



Parametric Study for Runner Modifications of Die Casted Part with Venting Systems

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Abstract: High-pressure die casting (HPDC) is a process used for creating complex components by injecting the molten metal inside the cavity at high pressure. Failure in die casting may reduce product mechanical properties, surface quality, and life cycle. In this paper, the die-casting process of an inspection instrument - test piece is investigated for parametric study and Computational fluid dynamics (CFD) analysis. Parameters used in the die-casting process are important since it affects the molten flow quality inside the cavity. Thus, a parametric study is done to investigate the optimum parameter use in the die-casting process of the test piece. Runner gating system design is also one of the important criteria to maintain the quality of products. This paper also investigated the effect of runner gating system design optimization in reducing gas porosity. The CT scan of the sample mold is included to compare the relationships between gas porosity occurrence with CFD results. This paper proposed a new runner design named outward curvature runner with an air vent that can improve velocity and temperature distributions in reducing die-casting defects. In addition to that, air vents are installed to extend the volume and promote higher suction, to eliminate gas bubbles entrapment inside the cavity.

Keywords: Porosity occurrence, parametric analysis, numerical analysis, design optimization

1. Introduction

Demand for metal injection molding (MIM) has been increasing for years, the growth is due to the capabilities of this manufacturing process to produce complex products while minimizing waste [1]. The advancement in technology and industrial revolution progress is important to manufacture die-casted parts economically and effectively in mass production. V-LINE@SYSTEM is a system used in the industrial injection molding process which separates plasticization and injection cylinders, filling the exact volume of molten metal, and providing heat and maintaining temperature for better fluid injection [2]. It is important for the manufacturer to confirm the quality of the die-casting process to minimize casting defects and improve productivity.

1.1 Casting Defects

High-speed injection of molten metal into the cavity in the die-casting process can cause backflow of molten metal which can lead to air bubble entrapment in the melt, forming pores or voids on the surface of the products. The air entrapment causes gas porosity defects in high-pressure die casts. As a result, the product is vulnerable to voids due to poor tensile strength and ductility [3]. Other than that, when the molten metal solidifies inside the mold, it always shrinks in volume. Shrinkage porosity happens when some part of the molten metal with high temperature solidifies

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