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IDENTIFICATION OF SHRINKAGE DUE TO MODULUS OF FLYWHEEL CASTING BY USING PROCAST SOFTWARE.

Shivtej P.Salokhe
MechanicalEngineeringDepartment,
Rajarambapu Institute of Technology, Islampur,
Sangli, India.
Yayati5000@gmail.com

U.M.Nimbalkar.,
Professor, MechanicalEngineeringDepartment,
Rajarambapu Institute of Technology, Islampur,
Sangli, India.
Uddhavrao.nimbalkar@ritindia.edu

***Abstract*—A flywheel is a rotating mechanical device that is used to store rotational energy. Flywheel has a significant moment of inertia, and thus resist changes in rotational speed .The amount of energy stored in a flywheel is proportional to the square of its rotational speed. Rejection rate is one of the major issues in Indian foundry. Foundries try to reduce rejection by experimenting with process parameters or modifying method and tooling design which reduces the quality of castings and increase cost of production.Shrinkage, blowhole, porosity, etc. are the main casting defects which is responsible to increase casting rejection rate. In present theories, flywheel model is simulate& update the results. Shrinkage is open when we take a cross section of flywheel casting.Modulus is the main parameter which is responsible to form cavity in the material. Modulus is relates with temperature cooling rate, solidification time, etc are the parameters to open shrinkage defect. Flywheel is the casting model & we have open the casting defects in flywheel casting.**

Keywords—Shrinkage defect, modulus,Solidification time,PROCAST software.

I. INTRODUCTION

A flywheel is a mechanical device successfully designed to efficiently store rotational energy .Flywheel resist changes in rotational speed by their rotational speed. The way to change a flywheels stored energy is by increasing or decreasing its rotational speed by applying a torque aligned with its axis of symmetry. Flywheel is useful in smoothing the power output of an energy source. For example, flywheels are used in reciprocating engines because the active torque from the individual piston is intermittent. In energy storage systems, delivering energy at rates beyond the ability of an energy source.This is achieved by collecting energy in flywheel overtime & then releasing it quickly, at rates that exceed the abilities of the energy source. Flywheels store energy very efficiently (high turn-around efficiency) & have the potential for very high specific power compared with batteries. Flywheels have very high output potential & relative long life. Flywheels are relatively unaffected by ambient temperature extremes. For simulation purpose 3D simulation degree, Autocast, FLOW-3D CAST, PROCAST, Finite solutions casting simulation software,MAGMA5,Etc software's available in market which is provide number of options to get easy solutions. Casting is a manufacturing process for making complex shapes of metal materials in mass production. There are two main consecutive stages: filling process and solidification process in casting production. The filling process gating system composed of pouring cup, runner, sprue, sprue well and ingate, is designed to guide liquid metal filling. Riser system is used to compensate shrinkage caused by casting solidification.Casting process design is important for production quality and efficiency. It is unavoidable that many different defects occur in casting process, such as porosity and incomplete filling. As such, improvement of the casting quality becomes important. More Scrap weight, less yield percentage, high rejection of part increases the cost of rejection. It also causes the environmental losses due to large scrap and rework. High rejection rate affects on the productivity. These are problems associated with presenttheories related to flywheel casting. Modulus generation is major parameter due to temperature cooling rate, solidification time .How it would be responsible this results we can observed here by using PROCAST software.

II. RESEARCH METHODOLOGY

The entire study has been carried out in four stages,viz. design of gating system, modeling of system, validationwithexperimentalresultsandtesting and finallycomparing theresultswitholdresults.Asperthefoundryrequirement,castingmaterial spheroidal graphite withgradeFC350wasusedandmoldmaterialwastakenas green silicasand.Thespecificationsofthe cope and drag box were800*900*250 mmandweight of the part flywheel is around 70kg.metal

Fig 1.model of flywheel

patternwasusedforgettinggoodqualityofmoldcavityandcastinganditwaseasilyavailableatacheaprate.

III. STUDY OF GATING SYSTEM

Before making a design of gating system, the existing patterns, casted parts and design of gating and feeding system of flywheel has been studied.For these castings,using the horizontal type pressured gating system.This type is normally applied in ferrous metal sand casting.Downsprue is used for filling molten metal into the cavity. Ingate, runner, downspure etc. of gating systems depends on the choke area.

