

# 熱塑性變形參數對鋁合金再結晶晶粒尺寸影響

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## 摘要

本研究係以熱加工模擬試驗機Gleeble 3500對A6061、A6066、A6082三種鋁合金於不同加熱溫度及應變速率進行高溫變形試驗。實驗程序為將各種條件實驗後所取得之真實應力-真實應變曲線，通過多元迴歸分析建構材料之流變應力方程式；再利用多元迴歸分析取得之相關係數，以代入模擬晶粒尺寸之方程式；最後，使用光學顯微鏡和掃描式電子顯微鏡觀察鋁合金在熱壓縮變形過程中，顯微組織的改變及晶粒尺寸實際值的量測，並與模擬值進行比較。當A6061、A6066、A6082三種鋁合金變形程度為66%時，進行高溫壓縮試驗後及多元迴歸分析後，可得到適用範圍為 $1s^{-1}$  ~  $0.001s^{-1}$ ，580 ~ 400 °C的流變應力方程式。分析結果顯示，材料之流變應力隨變形溫度升高而降低，應變速率增加而增大。藉由顯微組織觀察可得到，經過熱壓縮變形試驗後，因材料結構轉變，會產生不連續動態再結晶與旋轉連續動態再結晶。其中，以差排密度增加為主，且於原始晶粒晶界析出項鍊狀組織為DDR<sub>X</sub>；以差排堆積及差排爬升為主，且於原始晶粒內析出較細小的晶粒為RDR<sub>X</sub>。由實際值與模擬值比較，RDR<sub>X</sub>晶粒尺寸隨溫度降低、應變速率增加而減小，模擬值與實際值差距越少。反之，隨溫度升高、應變速率減緩而變大，模擬值與實際值相差越大。

關鍵詞：鋁合金、高溫變形、流變應力、動態再結晶、晶粒尺寸

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