石墨與碳化矽混合強化型鋁基複合材料流動性之研究

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摘 要

中文摘要 本研究主要目的在探討製程參數和冶金參數，對三種鋁基合金(A356.2、A413.1以及A390.1)添加石墨顆粒或混合式添加碳化矽和石墨顆粒之複合材料(Hybrid composite；AMC/SiCp/Gr.)下對其流動性的影響。本實驗採用CO2砂模鑄造法製作螺旋型流動性測試(Spiral fluidity test)砂模，量測各種不同成分的鋁基複合材料流動性，並使用電腦輔助冷卻曲線分析方法，分析不同成份的鋁基混合式複合材料在凝固時之熱參數的變化及釋放的潛熱值和凝固過程中固相分率的變化，以探討其對此種材料流動性之影響。 研究結果顯示，影響鋁基石墨顆粒複合材料之流動性的石墨顆粒添加量有一臨界值，即當石墨顆粒含量為4wt.%以上時，流動性才有明顯降低之現象，而其流動性隨著石墨含量之增加而呈現先增後降之趨勢。而對於混合式鋁基複合材料在添加固定的4wt.%石墨顆粒後，其流動性卻會隨SiCp的添加量之增加而呈現逐漸降低之趨勢。 此外，CA-CCA之研究結果指出三種鋁基石墨顆粒複合材料的凝固潛熱會隨著石墨顆粒含量的增加而有降低之趨勢，然而其會隨著石墨含量之增加，凝固溫度會上升，但總凝固時間會先增而後降，因此，其流動性才會呈現先增加後降之情形。而三種鋁基混合式碳化矽和石墨複合材料的凝固潛熱則會隨著碳化矽顆粒添加量之增加而有逐漸降低的趨勢，然而其會隨著碳化矽含量之增加，凝固溫度會上升，總凝固時間會降低，因此，其流動性才會呈現逐漸降低之情形。 觀察並分析螺旋型流動性測試鑄件的顯微組織，發現三種鋁基合金單獨添加Gr.顆粒或混合添加SiCp和Gr.顆粒之複合材料，其流動凝固模式的改變和固相分率的變化情形，對其流動性變化之影響，確有極密切之關聯性。

關鍵詞 : 鋁基混合式複合材料 ; 流動性 ; 石墨 ; 碳化矽 ; CA-CCA

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