Fig2.Drag pattern

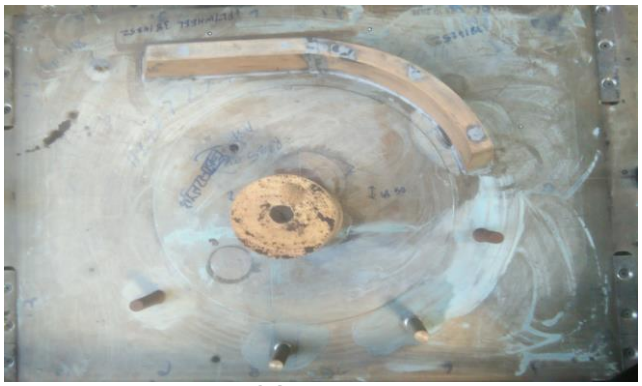

Fig 3.Cope pattern

Fig 3.Manufacturing mold box

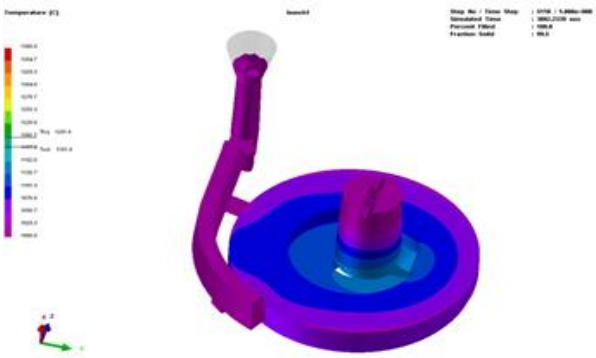

Fig 4 Gating system (centre pouring with riser)

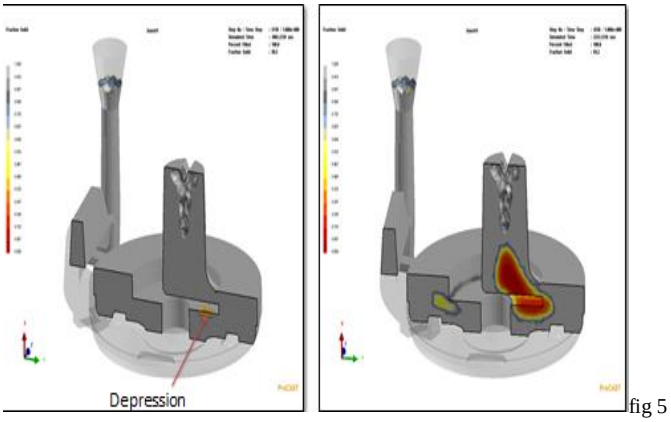

fig 5 Simulation results (depression & Shrinkage open)

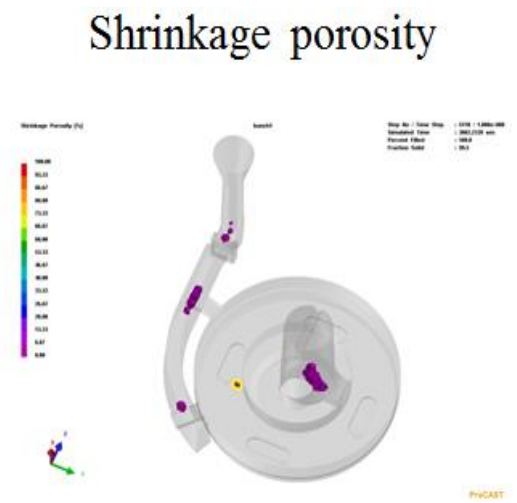

Fig 6.Identifying defect by using PROCAST

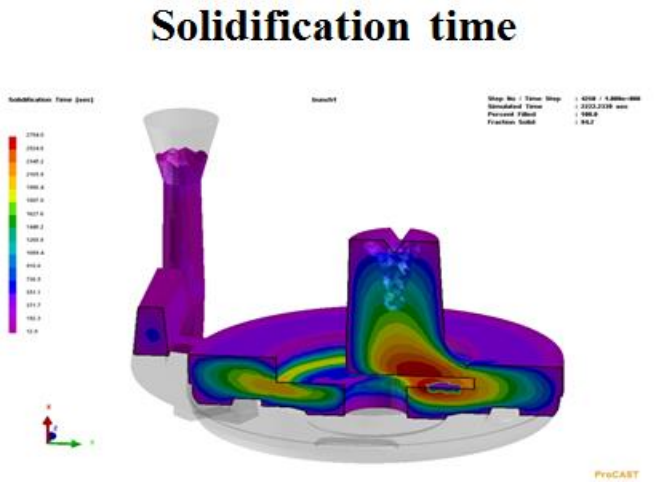

Fig 7.Solidification time

From above fig 7& fig 8 shows that solidification time & temp. cooling rate of flywheel casting .Pouring metal is temp is travel from 1400 degree C.to room temp taken time is almost 3 hours. In between this time riser temp.is greater than casting temp. Due to last feeling area of metal flow due to this modulus is formed. By forming the modulus material will be shrink& produce cavity in between the region of cross sectional area of flywheel casting.

