

# Effect of Process Parameters on Mechanical Property of A356 Aluminum EPC Casting under Normal Atmosphere

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## ABSTRACT

This research investigates the effect of process parameters of lost foam casting (LFC) at 1 atm including pouring temperature, coating thickness as well as casting thickness on the mechanical properties of A356 aluminum alloy castings, in order to obtain the better manufacturing conditions of A356 alloy LFC castings for the industrial co-operation partner. In addition, the influence of the same conditions on the porosity and microstructure of A356 aluminum alloy castings was also studied. The difference of mechanical properties for the as-cast and the T6 heat-treated A356 aluminum alloy castings was compared simultaneously. The dynamic universal test machine, Rockwell hardness tester, optical microscopy (OM), scanning electronic microscope (SEM) and energy dispersive spectroscopy analyzer (EDS) were also used to analyze the characteristics of A356 aluminum alloy LFC castings made at one atmospheric pressure solidification mode. The results of this study show that the strength, ductility and hardness of test bar castings at 720 °C pouring temperature are better than those of pouring temperature at 700 °C and 740 °C, and the same mechanical properties of T6 heat-treated test bar castings are superior to the as-cast ones. The same properties of test bar castings for pattern with coating thickness of 0.3mm are better than those with coating thickness of 0.6mm. In addition, the mechanical properties of step-type plate castings are decreased with the increase in section thickness. The best properties belong to the castings of thin 5mm thickness and the worst ones belong to the castings of thick 25mm thickness. The T6 heat-treated ladder-type plate castings possess the similar tendency for their mechanical properties. A356 aluminum alloy castings solidified at one atmospheric pressure, the porosities of castings at 720 °C pouring temperature are lower than those of 700 °C and 740 °C pouring temperature. The porosities of castings at three pouring temperatures are less than 2%. The porosity of castings with pattern coated with 0.3mm coating thickness is 3.25% higher than that of castings with pattern coated with 0.6mm one. OM observation found that the castings of 720 °C pouring temperature had more porosity than that of 700 °C. Moreover, the castings of pattern with 0.6mm coating thickness had a lot of eutectic accumulations on the matrix which lead to detrimental mechanical properties of castings. By SEM observation, it was found that the test bar castings of 700 °C and 720 °C pouring temperatures had microporosity, round gas pores and larger shrinkage on the fractured surface of test bar. Through EDS analysis, it was found that the phases in both castings consist of silicon (Si) and oxygen (O), due to the envelopment of silica sand during the flow filling of aluminum alloy melt. EDS analysis also revealed that the fracture surface contains carbon (C), owing to the carbon residue of the thermal decomposition products of EPS pattern loss on ignition. Keywords : lost foam casting, A356 aluminum alloy, mechanical property, porosity, T6 heat treatment

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