Analysis of Casting Defects in Small Scale Industry – A Review

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Abstract- *Casting is a manufacturing process extensively used for producing quality products for many engineering applications. Casting is a process which carries risk of failure occurrence during all the process of accomplishment of the finished product. Hence necessary action should be taken while manufacturing of cast product so that defect free parts are obtained. Mostly casting defects are concerned with process parameters. Hence, one has to control the process parameter to achieve zero defect parts. For controlling process parameter one must have knowledge about effect of process parameter on casting and their influence on defect. Some foundries are working with trial and error method and get their work done, most of the foundries have very less control on rejections.*

Keywords- Casting, Sand casting, Defects, Quality improvement, Quality control

I. INTRODUCTION

Foundry industries needs to perform efficiently with minimum number of rejections. Also they have to develop casting components in very short lead time. Casting process is state of art with experienced people, but these experience needs to be transformed in engineering knowledge for the better growth of the foundry industries.

To obtain this all knowledge about casting defect, their causes and defect remedies one has to analyze casting defects. Analysis of casting process is to find root causes of occurrence of defects in the rejection of casting and taking necessary steps to reduce the defects and to improve the casting.

III. CASTING DEFECTS

A. Blowhole

Blowhole is a cavities defect, which is also divided into pinhole and subsurface blowhole. Pinhole is very tiny hole. Subsurface blowhole only can be seen after machining.

B. Sand burning

Sand burning is also called as Burning-on defect, which includes chemical burn-on, and metal penetration. The defect occurs due to thick walled casting and at high temperatures.

C. Gas Porosity

Gas can be trapped air present in the cavity before the molding. It can easily be trapped as the metal starts to fill the cavity. Air is compressed more and more metal streams into the cavity and the pressure rises. When cavity is full it becomes depressed as small spheres of high pressure air.

D. Mismatch Defect

Mismatch in mold defect is because of the shifting molding flashes. It will cause the dislocation at the parting line.

E. Flash Defect

Flash defect is any unwanted excess match which comes out of the die attached to the cavity or runner. It forms a thin layer of metal at the parting faces.

F. Shrinkage

Shrinkage defect occur when feeding metal is not available to compensate for shrinkage as the metal solidifies.

G. Incomplete casting

Incomplete casting defect occurs due to short of poured. Portion of the casting is missing.

III. LITERATURE REVIEW

Table 1 Literature Review

Research Paper Title	Journal/ Year	Author	Remarks
Review on analysis of foundry defects for quality improvement of sand casting	International Journal of Engineering Research and Applications, March 2014	Sunil Chaudhari, Hemant Thakkar	• The sand process parameters should be decided experimentally depending on quality of sand. We should not select these parameters directly from other manufacturers.
Process Simulation of Die Casting	Lecture on Process Simulation of Die Casting, IIM Delhi Chapter, New Delhi, November 2011	Er. Sunilkumar Baghla, Dr. Jatinder Madan, Dr. Ravindrakumar Saxena	• Due to the absence of mesh, mesh free methods are better than finite element based method, thus eliminating the problems due to mesh entanglement and mesh distortion in the approximation function.
Defects, Causes and their remedies in casting process	International Journal of Research in Advent Technology, March 2014	Rajesh Rajkolhe, J. G. Khan	• Rejections of the casting on the basis of the casting defect should be minimized
Improving Quality of Sand Casting using Taguchi method and Ann Analysis	International Journal on Design and Manufacturing Technologies, January 2010	Lakshmanan Singaram	• The ANN technique has been shown as an effective method to model the complete relationship between the control factors and the quality index, casting defect.
Analysis and Validation of Sand casting process Using Procast	Journal of Basic and Applied Engineering Research, January-March 2015	Surinder Pal, Ajay Gupta, Rahul Kapoor	• Pro-CAST analysis isquite nearer to Experimental results.
Simulation of Die casting Process in an Industry helical Gearbox Flange Die	International Journal of Mechanical, Aerospace, Industrial Mechatronics and Manufacturing Engineering, 2014	Mehndi Modabberifar, Behrouz Raad, Bahman Mirzakhani	•The mechanical strength of final part increases by increasing molten metal injection pressure and decreasing Injection nozzle cross-sectional area.
Minimization of casting Defects using casting simulation Technique and Casting Defect Analysis using design of Experiment	International Journal for Research in Applied Science and Engineering Technology, June 2015	Atul A. Bhujugade, Vijay B. Sabnis	• Analysis of defects like shrinkage porosities computer aided casting simulation technique is the most efficient and accurate method • Rejection of casting due to sand related defects and pouring practices related defects is reduced with the help of taguchi optimization method
Design and Development of Clamping and Ejection Systems for Mould used on Gravity Die Casting Machine	International Journal of Engineering Research and Technology, October 2013	Vikas Sharma, Om Prakash Shukla	• Maximum time consumption in clamping and declamping, • more time consumption in leveling process due to casting deformation at the time of ejection • No wear and tear of