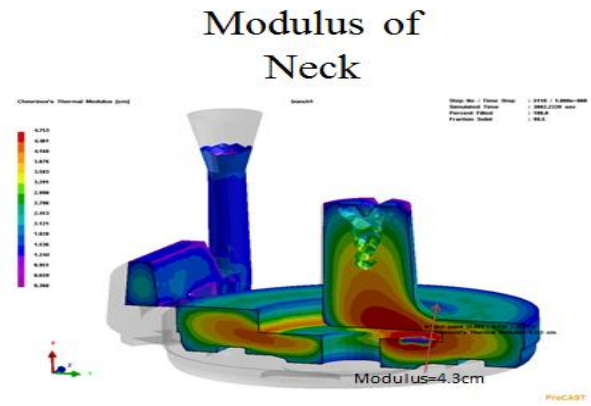

Fig 8.Modulus

Fig 9.Actual physical Trials

As per above process operation yet we get six number of trials & we reduced shrinkage zone & reduced casting rejection rate. This simulation & actual trials are very helpful for reduced manufacturing cost of flywheel casting , reduced trial cost, reduce development time, reduced trial cost,increases productivity, increases profit cost.

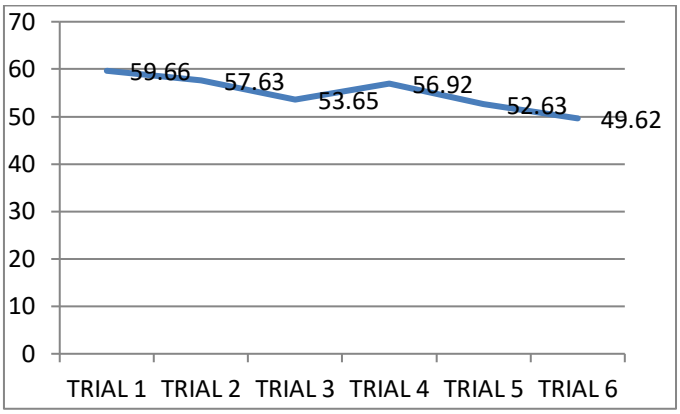

Fig 10.casting rejection rate as per new simulation

By using number of simulation we selected optimized trials on the basis on those trials are very helpful for reduced manufacturing cost of flywheel casting , reduced trial cost, reduce development time, reduced trial cost ,increases productivity, increases profit cost. By using this we reduced shrinkage defect & reduce casting rejection rate.

IV CONCLUSION

Above theories represents that, casting rejection is the main parameter which is directly proportional to the profit cost. For increasing profit cost we have to reduce casting rejection rate. Casting rejection is present when casting defect should be opened in trials. By using simulation we can conclude that, identify the exact location & size of defects on flywheel casting. Casting simulation software PROCAST enables us to forecast the defect identification & visualization. It reduces the cost of rejection. It also minimizes the environmental losses due to large scrap and rework. So, this paper work is beneficial to company which can be easily implemented.

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REFERENCES

1]Shivtej Salokhe&Prof. U. M. Nimbalkar, "Casting Simulation to identify shrinkage zones in flywheel casting by using PROCAST".march 2018

[2] Binu Bose V & K N Anilkumar, "Reducing rejection rate of castings using Simulation Model" Volume 2, Special Issue 1, December 2013.

[3] QIAO Yin-hu, ZHANG Chun-yan, CHEN Jie-ping, "Casting Forming Process Simulation of Aluminum Flywheel" TELKOMNIKA,Vol. 11, No. 4, April 2013, pp. 1930~1933.

[4] Dr.-Ing. A. Egner-Walter, S. Olive, Using Stress Simulation to tackle Distortion and Cracking in Castings.

[5] T.RAMU1, DR M.L.S.DEVA KUMAR, B.K.C.GANESH, "Modeling, Simulation And Analysis in Manufacturing Of A Flywheel Casting By S.G.Iron".

[6]AnkitaShinde ,Kratika Singh Rawat , Ruchi Mahajan, Veeraj Pardeshi, BalbheemKamanna and Sachin Sheravi, "Design and Analysis of Flywheel for Different Geometries and Materials".13 jan,2017.

[7] Zhi-pu PEI1, Dong-ying JU2,3 , Xue LI3,"Simulation of critical cooling rate and process conditions for metallic glasses in vertical type twin-roll casting" 21June 2017.

[8]Petrhausild,clotildeberdin,Phillippebompard,Nicolasverdier e Ductile Fracture of Duplex stainless steel with Casting Defects, 78 (2001) 607-616.

[9] Uday A. Dabade and Rahul C. Bhedasgaonkar ,Casting Defect Analysis using Design of Experiments (DoE) and Computer Aided Casting Simulation Technique. 7 (2013) 616 – 621.

[10] M. Di Foggia, D.M. D'Addona ,Identification of critical key parameters and their impact to zero-defect manufacturing in the investment casting process. 12 (2013) 264 – 269.

[11] PriyankaVisputea, DigambarChaudhari,Utilizing Flow Simulation in the Design Phase of a Casting Die to Optimize Design Parameters and Defect Analysis.