

## Formation and Control of Defects in Iron Castings



Engineering

KEYWORDS :

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### ABSTRACT

*Casting, one of the oldest manufacturing processes, dates back to 4000 B.C. when copper arrowheads were made. Casting processes basically involve the introduction of a molten metal into a mold cavity, where upon solidification, the metal takes on the shape of the mold cavity. Simple and complicated shapes can be made from any metal that can be melted.*

*The objective of this paper is to examine the metallurgical defects which have been found during examination of grey iron castings used to manufacture automotive parts using sand casting. This paper examines some of the causes and cures. The defects type examined are shrinkage and gas defects such as pin and blow holes*

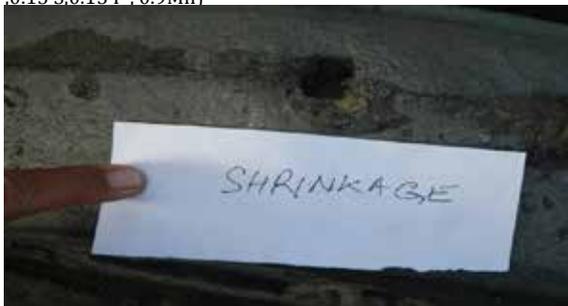
**1. Introduction:** Metallurgical defects in Iron castings can be very costly to foundry because many defects are revealed till the machining stage and the part has to be remade

Casting processes are widely known for their ability to manufacture products with a very attractive interplay of product complexity and dimensional accuracy. Sand casting uses natural or synthetic sand (lake sand) which is mostly refractory material called silica ( $\text{SiO}_2$ ). The sand grains must be small enough so that it can be packed densely; however, the grains must be large enough to allow gasses formed during the metal pouring to escape through the pores. Larger sized molds use green sand (mixture of sand, clay and some water). Sand can be re-used, and excess metal poured is cut-off and re-used also

Cast irons possess widely varying engineering properties and hence are used mostly in automotive casting. The various combinations of low cost with cast ability, strength, machinability, hardness, wear resistance, corrosion resistance, thermal conductivity and damping capacity are unequalled among casting alloys. Cast irons seem to be a simple metal but in its nature there are many mysteries, many, but not all, of these have been solved over the past three hundred years using the combined skill of the foundry men and the knowledge of the scientist to provide today's design engineer with a family of casting alloys that offer a virtually unique combination of low cost and engineering versatility. Therefore foundry practitioners are more concerned with grey Iron castings used in various industries. And this paper concentrates on such defects their cause and remedies.

#### Case Studies 1 :

The castings examined in this case study was an automotive fly-wheel weighing 20 kg grey cast Iron grade FG260 (3.5% C, 1.8 Si, 0.15 S, 0.15 P, 0.9Mn)



#### Shrinkage

Despite of all the controls shrinkage were found at the flange area and the curved wall this indicated insufficient feeding during solidification to compensate for volumetric contraction. After careful investigation it is identified that the riser had solidified before the cope part. In casting when the mould is filled major amount of heat is lost from the bottom part, then from

the side walls and the least from the top part. Therefore top part remains hot for longer time. The solution is to increase the riser size so that hot metal can be fed for longer time and with proper venting facility helping in the release of heat from the cope part.

#### Case Study 2.

The castings examined in this case study was an automotive fly-wheel weighing 20 kg grey cast Iron grade FG260 (3.5% C, 1.8 Si, 0.15 S, 0.15 P, 0.9Mn)



#### Sand Drop

The castings were rejected due to inclusion. To avoid sand drop it was suggested to put little water with the help of wet jute at the junction of the sprue at the cope part so that no sand drop takes place during closing. Casting was found to be alright after such a little effort at the mould closing time.

#### Case Study 3.

The castings examined in this case study was an automotive fly-wheel weighing 20 kg grey cast Iron grade FG260 (3.5% C, 1.8 Si, 0.15 S, 0.15 P, 0.9Mn)



The castings had a problem of cracking interpreted by Die Penetrant Test. The efforts were taken to find the root cause of cracking. After brainstorming it is found that the cracks are created because of section variation that leads to cooling stresses leading to initiation of crack. The section variation is modified uniformly without affecting the working component of casting. The carbon content is also controlled which gives more amount of ferrite that has less strength which may have resulted in crack.

## 2. Conclusion:

A lot of defects are occurring in the foundry may be corrected with careful and logical interventions of the supervisor. It is expected that such systematic documentation would help others to take the correct measures easily.

## 3.Acknowledgment

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