

A STUDY OF THE POWDER FORGING PROCESS ON AN ALUMINIUM ALLOY

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Abstract

In this study, we used prealloyed A2014 aluminium powder for compacting, sintering, and forging with flash to develop the powder forging process, and investigated the effect of the process parameters such as compacting pressure, sintering temperature and time, forging temperature and die design on the tensile properties of the forgings. The results showed higher compacting pressure, longer sintering time and higher sintering temperature would result in better tensile properties of the sintered billets. The tensile properties of the forgings were directly proportional to those of the sintered billets. After forged, the theoretical density of some forgings reached 100%. The best tensile properties in this study were T.S.=45.45kgf/mm², Y.S.=43.02kgf/mm² and elongation =1.93%. Among those, Y.S. could conform to the requirement of A2014 specification which was 42 kgf/mm². The results also showed the tensile properties of the forgings forged at 400~500°C would be better than those forged at 600°C. Lower yielding ratio and smaller flash gate would result in better tensile properties of the forgings.

Introduction

"Powder Forging" is the forming method of combination of powder metallurgy and forging technology. The conventional sintered parts will become dense after forging. The mechanical properties of these forged parts will be elevated, especially the impact properties. When it can conform to the requirements of the products, the powder forging process will compete with the conventional forging process due to its several advantages such as high yielding ratio, good accuracy, less working stages, easy for automation and lower forging load. So, the cost of the powder forging parts may be lower than that of the conventional forging parts. For example, the cost of a connecting rod will be about 16% less by the powder forging process[1~4].

There are several process parameters in the powder forging process. These include compacting pressure, sintering conditions, design of billet and die, and forging temperature. This work investigates the effect of these parameters on the tensile properties of powder forged parts of A2014 aluminium alloy. As to the forging die design, although it is beneficial for