CRACKS IN STEEL CASTING FOR VOLUTE CASING OF A PUMP

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ABSTRACT
Since so many years a problem occurs in KSB Pump Vambori for casting process i.e. cracks occurs in the castings & it is repeated one. Therefore the company has given opportunity to me to solve this problem. In case of steel casting there are mainly cracks & also blow holes induced due to the casting procedure. There are many factors for the casting defects .The factor is uneven material feeding in casting & also due to the mould material & also the core material. These cracks finally break directly the component of the casting i.e. in case of pump the casting component is like Impeller, Volute casing & casing cover.
At the time of feeding of steel material in to the casting the material is in liquid us form i.e. it is hot material & this material is feeding into casting at the time of feeding it develop different region of heat. At one side the temp is high &at other side the temp is low this also produce cracks. To simulate that casting we use the MAGMA SOFTWARE for simulation & validate it using NDT.

KEYWORDS: Centrifugal casting**,** steel material, core box, runner, mould,

INTRODUCTION

The function of casting is to produce component as per the required design & from that design we produce mould as per the design of a casting & also the core can be make. For making the casting there are different terms are required one of that most important is the gating system .the gating system consist of component like runner, in gate, well, sprue, basin which is most important component of gating system.[1]
There are many factors producing the foundry defect therefore the detection of defect is most important factor for analysis of foundry defect. In KSB pumps there is different NDT technique is used for detection of defect. Hence we have to use different condition monitoring technique for detection of cracks. These techniques are like a Radiography, magnetic particle & also acoustic emission. Which are generally used for detection of defect in a casting component? Acoustic emission (AE) can be described as a shock wave inside a material, which is under stress. [2]
The demand for steels with higher strength, ductility and toughness is always increasing. Many alloy additions aim to improve these final product properties by controlling grain size and precipitate formation during rolling operations. Large grain size decreases ductility and toughness, by allowing strain to concentrate at the grain boundaries to form cracks. Alloys often act by promoting a dispersion of very fine precipitate particles, and/or by inhibiting grain growth through these second-phase particles. An unfortunate side effect is a decrease in high temperature ductility and crack formation during the casting process, which is governed by similar mechanisms. [3]
The investigation of aluminium alloy die casting die failures was done with the emphasis on thermal cracks. The aim of the study was to prolong the in-service die life by cladding with maraging steels, which would be economically beneficial. A vast analysis of thermal fatigue cracks in aluminium alloy die casting is done. Immersion test apparatus was developed, which enables simulation of conditions during aluminium alloy die casting and enables controlled thermal fatigue testing of materials. [4]
The thermal aging embrittlement of cast stainless steels (CASSs) is one of the key material property degradation that would limit the long-term operation nuclear power plants. In this study, we investigated the recovery behaviours of thermal aging embrittlement of cast stainless steels (CASSs) by the reversion heat treatment. [5]

LITERATURE

Acoustic emission (AE) can be described as a shock wave inside a material, which is under stress. The shock wave causes the surface of the material to move, and this movement is measured with a very sensitive sensor. The transient elastic wave is generated by a rapid release of energy from a local source within the material.

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The thermal aging embrittlement of cast stainless steels (CASSs) is one of the key material property degradation that would limit the long-term operation nuclear power plants. we investigated the recovery behaviours of thermal aging embrittlement of cast stainless steels (CASSs) by the reversion heat treatment. Two heats of CF8M with different ferrite contents were used and the degree of aging embrittlement was measured by the micro-hardness of ferrite phases.

The design of mixed flow pump impellers of high specific speed is a much tougher than the other types of flow impellers and it becomes more complicated while deciding the blade positioning in the meridional annulus.

METHODOLOGY

3.1. SIMULATION: In case of simulation the KSB Pumps uses simulation software as MAGMA. We made 3D model in UG/Catia/Pro-e & then import that model in to that software. Then we add the geometry perspective for assigning axis & then assign the material for the object for each part that is use for casting i.e. casting material, chill, sleeve & finally for runner. After that we done the meshing perspective for that object that distribute the casting into different material as like a ANSYS .Then we use the definition prospective for assigning material properties, define temperature, define a heat transfer data & pouring time then we use the simulation command . After that we click on result tool bar then we get the temp vs. time graph for fraction solid for fraction liquid, porosity& for hot spot. Continuous casting is a primary method for steel production .The methodcurrentlyaccountsfor95% of the total world steel production. Steelmakers aim at the control of thermal behaviour of cast strands in the casting process as a number of quality and productivity issues (e.g. surface and internal defects) are caused due to improper setup of the mould and/or of the secondary cooling. Monitoring of the strand temperature and thermal stress is rather difficult to perform owing to high temperature sand severe environment. Pyrometers for the surface temperature measurement and they reported a substantial fluctuation of measured temperatures, which makes the measurement inapplicable.

