Optimization of liquid cooling fins in microelectronic packaging

Abstract

The present study investigates the heat transfer from a fin of the combination of cone and frustum of a cone immersed in boiling FC-72. The temperature distribution within the fin is determined with the help of a three-dimensional finite element computation technique using linear axisymmetric elements. From the temperature distribution, the fin base temperature gradients at various base temperature excesses are obtained. The numerical results are found to be in good agreement with published experimental data. Parametric studies have been carried out using this numerical method. An artificial neural network is used to consolidate additional data from the parametric studies. The genetic algorithm is then applied to the case of a fixed volume fin, in order to determine the dimensions which optimize the heat transfer per unit volume. It is observed that the heat transfer per unit volume decreases with fins of increasing volumes. Conclusively, the technique used in the analysis is able to provide a fast and accurate guideline to select and design the cooling for microelectronic systems.

Keywords — Fins, liquid cooling, microelectronics, optimization