

# Research on the Application of A356.0 Aluminum Alloy Semi Solid Slurry Technology in Gravity Casting

Lijun Hu \*, Yuxiao Zhu, Haichao Zhang

Wuxi Beier Machiney Co., Ltd. , 227Changjiang road , Xinwu District, Wuxi, China

\*Corresponding address: E-mail: 51394018@qq.com

**Abstract:** This article mainly studies the application of A356.0 aluminum alloy semi-solid slurry in gravity casting process. The process selects thin-walled aluminum alloy Valve body castings with complex structures as the research object. Trial production was carried out using two processes, the process of using aluminum liquid with a certain solid phase ratio prepared by semi-solid slurry to tilting gravity casting and the other process of conventional liquid tilting gravity casting. Conducting multiple rounds of experiments and collecting data from multiple sets of experiments. Comparative analysis of multiple data such as semi-solid and liquid interfacial fluidity, metallographic structure, and product properties, which laid a theoretical and practical foundation for the application of semi-solid slurry in aluminum alloy gravity casting.

## Keywords:

semi-solid slurry; fluidity; flow trace; misrun; grain

## 1 Introduction

Aluminum alloy gravity casting is a common aluminum alloy casting process, which happens to be used for products with worse work condition and high mechanical properties request. Because it works by gravity, this process has some limits in product Structures. Such as same products with thickness less than 5mm, complex structures, high requirement for pressure tolerance, when using gravity casting process, porosity, shrinkage and poor molding may occur. These defects lead to a low product qualification rate and an increase in manufacturing costs. Semi-solid slurry preparation technology involves the use of specialized methods to obtain a mixture of liquid and solid slurry, where the metal acquires a certain amount of non-dendritic primary solid phase near the liquids curve. Semi solid slurry due to its unique preparation method, results in finer grain size [1], increased fluidity, and reduced deformation resistance due to the presence of a certain amount of liquid phase. This enhances the fluidity of complex parts in gravity casting.

In this study, a common aluminum alloy casting material, A356.0, was proposed to use semi-solid slurry technology and carry out tilting gravity casting, in order to improve product qualification rate, reduce manufacturing costs, shorten process cycles, and explore mass production applications.

## 2 Experimental procedure

The supercharged valve body was selected as the research object in the experiment. The structure of the valve body was complex, and the inner cavity with an airway and inlays, it need high mechanical properties and tightness. The supercharged valve body was verified by the same tilting gravity casting machine, the same set of molds, the same A356.0 aluminum alloy. Experiments were conducted under two production process conditions: tilting gravity casting of semi-solid slurry obtained by semi-solid slurry technology and tilting gravity casting of conventional liquid slurry. Each process designed 3 groups process parameters with 20pcs products. Products are inspected for appearance, X-ray inspection, and tightness separately by group, and the comprehensive pass rate were separately calculated. According to the results of the comprehensive pass rate, randomly sampling a sample from each process of the two highest qualification rate groups, and making comparisons in appearance, internal quality (CT scan detection), metallographic structure and mechanical properties.

## 3 Results

### Comprehensive pass rate

Through comprehensive pass rate comparison, it was found that the comprehensive qualification rate of semi-solid slurry gravity casting product was higher.

### Appearance comparison

Through the appearance comparison, it was found that the surface flow trace and misrun of semi-solid slurry gravity casting product was significantly reduced

### Internal quality

Through the CT scanning comparison, it was found that the internal micro shrinkage of semi-solid slurry gravity casting product was smaller.

### Metallographic structure

Through the metallographic analysis and comparison, it was found that the grain size of semi-solid slurry gravity casting product was smaller.

### Mechanical properties

Through the mechanical properties testing comparison, it was found that semi-solid slurry gravity casting product had better mechanical properties.