An Investigation on the CAE and Surface Defects of Zinc Alloy Die-Castings

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ABSTRACT

The causes of formation and solutions for cold shut and gas porosity in AG40A zinc alloy die-casting are studied in this research. The experimental process employ the CAE and actual zinc die-castings to estimate and prove the designs of casting plans. In addition, the influences of casting parameters on the formation of defects are also explored. The parameters comprise the mold temperature and casting pressure. The experimental results indicate that there exists higher validity when using CAE to simulate the casting plans. The temperature distributions of casting simulation can almost point out the actual positions of cold shut in the castings. The solution which can avoid the formation of cold shut is the correct control of the mold temperature as the zinc melt was filled. When the mold temperature is 50°C, the substrate of castings contained chill layer with finer grains because its higher undercooling. The grain size at this layer was about 0.5 μm and the depth of cold shut formed was about 150 μm. The gas in die was entrapped into the casting and formed to dispersed spheral porosity. When the mold temperature is increased to 180°C, the grains size formed was about 0.5 μm to 1 μm in the chill substrate and the amounts of cold shut were reduced. Meanwhile, the entrapped gas was formed to bubble trail with spheral tailed shape, and the tail ’s length was about 1mm. In addition, the inadequate casting pressure would result in misrun defect, however, using higher casting pressure would cause the castings having flash burr defect. The practical die-casting shows that the valid casting pressure should be higher than 235Kg/cm2 and lower than the clamping force of die-casting machine. Finally, if the casting design scheme of AG40A zinc alloy die-casting can incorporate with the CAE simulation, the validity and feasibility of scheme will be easily achieved. Therefore, the better casting parameters for AG40A zinc alloy die-castings comprise the control of mold temperature, the filling gating control and the casting pressure. Sequentially, if setting the proper vent hole and over flow, the formation of cold shut and gas porosity will be eliminated thoroughly.

Keywords : AG40A zinc alloy ; die casting ; cold shut ; gas porosity ; CAE ; mold temperature ; casting pressure

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