THE EFFECT OF NODULARISATION PARAMETERS ON THE QUALITY OF DUCTILE IRON

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Syukur Alhamdullillah to Allah S.W.T for giving me the continuous strength and motivation for completion of this project. Deepest thanks to my family and future family. Linda, I favor you for 3rd time.

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ABSTRAK

Pada dasarnya permintaan produk plastik di negara ini sangat menggalakkan kerana produk plastik adalah setanding dengan produk yang dihasilkan dari bahan yang lain malah produk plastik juga lebih cantik dari segi rupa bentuk serta bermutu. Maka dengan itu untuk menghasilkan produk plastik yang bermutu, produk plastik yang ingin dihasilkan perlu melalui beberapa proses yang sepatutnya terutamanya yang penting sekali ialah pada proses permulaan yang melibatkan proses reka bentuk.

Di sebabkan produk plastik ini boleh dihasilkan dengan menggunakan pelbagai jenis acuan seperti acuan 2-plat, acuan 3-plat, acuan pelari panas dan acuan pelari tertebat maka produk plastik ini perlu dijalankan analisa aliran bahan terhadapnya. Ini supaya produk plastik dapat dihasilkan tanpa kecacatan dan dapat menghasilkan ciri-ciri yang menepati spesifikasi sebenar. Kajian ini menggunakan perisian Moldflow Mold Adviser untuk mengkaji permasalahan terhadap acuan 2-plat dan acuan 3-plat kepada sistem spru, pelari dan get.

ABSTRACT

Demand on plastic product in this country is very tremendous because plastic product has better in quality, design and appearance than any material product. To produce better quality of plastic product, it needs to have some processes and most important is initially in design stages.

Because of that, plastic product can be produced using any different mold such as 2-plate mold, 3-plate mold, hot runner mold and insulated runner mold. Material flow analysis should be running to the plastic product to ensure no defect and follow the characteristics from actual specification. This project is using Moldflow Mold Adviser software to analyze the problems for 2-plate mold and 3-plate mold, which are dependent on sprue, runner and gate system.

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INTRODUCTION

1.1 Background

Application of ductile iron continues to increase over the years. It is due to its ease of recycling, relatively low cost production and producing capability with a wide range of microstructure and mechanical properties.

Ductile iron is born from continuous research done towards cast iron. The characteristic for both of iron is differing much. While cast iron is simply known as brittle with graphite flake microstructure, ductile iron is ductile and held the advantages of uniform distribution of nodule graphite microstructure. It offers a combination of strength, fatigue resistance, toughness and ductility in addition of famously advantages of cast iron – machinability, castability and economic of production.

The production of ductile iron means for adding magnesium to molten metal. There is four common techniques classified; transfer method (open ladle addition, sandwich, trigger process), plunging method, injection method and pressure ladle or pressurized chambers method. Because of fading problem, in mould method was developed in which metal is inoculated as it poured into the casting or within the actual running system of the casting itself.

In mould method is classified as late inoculation technique offers advantages of virtually elimination of fading problem, lower increasing of silicon content in molten metal, effectively preventing the formation of carbide and greater consistency of structure uniformity.

Inoculation mechanism for in mould differs to great extent from other techniques. For example, during addition of nodularizing alloy to the iron inside the mould, the resulting high pressure of magnesium vapor may damage the mould itself. Otherwise, the vapor entrapped in the mould cavity may lead to the formation of incomplete castings.

The injurious effect of nodularization can be screening by using nodularizing alloys with relatively low magnesium content. But, the decrease of magnesium content in alloying agent may contribute of higher percentages alloy used which leading to yield decreasing. To make matter worse, the probability of partially undissolved alloy after filling the mould may occurs. Therefore the percentage and size of nodularizing alloy should be carefully applied in conjunction with the temperature and pouring rate of the molten metal, in order to successfully complete the inoculating process inside the mould.

With it, confirmation of parameters influence such percentage of nodularization agent used towards casting mechanical properties is worth to study for. Other than that, control factors such the particle size of nodularization agent, distance reactive from reaction chamber, and influence of casting cavity for effect of nodularization was also investigated. Hence, with the right combination of control factors, microstructure of the casting cavity as well as the mechanical properties of selected range can be predicted.

1.2 Importance of research

This research will deepen the knowledge of specific processing properties and parameters of ductile iron. Successfully discovered the main effects, interactions between parameters and significance parameters will enhance the understanding of in mould treatment for processing ductile iron.

1.3 Problem statement

There is a need to establish a clear understanding the effect of nodularisation parameter on the quality of ductile iron using in mould method. The controlling parameters affected nodularisation and mechanical properties will be the priority to identify its reflected variables.

1.4 Objectives of the study

The project is aimed at;

i. Determine the effect of percentage of nodularisation agent, runner distance and component size on nodular count in ductile iron, and

ii. Established the mechanical properties and material characterization of the ductile iron produced from the in mould treatment method.

1.5 Scopes

i. The grey iron treated was of a FC 450 normally used in automotive industry.

ii. The method that was employed in treating grey cast iron is the ‘in the mould treatment method.’

iii. The sand casting process was used in casting of the ductile iron.