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Enhancement Mechanical Properties of CI200 Material using Magnetic Field

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Abstract

The casting method is one of the primogenital methodologies involving squeezing and jolting the green sand used as molding material and further was established with the use of binders such as clay or organic resin. The constant search for innovative molding material leads to the magnetic process parameters i.e. magnetic field. The preliminary trials on one of the process parameter i.e. magnetic field were carried out and the input parameter for the magnetic mold was optimized. In this work CI200 cast iron has been used for the melting casting route using a furnace and the molten metal is poured into a magnetic mold in terms of altering voltage 60 Volts, 100 Volts, and 150 Volts provide to mold. CI200 casting in magnetic mold and also the espousal of magnetic field for boosted mechanical property. The CI200 casting produced from the magnetic mold was subjected to mechanical tests i.e. strength and Percentage elongation and data compared with the casting of the same composition made in sand casting. It observed that the tensile strength of CI 200 was found that 137.2424 MPa without magnetic field and with magnetic field 195.5463 MPa for 60 Volts, 216.3047 MPa for 100 Volts, and 237.3373 MPa for 150 Volts respectively the tensile strength obtained from CI200 casting made in an increasing magnetic field increase tensile strength The result suggests that casting of magnetic mold material will higher properties as compared to conventional sand casting material.

Keywords: *Casting, CI200, Magnetic field, Mechanical Property*

1.0 Introduction

The Casting is one of the elementary methods, but the components produced by the casting process invariably have flaws. Casting is used as a production technique in almost every industry, either directly or indirectly[1]. There is a need in the casting process for reducing casting defects and improving mechanical properties using various methods[2-5]. When considering the casting process, several parameters must be observed, as the material's properties can fluctuate[6-9]. To progress the quality of casting the type of other molds like metal mold, no-bake sand mold, shell mold, etc. are being employed[10,11]. Therefore, the focus should be on assessing the best method that yields the best results in terms of property. There is major potential for modifications in the casting process to adopt new processes and technologies that can increase the mechanical properties of the product[12-14]. Even slight modifications in the casting process can significantly change the properties of the product[15]. In this context, the development of magnetic mold with the application of magnetic field finds popularity. The intensity of the magnetic field depends on the voltage supply so here we are varied voltage for producing a magnetic field which

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is 60 Volts, 100 Volts, and 150 Volts. The casting has been obtained by melting CI 200 alloy in the furnace. Further casting is produced in die molds. The casting has been characterized for tensile strength which is compared with sand casting which is the conventional method.

2.0 Materials

In this experimental work, we are selecting CI200 material with a composition where carbon varies from 2.95 to 3.45%, silicon ranges from 2.10 to 2.90%, manganese is between 0.55 to 0.75%, sulfur is 0.04%, and phosphorous is 0.10%. The tensile strength of the material is 207 MPa.

3.0 Experimental Procedure

The Hollow cylinder taken in which is surrounded by copper wire winding whose number of turns is fixed which is 15 turns and given voltage to winding is changing like 60 Volts, 100 Volts and 150 Volts by using dimmer.

As per the experimental setup, it consists of copper winding wound around a mold. Dimmers are used to change the voltage, thereby varying the magnetic field. Electric supply is provided to the mold through the copper winding, resulting in the generation of magnetic fields that vary with the dimmer.

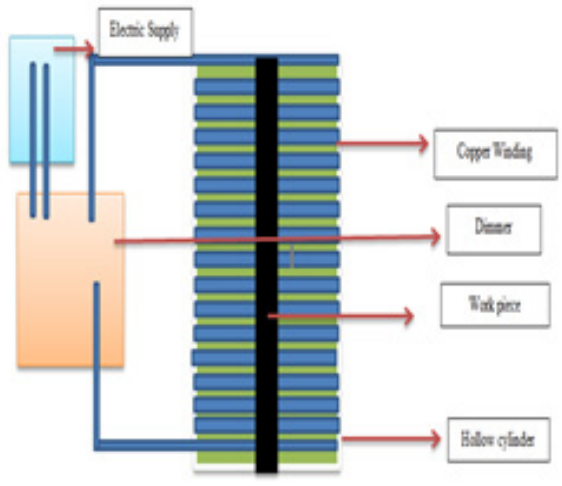

Figure 1. Schematic Diagram of Magnetic Moulding Setup.

Figure 2. Magnetic Mold with Dimmer.

4.0 Result and Discussion

When liquid metal was poured into the magnetic mold, the magnetic flux intensity is generally higher near the coil and gradually decreases towards the center of the coil. When magnetic flux intensity is higher, initial nucleation occurs. As long as the intensity is higher nuclei are broken up into small fragments near the mold wall convection of a higher magnetic field, with magnetic field intensity gradually decreasing towards the center leading to grain growth. When the magnetic flux intensity increased from 60 Volts, 100 Volts, and 150 Volts, the higher intensity, enhances the thermal conductivity and leads to grain growth. The tensile strength of magnetic mold casting is 195.5463 MPa at 60 Volts, 216.3047 MPa at 100 Volts, and 237.3373 MPa at 150 Volts for die casting. The Tensile strength without a magnetic field is 137.2424 so the magnetic mold casting has tensile strength almost 72.93 % times higher than the sand casting. This is due to the refined grain structure of magnetic mold where in the number of grain boundaries inhibit the dislocation movement leading to enhance strength.

5.0 Conclusion

The important finding that from this investigation can be as follows

- The Magnetic mold assembly has been designed and established.
- The CI200 cast produced in the magnetic mould has shown much improved mechanical property over sand casting. Tensile strength was improved by 72 percentages over sand casting. Where we

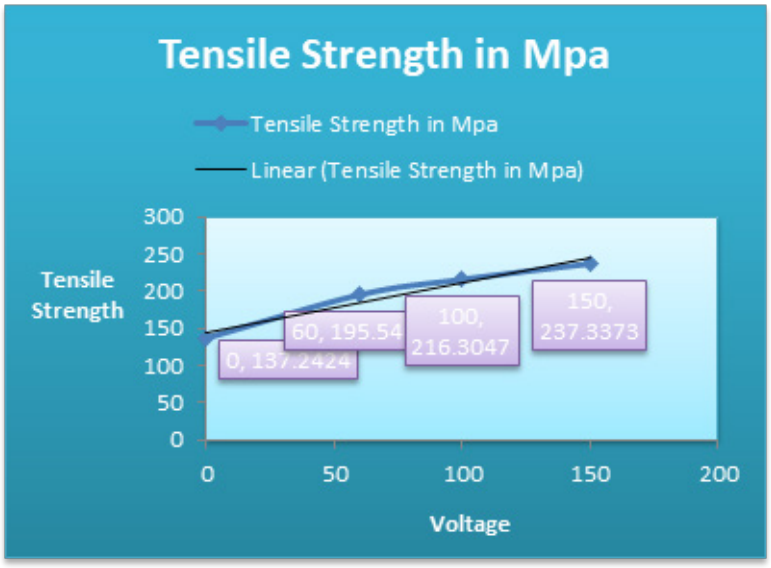

Figure 3. Tensile Strength Vs Voltage.

concluded that increasing magnetic intensity increasing tensile strength

- It was also observed from work that change in magnetic field strength has an effect on the mechanical properties. When the field strength is varied from 60V to 150V tensile strength better over sand casting.

The use of magnetic field to produce casting has shown excessive promises and an attempt may be made obtain these casings in the field more properties in the future.

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