is limited by the heat it produces. As the number of transistors and the clock speed of CPUs increase they become more powerful, but they also generate more heat which must be removed or the chip will over heat and fail. CPUs in laptops and some desktop computers are currently cooled using heat pipe heat sinks. However, as CPUs increase in power, greater heat transfer capacity will be required, and the capabilities of current heat pipe designs will be exceeded. Thus it is necessary to develop an innovative cooling device that is capable removing a higher heat flux. Oscillating heat pipes (OHP) are a viable option, however, the current design is too large for incorporation into electronics packages. The compact OHP is proposed as a solution. The current investigation is designed to produce a compact OHP as a replacement of current cooling technologies. Electroforming was chosen as the method for fabricating the OHPs because of its cost effectiveness, and the maturity of the technology which lends itself well to prototyping. The electroforming technology was studied and an electroforming bath was constructed. In order to create an OHP in an electroforming bath, several techniques of masking the substrate for electroforming were studied and the preliminary process design of using photo lithography as a masking technique was completed. During testing of the electroforming system a new wicking structure was created, which is a form of dendritic growth. The wicking structure was analyzed using a light microscope and a three vapor chambers were fabricated and tested to characterize the capillary performance of the wick structure and heat transport capability.