



利用電容法量測熱管與均熱片內之空隙率變化

(以下內容一頁為限，不可揭露關鍵技術內容；填表完成後請刪除此行)

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<http://artemis.me.ntu.edu.tw/Home.html>

市場及需求： 近年各種科技產品均朝尺寸縮小且高處理性能之趨勢發展，熱管與均溫板輕薄且貼合熱源以達到高散熱之優點，受到眾多對散熱有高度需求之業界公司青睞。熱管與均溫板內之氣液分布對其冷卻效果具重大影響，且燒乾現象的發生將導致熱管或均溫板散熱效果嚴重惡化，因此若能得知元件內部之空隙率，可瞭解其使用極限，使其在安全的熱通量下運作，亦可作為未來優化熱管與均溫板之重要參據。

技術摘要(含成果)： 本技術利用量測散熱元件之電容推算出內部氣液分布，由於液態水與水蒸氣之介電常數不同，而介電常數是影響電容值之重要參數，藉量測散熱元件之電容值，可得知其內部之空隙率，達到可視化之效果。

優勢： 由於熱管與均溫板通常為銅製金屬之外殼密封情況下進行操作，傳統侵入式的量測並不適用，故本技術提出利用量測散熱元件之電容推算空隙率具非侵入性之特色，並可藉多點量測之方式，建立內部 2D 氣液分布圖。

競爭產品： 市場上尚無商業化之產品可應用於觀察熱管或均熱片內部之氣液變化，學術上之可視化應用多藉客製化具透明面之熱管或均熱片來觀察內部相變化現象。

專利現況：

(1) 本技術尚無相關專利。

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Void fraction measurements in heat pipe and vapor chamber using the capacitance method

(Below is limited to 1-page only; be careful not to disclose vital technology content. Please delete these words when the document is finished)

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Market Needs:

Technology advances in high density packaging and high performance computing exacerbates the heat dissipation problem. Heat pipe (HP) and vapor chamber (VC) are extensively used as heat dissipaters application because of their thin geometry and rapid cooling capability. Two-phase change between liquid and vapor of inner working fluid and their distribution in HP or VC are crucial to the cooling performance. As the heat flux to HP or VC exceeds their critical limit, dryout would easily occur and deteriorate heat dissipation. Therefore, understanding of void fraction within HP or VC allow users to know the thermal constraints of the device. Visualization of inner void fraction change could also facilitate future effort in enhancing HP and VC design.

Our Technology:

Our technology proposes the use of electrical capacitance method to measure void fraction change of HP and VC during heating and cooling processes. Due to the difference of dielectric constants between water vapor and liquid water, void fraction could be estimated from the capacitance measurements.

Strength:

HP and VC are usually made of copper metal and operate as enclosed entities. Traditional invasive measurements of interior activities are not suitable for HP or VC. By contrast, our technology which utilizes capacitance measurements to calculate inner void fraction change, has advantage of non-invasiveness. The 2D mapping of void fraction distribution can be established through capacitance measurements of multiple points.

Competing Products:

No commercial products or equipment can be used to observe inner void fraction change within HP or VC yet. Even for academic research, most common non-invasive approach to investigate inner phase-change phenomenon of HP or VC is observation through custom-made transparent cover.

Intellectual Properties: N/A

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