A Technical Review on casting defect in Shift arm

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ABSTRACT

In current scenario, in most of Casting industry, in manufacturing division major challenge is to reduce the casting defects and bending of casting component. A shift fork is a forked end metal lever that straddles a manual transmission gear shaft. Its purpose is to slide gears into or out of engagement with other gears in order change from one gear ratio to another in a manual transmission. Manufacturing of shift arm faces certain defects from which required dimensions of shift arm is not obtained. In order to increase the productivity and to prevent casting defect certain changes need to be made.

This technical review paper deals with various defects in casting process for the manufacturing of shift arm with its remedies. The results of the various researchers in same field have been analysed and studied.

Keywords: - *Shift arm, casting defect, productivity, bending, fork arm.*

1. INTRODUCTION

Shift arm is used for transmitting power in automobile. A Shift arm, is also known as shift fork or gear fork.
Shift arm is generally a metal lever which is attached to the shift assembly in a manual transmission equipped automobile and it is used for changing gears.
Defects are defined as conditions in a casting that must be corrected or removed, or the casting must be rejected. Defects are basically of four types: Filling related defect, Shape related defect, Thermal defect, Defect by appearance.
The gear shifter manufactured out of lost foam casting observes bending defect which leads to rework and that in turn reduces the productivity.

2. LITERATURE REVIEW

(1)

Rajesh Rajkolhe et. al discussed about foundry industries in developing countries suffer from poor quality and productivity due to involvement of number of process parameter. 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.
To obtain this all knowledge about casting defect, their causes, and defect remedies one has to be analyse casting defects. Casting defect analysis is the process of finding root causes of occurrence of defects in the rejection of casting and taking necessary step to reduce the defects and to improve the casting yield. [1]

(2)

C.W. Hirt has carried out and experiment that shows the comparison of computation results with carefully performed experiments that FLOW-3D does an excellent job of identifying probable defects in lost foam castings.

Furthermore, the computational results provided by FLOW-3D have been shown to give useful insight into the origin of defects, which can then be used as the basis for making improvements in the process. [2]

(3)

L. M. JUGULKAR et. al have done analysis on Pareto principle and cause effect diagram are used to identify and evaluate different defects and causes for these defects responsible for rejection of components at different stages of manual metal casting operations. The correct identification of the casting defect at initial stage is very useful for taking remedial actions. This paper presents the systemic approaches to find cause of defects occurred due to manual operations. So finally, it was found that the manual metal casting operations are done with some negligence and carelessness. So, by suggesting some other remedial issues and by implementing possible of them reduces total rejection more than 30%. If suggested remedy of automation will be implemented it reduces all defects more than 70%. This systematic study proves that by means of effective analysis of tools and processes, it is possible to control the casting defects. [3]

(4)

Samuel B. Assfaw et.al conducted an experiment and found out that if the matrix of the variables that produce good result can be applied by Akaki Basic Metals Industry (ABMI), there will obviously be a substantial saving in the cost of production. Finally, the conducted experiments, it is clearly evident that the trail of experiment is the better combination of the parameters like sand binder ratio, mold permeability, pouring temperature and de oxidant amount are the leading parameters for optimizing the process in order to minimize the casting defects. The future scope of this experiment can further guide in selecting the various combinations for the process with mode trails can help in minimizing the defects of castings. [4]

(5)

Bihari AK et. al emphasised on the production of near net shape components has further stimulated the growth of the investment casting industry in recent years. Since the investment casting process is relatively complex and expensive compared with other casting processes. Initially, a schematic flow of the main processes is provided; afterwards the main processes are discussed in more detailed manner with their manufacturing methods and product specifications. These concepts are indispensable to introduce the discussion on the critical parameters for investment casting process and some proposal to implement a few new methods for quality assurance of the processes and products. [5]

(6)

