鑄件模數對重力鑄造鋁-矽(鎂)系合金流動性之影響

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摘 要

本研究係針對重力鑄造之Al-Si系和Al-Si-Mg系合金，探討合金參數，如Si含量與微量元素Mg(合金強化元素)、Sr(共晶矽調質元素)、 P(初晶矽細化元素)和Ti(鋁晶粒細化元素)之添加，以及金屬模模溫和鑄件尺寸厚度等製程參數對U型金屬模流動性測試鑄件之凝固模式和流動性之影響。並藉由金相顯微組織之觀察，分析不同合金成分和製程條件之凝固模式，以探討Al-Si(Mg)系合金之重力鑄造流動凝固機構對不同尺寸鑄件(代表不同鑄件模數)流動性之影響。 研究結果顯示，提升金屬模模溫和增加鑄件尺寸厚度皆可增進Al-Si(Mg)系合金之流動性，過共晶合金之流動性較亞共晶及共晶合金佳。在亞共晶或進共晶 Al-Si合金中添加Ti和Sr會促進合金之流動性，但在過共晶合金添加Ti和P則會降低合金之流動性，惟三者再添加Mg，則又增加其流動性。此外，從研究分析結果得知，合金之流動凝固模式為影響重力鑄造此類合金流動性之主因之一；對於亞共晶、近共晶和過共晶合金之流動性測試厚件而言，阻礙熔液流動停止位置在鑄件之頂端，而對於薄件而言，亞共晶和近共晶合金，此一位置在鑄件之底部，過共晶合金則在頂端或底部。由實驗結果亦可獲知，阻礙流動停止之位置若為頂端者，其流動性會較在底部者佳。此外，若控制重力鑄造之鑄件尺寸以及模溫，造成較大的冷卻速率和過冷度時，顯微組織會出現Cellular (蜂窩狀) structure微細的共晶組織。 合金之流動性和製程參數之間的相關性為：合金流動性與模溫呈現出指數的關係，合金流動性與過熱度為一乘冪的關係，合金流動性和平均淨液壓力頭及平均流動速率成反比之關係，然而，合金流動性與凝固時間及鑄件模數之相關性並不高。

關鍵詞 : 鑄件模數;重力鑄造;流動性

目錄

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