

# 噴嘴幾何形狀與多孔材貼附層對平板衝擊熱傳之影響

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## 摘要

衝射在工業界是一項很重要的熱傳技術，例如金屬與玻璃退火、雷射冷卻、氣渦輪葉片冷卻與微電子散熱等。衝射的熱傳增強技術，目前在學術界仍是被積極探討的問題。本論文以數值模擬方式探討在衝擊目標平板上覆蓋一層有或無中心孔之多孔介質厚層對於衝射熱傳之增強效果。在模擬中，純流體區域選擇RNG 紊流模型，而多孔介質區域則採用Forchheimer 延伸達西的模型。數值模擬結果以文獻可獲得的實驗數據做合理性驗證，對於現有模型在高雷諾數的缺失，本文也提出修改的建議。計算結果顯示，貼附一層有足夠深度的中心孔多孔介質層可以有效提升熱傳效果，但若是附加一層沒有中心孔、或是有不夠深的中心孔多孔層則會不利於散熱。這些物理現象可經由模擬之流動觀察獲得良好的解釋。在固定孔系率與穿透性的條件下，本文探討的熱傳問題中具有影響力的參數包括：衝射雷諾數、噴嘴幾何(含噴嘴長度以及噴嘴與中心孔的直徑比)、噴嘴至平板距離以及中心孔深度。適當的中心孔幾何可引導冷空氣進入多孔區並與沿著加熱平板進行熱傳；噴嘴與中心孔直徑相同時得到的熱傳效果最佳；對於噴嘴長度的選用，在低雷諾數時噴嘴越短使流體越趨近均勻流的熱傳效果越好；高雷諾數時，噴嘴長度應可使流體達到完全發展流所得到的熱傳效果較好。最後，本文對於此探討的問題提出紐賽數與雷諾數之關係式，期能供設計者對於平板貼附有中心孔多孔介質層之衝擊冷卻設計之用。

關鍵詞：衝射、多孔介質、中心孔、數值模擬、中心孔深度、雷諾數

## 目錄

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