Saparudin Ariffin et. al have verified the accuracy of the simulation model, the computer predictions are compared with the experimental result. It shows that there is excellent agreement between computer predicted and the actual defect on the casting part. From the simulation result, potential porosity locations were identified at the edge of conical chamfer, especially if there is diameter changing along the casting part. It was proved by Non-destructive analysis that the defects occur at the same predicted locations and presence as shrinkage porosity. [6]

(7)

T. R. Vijayaram et. al discussed that Metal casting industries are actively involved to reduce scrap rejection and rework during manufacturing process of the components, to achieve this, the production concerns must follow the quality control procedures correctly and perfectly without any negligence. Timely implementation of the modified techniques based on the quality control research is a must to avoid defects in the products. In this review paper, some of the solutions and quality control aspects are explained in a simplified manner to eliminate the unawareness of the foundry industrial personnel who work in the casting manufacturing quality control departments. Besides, statistical quality control (SQC) is also highlighted to understand its recent application and techniques adopted in the developing metallurgical engineering foundries. [7]

(8)

A. Alagarsamy observed that foundries are still using trial and error methods to solve casting problems. There are benefits to using a more disciplined approach to define, identify and determine the root cause of a defect. Use of international standard defect codes for classifying the defects is illustrated. Powerful techniques such as defect mapping, questioning to narrow down the root causes and design of experiments to identify and control the variables are explored. [8]

(9)

Dr. R.G Mench et. al studied the design of experiment and FMEA techniques which are combined to analyse casting defects. Casting Defects can be minimized with optimal level settings of process parameters. Pareto

principle is used to identify and evaluate different defects and causes for these defects responsible for rejection of components at different stages of manual metal casting operations. The correct identification of the casting defect at initial stage is very useful for taking remedial actions. [9]

(10)

Abhijeet B. Vante et. al have discussed that quality control tools and Quality standards such as KAIZEN, 7QC TOOLS, and TPM etc. for reducing rejection rate of castings and thus improving quality of casting by better control is important. [10]

(11)

C. M. Choudhari, et.al, have stated that various casting defects can be minimize by simulation software basis, software helps to improve quality of casting process and parameters. Utilization of methodology which involve four decision (1) orientation and parting line, (2) core print design, (3) feeder design, and (4) gating design. Experiment are performed for process by trial basis with help of simulation software which optimize faster and better result. It helps to minimize the bottleneck and non-value-added time in casting development as it reduces the number of trail for casting required on shop floor. [11]

(12)

G. K.Sigworth concluded the concept of quality for improvement in aluminium casting which combination of strength and elongation possible in heat treated casting with the help of numerical value index. The concentration of casting defects was generating while molten material flow in mold. For getting defects free casting, the solidification rate is considered as important function, because it determines the size and amount of micro porosity (brittle phase) of component in casting. In solidification time molten material in die freeze quickly and concentrate high content of gas on different thickness which effects on tensile property. [12]

3. OVERVIEW OF RESEARCH PAPERS

- The systemic approach is used to find cause of defects occurred due to manual operations with help of Pareto principle.
- For controlling process parameter, one must have knowledge about effect of process parameter on casting and their influence on defect.
- To identify probable defects in lost foam castings FLOW-3D is best.
- Timely implementation of the modified techniques based on the quality control research is a must to avoid defects in the products
- Powerful techniques such as defect mapping, questioning to narrow down the root causes and design of experiments to identify and control the variables are explored.
- Quality control tools and Quality standards such as KAIZEN, 7QC TOOLS, and TPM etc. are used for reducing rejection rate of castings.
- Casting defects can be minimized by simulation software.
- For getting defects free casting, the solidification rate is considered as important factor.

4. CONCLUSION

- With the help of FLOW-3D software, defect mapping technique and Pareto principle casting defects can be minimized.
- Quality tools and Quality standards such as KAIZEN, 7QC TOOLS, and TPM should be used for production so as to minimize he rejection rate.
- Industries should adapt new technologies and techniques to avoid casting defects.
- Solidification rate is to be kept in mind for obtaining defect free casting.

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