

Introduction of Sand Casting Process- An Overview

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Abstract - DISAMATIC is associate automatic assembly line used for quick manufacturing of flaskless sand moulds for inexperienced sand casting. This methodology is typically accustomed mass manufacture of metal castings for the automotive and machine business. Sand castings methodology is susceptible to get some defects resulting in high rejection rates. An industrial plant that produces within ball rejection is taken under consideration to be ancient whereas the quality these days is anticipated to evolve per million defects. So management of defects has become a vital issue for the industrial plant industry. Sand castings methodology is susceptible to many defects resulting in high rejection rates. An industrial plant that produces within ball rejection is taken under consideration to be ancient whereas the quality these days is anticipated to evolve per million defects. So management of defects has become a vital issue for the industrial plant trade. The purpose of this paper is to optimize the sand casting methodology parameters of the castings store-bought in many industries.

Key Words: Sand casting, Pattern, Molten metal, Sands, Sand molds, Sand casting operation.

1. INTRODUCTION

Sand casting is traditional methodology of producing that used sand as a refractory medium to extend the standard of the casting. Sand casting involves melting metal and pouring it into a mould cavity shaped by impression of the pattern. This pattern is sort of an equivalent dimensions as of the ultimate sized model. A small tolerance is given by enlarging to account for shrinkage and machining allowances within the final casting. Its form resembles the form of the specified product. During this cavity, the molten metal is poured and allowing the metal to cool until it solidifies. This coagulated one half part is taken out of the mould, and cleansed then finished by machining processes to create it appropriate to be used. Here the sand used is named green sand. Its composition includes 90% base sand, 7% binder and 3% clay.

2. Literature review

Sunil Chaudhari, Hemant Thakkar [1] they found the various simulation techniques and software are the benefit for industry. It provides number of advantages such as high quality of surface, reduce different types of defects. If casting using some technological way minimize the defect in casting.

Sagar M Baligheid, N Krishnamurthy [2] classified the advantages of rapid prototyping used in the sand casting process for getting more dimensional and surface finish. The rapid prototyping get less lead time to manufacturing product.

Lal Narayan Pandey, [3] Using taguchi method to reduce the defects occurs in sand casting process. Taguchi methods that factor which will be reduce different defects.

Bhushan Shankar Kamble [4] it reviews that in some small foundry had not standardized process for sand casting. The systematic work will be benefits of improving the quality of product.

Sameer Rafiq Shah [5] Sublime sand casting method is generally used in different types of manufacturing for making machine parts like gear, helical spring, torsion spring, conical spring.

Manikanda Prasath K, Vignesh S [6] the sand casting have application and advantages would be remarkably elevate. The sand casting process will be the first preferred than other process in casting.

Manpreet Dubey, Abhishek Sharma [7] the paper is review that is fully analyzed that the process of sand casting with their application and background. The advancements are making major role in increase the production rate.

Nishant Hawaldar, Jing Zhang [8] they classified difference between conventional sand casting process and 3D printed mould sand casting process. For reduce the lead time and wastage of materials.

Cindy Sithole, Kasongo Nyembwe [9] the sand casting it is important for industry to making a large production. By using six sigma methodologies the industry will be reduce defects in sand casting.

I Rajkumar, N Rajini [10] the feeding system is use to minimize the unrest through proper location of parts. By simulation reduce the lead time required to sand casting process.

Wossenu Ali [11] by analysis the different defects the main reasons for this use previous sand and high percentage of clay content.

Aniket Nargundkar, Apoorva Shasri [12] the paper is reviewsthat using of different combination of sands with their different properties for improving the quality of product.

Vishwas Mehta, Atharva Kulkarni, Rohan Mahale [13] by using 3D model and visual simulation in casting filling process they make high accuracy and visibility occurs in the sand casting process.

S Dhanush, S Balaganesh [14] it found the single method/technique is not sufficient for different types of parts, objects, and products. By using different techniquereduce the defects occurs in sand casting.

S Prashanth, Dr.T.Sathish, Dr.R.Venkatesh [15] by performing different experiments they found the moisturecontain in sand will make major role of casting defects.

