[G13]

Sintering Behavior of Commercial 7xxx Series Al Alloy Powders with Heating Rates

Ei Tae Bae[a,*], Min Suk Kong[a], Kyung Ho Min[a], Young Do Kim[a], Si-Young Chang[b]
[a]Division of Materials Science & Engineering, Hanyang University, Seoul 133-791, Korea
[b]Department of Materials Engineering, Hankuk Aviation University, Kyounggi-do 412-791, Korea

1.Introduction

Aluminium P/M products have the advantages for the application in the automotive industry because of the high strength-to-weight ratio and the net-shape fabrication of the P/M method. Especially, 7xxx series alloy has the most attractive properties including its excellent high room-temperature strength, stress corrossion cracking and corrosion-resistance. However, in case of the Al-Zn system, the liquid phase has a transient aspect because of the high solid solubility of Zn in Al. Therefore, transient liquid phase sintering behavior was observed during the sintering process. And the amount of liquid and its duration were influenced by the process variables including heating rate, final sintering temperature, sintering atmosphere etc.[(1)]. In this work, densification rate, microstructure and the behavior of the liquids which formed by melting of the additives and the various binary and higher order eutectics with heating rate was investigated.

2.Experimental Methods

The commercial 7xxx series Al alloy powder, AMB7775, were cold pressed at 250MPa using uniaxial press. Delubricating was performed at 350℃ for 1h and sintering was carried out at temperatures up to 600℃ for 1h under a dry N_2 atmosphere. The heating rate from the delubricating temperature to the sintering temperature was 20℃/min, 60℃/min and 100℃/min. The sintered density was measured and DSC analysis was carried out on the delubricated sample up to 600℃ with different heating rates. For microstructural observation by SEM, samples were quenched directly from a furnace into cold water. The liquid fraction was measured on samples from backscattered electron images selected at random.

3.Results and Discussion

As a result of DSC analysis, it was shown that the faster heating rate delayed the formation of liquid to higher temperature. At higher heating rates(100℃/min), the liquid fraction was enhanced during sintering because the opportunity for diffusion to occur before melting was minimized and therefore local saturation could occur more easily[(2)]. The sintered density increased according as heating rate was faster.

4.Reference

1.G.B.Schaffer, T.B.Sercombe, R.N.Lumley, Materials Chemistry and Physics **67** (2001) 89
2.R.N.Lumley and G.B.Schaffer, Scripta Materialia **35** (1996) 589