ABSTRACT

The purpose of this study is to investigate the effect of process and metallurgical parameters on the hybrid aluminum matrix composites AMC/SiCp/Gr. which used three types of aluminum alloys A356.2, A413.1 and A390.1 as matrix alloys. The reinforcement materials are silicon carbides particles (SiCp) and graphite particles (Gr.) which their sizes are micrometer order. The fluidity measurements are conducted by using CO2 sand mold method and spiral fluidity test pattern. In addition, the computer-added cooling curve analysis method (CA-CCA) was utilized to evaluate the effects of solidification temperature and solidification time on the fluidity of the three types of hybrid aluminum composites. The latent heat and the solid fraction change during the flow and solidification in the cavity are also calculated by CA-CCA method. The data show significant influence on the fluidity of the composites. The results of this research indicate that the fluidity of aluminum added with graphite particles composites was firstly increased with the increase amounts of graphite for the AMC/Gr. composites and then was decreased with the increase amounts of graphite. The best fluidity occurred at four weight percent (4wt.%) graphite added amount. However, the fluidity was gradually decreased with the increase of silicon carbide amounts for the hybrid AMC/SiCp/Gr. composite. The CA-CCA analyses find that the solidification temperatures increase and latent heat decreases and the solidification time increases firstly and then decreases with the increase amounts of graphite for the AMC/Gr. composites. But, the solidification temperatures increase and latent heat and solidification time decrease with the increase amounts of silicon carbide for the AMC/SiCp/Gr. composites. Finally, the microstructure observations about the spiral fluidity test castings of AMC/Gr. and hybrid AMC/SiCp/Gr. composites indicate that the fluidity was significantly affected by the solidification modes and the solid fraction change along the spiral fluidity test castings.
3.5 凝固冷却曲线之量测
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4.1 螺旋型流動性測試
4.1.1 鋁基石墨複合材料之流動性
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第五章 結論

参考文獻
Fig. 4-55 Microstructures of A413+10wt%SiCp+4wt%Gr. composite observed at the spiral fluidity casting reveal the solidification. (a) entrance: mushy solidification (b) mid-section: mushy solidification (c) flow tip: mushy solidification.

Fig. 4-54 Microstructures of A390+5wt%SiCp+4wt%Gr. composite observed at the spiral fluidity casting reveal the different solidification. (a) entrance: mushy solidification (b) mid-section: mushy solidification (c) flow tip: mushy solidification.

Fig. 4-53 Microstructures of A413+15wt%SiCp+4wt%Gr. composite observed at the spiral fluidity casting reveal the different solidification. (a) entrance: mushy solidification (b) mid-section: mushy solidification (c) flow tip: mushy solidification.

Fig. 4-52 Microstructures of A413+10wt%SiCp+4wt%Gr. composite observed at the spiral fluidity casting reveal the different solidification. (a) entrance: mushy solidification (b) mid-section: mushy solidification (c) flow tip: mushy solidification.

Fig. 4-51 Microstructures of A413+5wt%SiCp+4wt%Gr. composite observed at the spiral fluidity casting reveal the different solidification. (a) entrance: mushy solidification (b) mid-section: mushy solidification (c) flow tip: mushy solidification.

Microstructures of A356+15wt%SiCp+4wt%Gr. composite observed at the spiral fluidity casting reveal the different solidification. (a) entrance: mushy solidification (b) mid-section: mushy solidification (c) flow tip: mushy solidification.

Microstructures of A356+10wt%SiCp+4wt%Gr. composite observed at the spiral fluidity casting reveal the different solidification. (a) entrance: mushy solidification (b) mid-section: mushy solidification (c) flow tip: mushy solidification.

Microstructures of A356+5wt%SiCp+4wt%Gr. composite observed at the spiral fluidity casting reveal the different solidification. (a) entrance: mushy solidification (b) mid-section: progressive solidification (c) flow tip: mushy solidification.

Microstructures of A390+10wt%SiCp+4wt%Gr. composite. The dynamic thermal analysis results for A390+10wt%SiCp+4wt%Gr. composite. The positions of the thermocouples superimposed on the spiral fluidity casting and the temperatures and solid fractions measured for A390+10wt%SiCp+4wt%Gr. composite. The thermal analysis result for A390+10wt%SiCp+4wt%Gr. composite. A comparison of solid fraction (fs) and solidification temperature for A390+10wt%SiCp+4wt%Gr. composite.

Microstructures of A390+8wt%Gr. composite observed at the spiral fluidity casting reveal the different solidification. (a) entrance: mushy solidification (b) mid-section: mushy solidification (c) flow tip: mushy solidification.

Microstructures of A390+4wt%Gr. composite observed at the spiral fluidity casting reveal the different solidification. (a) entrance: mushy solidification (b) mid-section: progressive solidification (c) flow tip: mushy solidification.

Microstructures of A390+2wt%Gr. composite observed at the spiral fluidity casting reveal the different solidification. (a) entrance: mushy solidification (b) mid-section: mushy solidification (c) flow tip: mushy solidification.

Microstructures of A413+4wt%Gr. composite observed at the spiral fluidity casting reveal the different solidification. (a) entrance: progressive solidification (b) mid-section: progressive solidification (c) flow tip: mushy solidification.

Microstructures of A413+2wt%Gr. composite observed at the spiral fluidity casting reveal the different solidification. (a) entrance: mushy solidification (b) mid-section: mushy solidification (c) flow tip: mushy solidification.

Microstructures of A356+8wt%Gr. composite observed at the spiral fluidity casting reveal the different solidification. (a) entrance: mushy solidification (b) mid-section: progressive solidification (c) flow tip: mushy solidification.

Microstructures of A356+4wt%Gr. composite observed at the spiral fluidity casting reveal the different solidification. (a) entrance: mushy solidification (b) mid-section: progressive solidification (c) flow tip: mushy solidification.
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