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# Relationship between Casting Condition and Gas Porosity in Magnesium Alloy Die Casting

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**Abstract:** Magnesium alloy casting has improved automotive fuel efficiency, usage is expected to become conventional in automobile industry. HPDC is able to cast mass production through high speed and pressure casting, it is widely used for automotive components made of aluminium alloy. However, it causes characteristic defects such as shrinkage and air trapping in the casted parts. As a solution, visualizations such as molten metal flow and non-destructive evaluation has been conducted. In this investigation, a cause and prediction of defects in magnesium alloy die casting was examined with X-ray computed tomography (CT) and computer simulation. The size of specimen was 200 mm x 100 mm, and thickness varies form 4 mm to 16 mm like a ladder-step shape. Overlapping the four test pieces in order to suppress the change in the transmittance with the angle was taken by X-rays. Mold filling processes of the magnesium casting was simulated with the JSCAST. In relationship between gas volume to the thickness of gate, it was confirmed that both variables are dependence. In narrower gate, it was confirmed that molten metal was mainly flowed to the side of cavity and gas volume was reduced. On the other hand, in wider gate, it was confirmed that molten metal was mainly flowed to the center of cavity and filled time was reduced. X-ray analysis and computer simulation comparison confirmed that it was necessary to add the effects of porosity shape and solidified shrinkage into simulation.

**Keywords:** Die casting, X-ray CT, Simulation, Magnesium alloy.

## 1. Introduction

Emission control in the present age where global warming has attracted considerable attention is growing stricter from year to year. A fuel-efficient car which can decrease carbon dioxide emissions is especially desired all over the world. High pressure die-casting (HPDC) process which is realizable as one of the effective means has attracted attention. HPDC is able to cast mass production through high speed and pressure casting, it is widely used for automotive components made of aluminium alloy. However, it causes characteristic defects such as shrinkage and air trapping in the casted parts. These porosities have reduced quality and confidence of products such as strength of components and resistance to air leakage from pressure vessels. As a solution, visualizations such as the molten metal flow [1,2] and non-destructive evaluation have been conducted [3].

In this investigation, a cause and prediction of defects in magnesium alloy die casting was examined with X-ray computed tomography (CT) and computer simulation. The relationship between the molten metal flow of magnesium alloy and gate thickness was investigated in simulation. After better condition from simulation results were casted, the comparison of simulation and X-ray analysis was examined.