3. Process of sand casting

3.1 Sand Preparation = Prepare sand and core sand for molding, generally using a sand mixer to mix the used sandand the right amount of clay.



Fig-1 Sand mixer

3.2 Pattern making = Molds and core boxes are made according to the part delineations. Generally, we can use rustic molds for single corridor product, plastic or essence molds for mass product, and pattern plates for large castings. Currently, molds are made by drawing machines, so the product cycle is docked significantly, and it could take 2 to 10 days for mold.



Fig-2 Pattern Making

3.3 Molding = sand molding, core making, and mold fitting are the main features in the molding. Sand molding means forming the depression for the casting from the molding sand. Core making refers to the product of the cores, which are used to form the internal shape of the casting. Mold fitting is the assembly of the upper and lower sandboxes after the cores has been placed inside the cavity. Molding is a pivotal part of the casting process.



Fig-3 Molding

3.4 Melting= the chemical composition needs to match the needed essence. A suitable furnace is named to melt the amalgamation material to form a good liquid essence (piece and temperature of the molten essence must misbehave). Melting adopts cupolas or electric furnaces (due to environmental conditions, cupolas have substantially got outlawed).



Fig-4 Furnace

3.5 Molten Essence Pouring= the molten essence from the electric furnace is poured into the earth using a spoon. The speed of pouring is critical to insure that the molten iron fill the entire depression. It's also dangerous to pour the iron, so be careful.



Fig-5 Molten metal

3.6 Sand Removal= after the molten essence solidifies, take a hammer to remove the sprue and shake off the beach from the castings. The castings are also blasted with a sandblaster to give a clean surface. The casting blanks are ready to leave the plant after examination.



Fig-6 Sand removal

3.7 Grinding = for castings with special conditions, or where the face of the casting blanks cannot be over to anticipation, simple grinding. And grinding is generally done with a grinding wheel or grinder to remove churrs and give the casting a better finish.



Fig-7 Grinding

3.8 Inspection = generally, during the cleaning and grinding phases, non-conforming castings have been picked out. But still, final examination is needed. And for castings with assembly conditions, we need to make a set of tools or through-stop needles for review to insure no problems with the assembly. [6] [8] [9]



Fig-8 Inspection

4. Types of sand molds

Sand molds are characterized by the type of sand that comprise them and by the method used to produce them. There are three basic types of sand molds.

4.1 Green sand = the most common mold material is green molding sand, an admixture of sand, clay, and water. The term "green" refers to the fact that the sand in the mold is moist or damp while the metal is poured into it. Green-sand molding is the least precious system of making molds, and the sand is reclaimed fluently for after reuse. In the skin-dried system, the mold surfaces are dried, either by storing the mold in air or by drying it with firebugs. Because of their advanced strength, these molds are generally used for large castings. [5]

4.2 Cold box molds = in the cold-box mold process, various organic and inorganic binders are blended into the sand to bond the grains chemically for lesser strength. These molds are more dimensionally accurate than green-sand molds, but are

more precious to make. In the single mold process, a synthetic liquid resin is mixed with the sand, and the admixture hardens at room temperature. Because the cling of the mold in this and in the cold-box process takes place without heat, they're called cold-setting processes. [7]

4.3 No bake molds = No bake molds could be a casting method that involves the utilization of chemical binders to bond the molding sand. Sand is sent to the mold filler station in prepared for fill of the mold. A mixer is employed to mix the sand with the chemical binder and catalyst. Because the sand exits the mixer, the binder begins the action of hardening. This technique of mildew filler is used for every 1/2 the mold (cope and drag). Every mold is additionally compacted to create a robust and thick mold. [13]

5. Defects

Various defects can develop during manufacturing, depending on factors such as raw material quality, mold design and control of machining parameters. While some defects only affect the appearance, others can have a major negative impact on the structural integrity of parts made.

5.1 Misruns = Misrun is a kind of casting illness that happens whilst the metallic is not worthy to fill the mould melancholy and consequently leaves the unfilled element with inside the mould melancholy. [1]

Causes:

- i. The molten metallic might also additionally have decrease fluidity.
- ii. The temperature of molten metallic is low.
- iii. Pouring velocity is slow.
- iv. Cross segment of the mould melancholy is thin.

