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碩士論文

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板狀熱管用於筆記型電腦散熱之研究

Studies on the Cooling of Notebook PC by a  
Plate Type Heat Pipe

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## 摘要

本研究主要是探討平板狀熱管應用在筆記型電腦散熱的可行性。由於電子產品的積集化造成發熱密度的增加，如何維持正常工作溫度的熱管理益顯重要。CPU的冷卻由早期自然空冷、強制空冷到利用熱管來散熱。未來，散熱器的大小將決定電子產品的大小。本文基於如此的觀念，利用筆記型電腦最大的可用面積—LCD的背板當成自然冷卻的散熱器，設計一個熱管將CPU所產生的熱量傳遞至板上散逸，如此可省去機體的熱沉及散熱風扇空間，並節省電力及降低噪音。本文經由此散熱器的理論分析與性能測試的結果作一比較，以驗證此一散熱器的可行性。本研究設計一平板型熱管，平板面積為 $0.12\text{m}^2$ 。本研究以CPU的熱源做為蒸發部，以平板做為凝結部，採用自然冷卻。所探討的設計參數包括工作流體種類，工作流體充填量，與真空度；操作條件則包括流經熱管的風速，傾斜角度，及加熱量大小。本研究發現，在最嚴苛的工作條件下，散熱板面溫度不超過 $70^\circ\text{C}$ ，本散熱器最大的散熱量為 $24\text{w}$ ，顯示平板狀熱管應用在筆記型電腦的散熱具可行性。。

## Abstract

The purpose of this investigation was to fabricate a new plate-shape heat pipe and to test the thermal performance of this heat pipe.

Heat pipe is a device that makes use of the property of phase change between liquid and vapor to transport mass thermal energy. Because of the boiling and condensation during the change phase, it may obtain relatively larger heat-transfer coefficient than that in the liquid or vapor force convection. Therefore, heat pipes are commonly found in the applications such as heat dissipation, heat spreading, energy storage, heat recovery and improvement of the cooling speed of cooked foods ...etc.

Due to the fact that semiconductor industry has been developed unceasingly in recent years, the heat dissipating effectiveness for the miniaturized and integrated high power electronic devices have become more and more important. Correspondingly, CPU dissipation methods have successively made progress from natural convection, forced convection, to heat pipe .In the foreseeable future, the size of heat-sink will decide the size of the electronic products. Base on this concept, this study attempted to design a new heat dissipation device in which the back plate of the LCD monitor of a notebook computer was utilized as a natural cooling dissipater. The undesirable heat from CPU was transported by heat pipe into the back plate where it may easily be dissipated. This offered us the advantage of economizing the required space for fan and heat sink .In addition, this saved the power consumption of fan and decreased the noises. Because the plate-shape heat pipe itself served as one kind of heat-sink, the thermal resistance of heat transport was greatly reduced. In this thesis, a new plate-shape heat pipe, by virtue of verifying and comparing the results of its theoretical analyses and experimental tests, was proved to be feasible. This heat dissipater's maximum heat removal capability was 24W when outside air temperature was 31°C and plate temperature was kept below 70°C.

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