Study on High Pressure Solidification Process of A356 Aluminum EPC Casting

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ABSTRACT

In this study, high pressure of 10 atm solidification mode and T6 heat treatment were conducted on the evaporative pattern casting (EPC) process of A356 aluminum alloy. The effect of casting process parameters such as pouring temperature, coating thickness and high pressure duration time on tensile strength, yield strength, elongation rate, Rockwell hardness, density, porosity and microstructure of the A356 aluminum alloy castings were also evaluated. The purposes of this study are to understand the improvement of high-pressure solidification mode on the mechanical properties and quality of A356 aluminum EPC casting. The results of this research provide the industry-university cooperation manufacturers with the better high pressure casting mode process for the production of A356 aluminum alloy castings. The result found that the difference exist between tensile strength, yield strength, elongation, Rockwell hardness, and toughness of the A356 aluminum alloy standard tensile test bars and ladder-type castings under the high pressure solidification conditions with different process parameters. For the standard tensile test bar castings of 720 °C pouring temperature, their strength, hardness and ductility are superior to those of 700 °C, 740 °C and 760 °C pouring temperature. The standard tensile test bar castings and ladder type castings of pattern coated with 0.3mm coating thickness show better strength, hardness and ductility and toughness then the castings of pattern coated with 0.6mm coating thickness. The A356 aluminum alloy standard tensile test bar castings with 6 minutes duration under 10 atm high pressure solidification possess better strength and ductility than those with 3 minutes or 10 minutes duration under 10 atm high pressure. Through T6 heat treatment, the strength, hardness, ductility and toughness of A356 aluminum alloy standard tensile test bars and ladder type castings under 10 atm high pressure solidification are superior to the as-cast castings. For 10atm high pressure continued to 6min, 720 °C pouring temperature and 0.6mm thickness of coating A356 aluminum alloy standard tensile test bars, cast and T6 heat treatment hole rate, the rate of 0.39% of the cast holes in the T6 heat-treated 0.36% not very different, due to the T6 heat-treated test bars is not measured before the porosity of the test bars, therefore the porosity of the difference, the mechanical nature of difference. Casting for the EPC to take 10 atm high pressure solidification mode of the A356 aluminum alloy casting, high pressure for 6 minutes, 720 °Cpouring temperature and 0.3mm thickness of coating aluminum castings internal porosity of the little, the aluminum grain size distribution is better , but also no accumulation of eutectic segregation phenomenon.

Keywords : evaporative pattern casting、A356 aluminum alloy、high pressure solidification、mechanical property

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