Remedies:

- i. The pouring temperature has to be excessive.
- ii. Gating machine has to be modified.

5.2 Inclusions = When the metallic is melted, the flux is brought to it so that you can take away the unwanted contaminations and oxides found in the metals. During the time of tapping, the sediment have to be assets eliminated else if it mixes with molten essence, additionally it reasons a disfigurement referred to as inclusions. Also there are various different motives that are accountable for sediment conformation. These reasons are referred to below. [10]

Causes:

- i. Indecorous gating machine.
- ii. Improper pouring of molten metallic and soft ramming and core sand quality and indecorous flux.

Remedies:

- i. Modifying the gating machine and pouring method and Use the right flux.
- ii. Proper ramming of sand has to be finished.
- iii. Superior sand has to be used.

5.3 Cold shut = When the quantities of the molten essence influx together, there is a loss of emulsion among them because of unseasonable solidification. This disfigurement in casting is referred to as bloodless shut. [4]

Causes:

- i. This illness might also additionally do because of loss of fluidity of molten metallic.
- ii. Faulty design and decrease pouring temperature of essence.

Remedies:

- i. Design of the gating machine has to be amended.
- ii. Maintaining the superior pouring temperature of molten metallic.

5.4 Shrinkage hollow space = This illness is induced because of melancholy with inside the shell with inside the casting that is because of solidification loss that restricts the amount of liquid metallic to be had with inside the final area to concrete. [11]

Causes:

- i. This happens because of a faulty gating machine.
- ii. Also because of incorrect chilling.

Remedies:

- i. Gating machine has to be refined.
- ii. Chilling machine has to be modified.

5.5 Blow holes = Blow holes are like small cavities in a casting. The holes that seem at the floor of the metallic casting are called open blow holes. While the holes which do with inside the metallic casting are termed as blow holes.

Causes:

- i. This illness happens because of inessential moisture content material with inside the molding sand.
- ii. It happens because of low permeability of seashore and excessive first-rate grain sand.
- iii. Excessive binders additionally reason this illness in casting and improper baked cores additionally cause this illness.

Remedies:

- i. Moisture content material has to be regulated and Cores have to be baked properly.
- ii. Cores and moulds have to be vented properly.
- iii. Binders have to be used with inside the preferred amount.

5.6 Porosity = the porosity is a pin holes kind illness visible within side the casting. This illness is likewise referred to as fuel line porosity as hydrogen fuel line is accountable for this defect. Generally the gases continue to be absorbed through the molten metallic. [14]

Causes:

- i. This illness happens because of low permeability of the molding sand in addition to excessive moisture content material gift within side the sand.
- ii. Gases dissolved in molten metallic also are responsible and excessive pouring temperature is accountable for porosity.
- iii. This illness might also additionally do because of decrease amount of flux utilized in molten metallic.

Remedies:

- i. Increase the share of flux.

- ii. Proper venting have to be finished and moisture content material of the molding sand have to be reduced.

5.7 Swells = Sometimes because of excessive stress of the molten metallic, the mould will amplify slightly. Because of this the dimensions of hollow space will increase and so the very last casting can be bulgy at that point. This illness is referred to as swells. [15]

Causes:

- i. Soft ramming reasons this illness and low electricity of sand cores.
- ii. Mold is not supported correctly.

Remedies:

- i. Harder ramming has to be finished.
- ii. Strength of mould and sand cores has to be increased.
- iii. Proper aid has to be provided to the mould.

6. Conclusions

In moment's global completion, it's important for foundry to concentrate on process enhancement to increase competitive advantage. Competitive advantage for sand casting foundries means advanced product process, bettered plant conservation processes, bettered product quality and proper operation of resources, especially scarce resources. Process knowledge could be truly critical for sand casting foundries to palliate its limitations compared to other substance manufacturing ways. This paper aimed at defining process knowledge of the sand casting. Thus sand casting process is useful to manufacture intricate, irregular and tough shaped casting products. And the castings so produced have high dimensional delicacy, good surface finish, no residual stresses and superior mechanical properties. All in all, it can be concluded that sand casting is one of the most important methodologies to produce the metallic corridor and structures, still, a better understanding and thereby a well- conditioned control of sand casting is still required.

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