			casting due to hydraulic cylinder friction • Time reduction with the help of ejection assembly and guide fixture

IV. RESULTS AND DISCUSSION

Table 2 Results

Name of Defect	Causes	Remedies
Blowhole	• Inadequate core venting • Excessive release of gas from core • Excessive moisture absorption by the cores • Low gas permeability of the core sand	• Improve core venting, provide venting channels, ensure core prints are free of dressing • Reduce amounts of gas. Use slow-reacting binder. Reduce quantity of binder. Use a coarser sand if necessary. • Apply dressing to cores, thus slowing down the rate of heating and reducing gas pressure. • Dry out cores and store dry, thus reducing absorption of water and reducing gas pressure.
Sand Burning	• Lustrous carbon content too low • Proportion of low-melting-point substances too high • Uneven mould compaction	• Increase proportion of lustrous carbon producer. This in-creases the amount of coke as well as the amount of lustrous carbon, which then results in positive separation between mould and metal. • Use purer silica sands or, if necessary, add new sand. Reduce dust content. If necessary, reduce the amount of bentonite. • Ensure uniform compaction. If necessary, increase heat removal from the moulds.
Gas Porosity	• Break-up of mould sections during stripping of patterns, core setting or assembling of moulding flasks • Uneven compaction of moulds, compaction too high in places.	• Check moulds for pressure marks and, if necessary, insert pressure pads • Carefully blow out mould cavities • Improve pattern plates, increase pattern tapers and radii. Heat pattern plates and, if necessary, use release agent.
Mismatch Defect	• A mismatch is caused by the cope and drag parts of the mould not remaining in their proper position. • This is caused by loose box pins, inaccurate pattern dowel pins or carelessness in placing the cope on the drag.	• Check pattern mounting on match plate and Rectify, correct dowels. • Use proper molding box and closing pins.
Flash Defect	• Damage to die faces and die components • Parts of the die have insufficient strength • Bending, crowning of stretching of dies • Cavities offset from Centre of platen • Insufficient machine clamp-up	• The solution here is very simple: weight down the mold
Shrinkage	• The density of a die casting alloy in the molten state is less than its density in the solid state. Therefore, when an alloy changes phase from the molten state to the solid state, it always shrinks in size.	• The general technique for eliminating shrinkage porosity is to ensure that liquid metal under pressure continues to flow into the voids as they form.
Incomplete Casting	• Insufficient quantity of liquid metal in the ladle. • Premature interruption of pouring due to workman's error.	• Have sufficient metal in the ladle to fill the mould, Check the gating system. Instruct pouring crew and supervise pouring practice.

V. CONCLUSIONS

By referring different research paper different casting defects are studied and they are listed as above. Quality Control Department of casting Industries may use the same analysis to reduce casting defect and improve the productivity.

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