A390鋁合金煞車蹄片之鑄造模擬分析

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摘 要

在機車零件中，煞車蹄片所使用的材料以A356鋁合金為主，易使煞車蹄片因熱膨脹而導致尺寸稍微增大。在作動時，使煞車來令片與煞車鼓之接觸產生不良磨擦現象，造成煞車能力減弱。因此，若採用具有低熱膨脹特性之A390鋁合金製造煞車蹄片，則可避免此現象之產生。 本研究主要目的是針對CO2砂模鑄造A390鋁合金煞車蹄片製程模擬之研究。利用電腦輔助工程分析(CAE)軟體FLOW-3D，探討澆流道系統設計對鑄造煞車蹄片收縮等缺陷之影響，以瞭解A390鋁合金煞車蹄片鑄造充模流動及凝固之情形，並研究煞車蹄片較佳之鑄造方案設計，且以實際鑄件及X-ray檢驗瞭解FLOW-3D模擬結果的正確性。 藉由FLOW-3D模擬軟體內建的分析指標之固相分率、凝固時間、溫度梯度、固液界面速度及Niyama孔洞指標等缺陷預測指標，進行對蹄片鑄件模擬結果分析。其次，對產生缺陷可能的位置進行切剖觀察，並設計適當冒口補充鑄件縮孔。最後，澆鑄A390鋁合金蹄片鑄件，並以X-ray檢驗鑄件縮孔之位置。 研究結果顯示，設置豎澆道井設置可以緩和鋁液自豎澆道頂部入口流入後，對底部橫流道之衝擊，且在橫流道與進模口交接處設置雙邊R角，亦可減緩鋁液在進模口之流速。另採用非壓力式1:4:4澆流道系統，具有較其它澆口比(1:2:2、1:2:3或1:3:3)之澆流道系統更為平穩的流動情形，且能有效降低擾流之產生。而實際A390鋁合金煞車蹄片鑄件所產生之縮孔區與電腦之模擬結果則大致互相吻合，故以電腦輔助模擬分析確可設計與評估A390鋁合金煞車蹄片鑄造方案之設計。

關鍵詞 : 煞車蹄片 ; A390鋁合金 ; 鋁合金 ; CO2砂模法 ; 電腦輔助工程分析

目錄

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