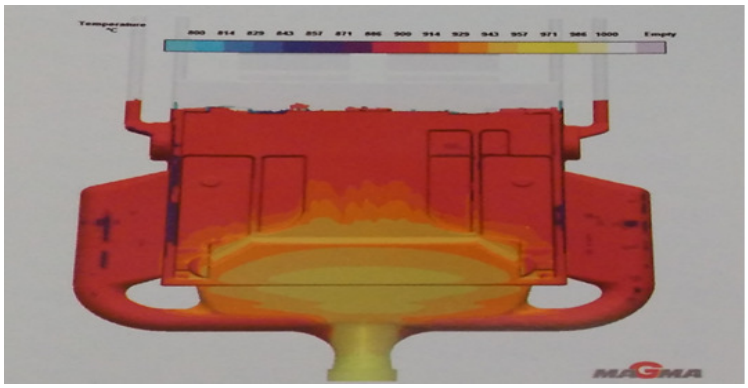

Fig 3.1.1 Original design –filling temperature

Fig 3.1.1 show the original design before implementation of magma the design of volute casing &impeller are unchanged. it shows the different region of temperature distribution. Also fig 3.1.2 show the improved design after implementation of magma. That changes the actual design. It shows that that software simulates the heat & reduces the possibility of failure by reducing the cracks. Fig 3.1.3 shows that different rating for different region.

It shows the two region 1st shows result after implementation of magma & 2nd region shows result after implementation of Magma

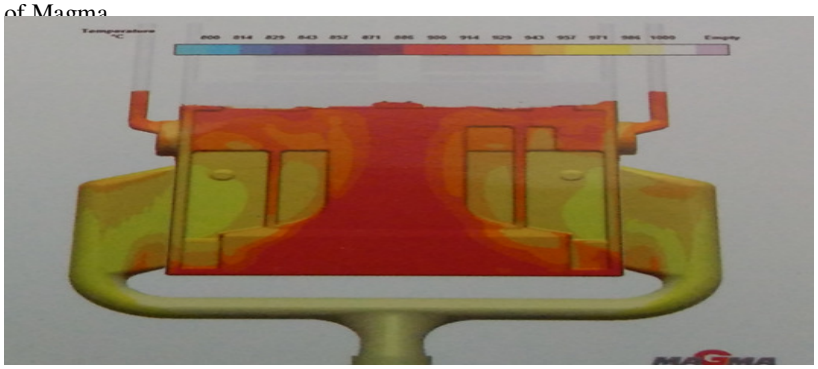

Fig 3.1.2 Improved design –filling temperature

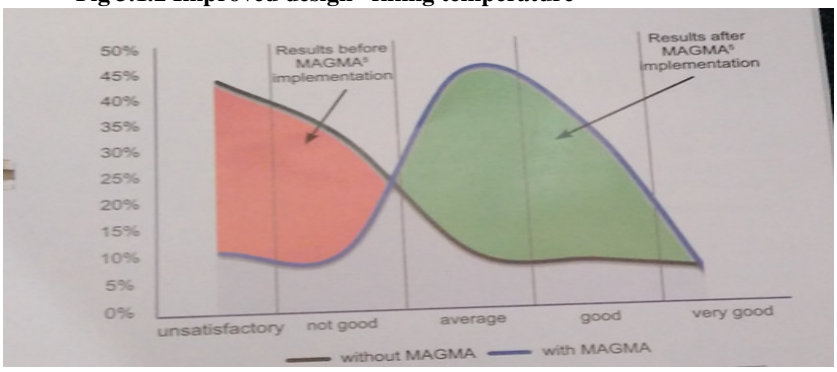

Fig 3.1.3 Rating before & after implementation of magma software

EXPERIMENTAL METHOD

4.1. NDT TESTING:

4.1.1ACOUSTIC EMISSION: Pumps are used in most of our domestic and industrial applications. Every pump manufacturer supplies characteristic curves for their equipment illustrating pump performance under given conditions. These curves demonstrate the inter-relationship between discharge capacities, pump head, power and operating efficiency.

4.1.2. ULTRASONIC TESTING:

This story starts in the early nineties when the NDT world was changing considerably due to the results of the PISC Programmed (Program for the Inspection of Steel Components) and other studies worldwide. It was in the same period that the Performance Demonstration Initiative (PDI) was formed by US Utilities to implement the performance demonstration requirements of the ASME Code

4.2. ACTION PLAN TO REDUCE CRACKS:

In the recent year the KSB Pumps uses a method to reduce the cracks in casting in case of a impeller & volute casing of a pump. But which is not a suitable one for that purpose I find reason behind that & uses action plane for that for cracks. For that purpose we check different parameter like a core material metal, chemistry, riser size, and pouring temp & knock out effect on those casting cracks. We check that parameter by actual experiment perform on that volute casting. The research is going on to find actual parameter which produce cracks reduce.

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RESULT

The centrifugal casting produces cracks due to core box material, metal chemistry, riser size, pouring temp & knock out.

CONCLUSION

It is say that MAGMA SOFTWARE gives the good result as compare to ordinary one.

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