"Investigation on Wearing of Blade of Sand Mixer used in Foundry Industry to Enhance the Life of Blade": A Review

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***Abstract*— The Foundry sand mixer is very ruggedly constructed from heavy steel sections, with a fixed mixer pan, all mounted on substantial base frame. The motor is installed horizontally, driving the gearbox through a flexible coupling.The rotating mixer unit consist of mixing rotor, which rotate on their own axis and simultaneously revolve around the tank circumference. Rotor consist of three mixing arm with replaceable wear blades.The integral charge hopper, built into the top of the mixer cover, feeds sand into the mixer. Discharge of the regenerated sand from the mixer is achieved by means of a large opening in the pan of the unit. This consists of a circular segment, which opens to allow for the rapid discharge of sand to take place in 10 to 12 seconds. The blade rotation compresses and cascades sand from the ribbed walls to the centre dome. The continuous vortex action created by this tumbling motion produces highly effective mixing. The batch is prepared in a short cycle time, and is discharged as a completely aerated and perfectly homogenous mixture. After number of cycles the clearance gap between blade bottom an mixer bottom increases due to wearing. The present paper analyzes wear causes of a revolving-blade mixer with the most important of them- sticking of grains between the blade end and the bottom. Various hardfacing operations are recommended to reduce the wearing of blade.**

INTRODUCTION

The sand mixers are basically used in the foundry industries. They are used for preparation of moulding sand which is used for mould making in which molten metal is poured to produce required casting component. In these mixers the moulding sand, betonite, coal dust & water is mixed. The process of mixing the sand mixture is carried out in a controlled manner in the pan by the mixer blades which are attached with hub mounted on the gear box shaft. This project deals with the analysis of wearing of the sand mixer blades to reduce wearing and increase the life of blades. The project also aims at reduction of weight of blades using finite element analysis approach.

The wear-and-tear that organic sand and binders inflict on sand-mixing blades leads to significant maintenance and replacement cost. Hence the mixer bladesmust be strong enough to execute the process thoroughly and still endure significant wear. Without hard facing, a mixer blade may be functional for a month or so oftypical operation before it needs to be replaced.

FUNCTIONS OF FOUNDRY SAND MIXER

The Sand Mixer was designed to quickly, uniformly and mechanically manipulate a heterogeneous mass of sand materials, of varying aggregate sizes, into uniformly blended and bonded homogenous product. It consists of cylindrical pan, three heavy blades, which rotate in a circular path about a vertical shaft. A discharge door is provided at the bottom of the pan. The three blades are slightly off the true radius to allow for free rotation as well as eliminate any wear due to friction which may arise from contact between the blades and the pan. The design theory of the sand Mixer considers the geometrical parameters of the Mixer, which includes the frame mixing pan, blades, shaft and driving Mechanisms.

2. LITERATURE REVIEW

Jurgis Jurevičius, et al [1]-The main causes for wearing-out of a revolving blade mixer are :Loads occurring at transmission starting; Accidental occurrence of hard grains together with Mixed substance; Intensive wearing of blades and bottom. Revolving-blade mixer reliability may be increased using a vibro -impact and overload suppressing element in the transmission system - an elastic centrifugal coupling with two rigidity modes, by welding wornout blades with special wear-resistant substances, by producing blades of wear-resistant, but much more expensive alloyed steel grades, by producing blades of low alloyed steel grades but with their thermal hardening, by producing thicker blades and by using blades with ,agitators". Wearing of the blade surface is because of various parameters like rotational speed of blades, clearance gap between bottom of the blade and mixer pan. Surface hardening of the blade surface will be useful to increase the life of the blade.

J. O. Osarenmwinda ,et al [2]-The forces acting on the shaft are those acting on the blades which are transmitted to the shaft, these include the reaction due to weight of blades; reactions due to green compression strength of moulding sand and centrifugal effect on both blades and shaft.

Forces acting on the blades are calculated to find out the shear stress acting on the blade which is responsible for wearing of the blades.

***A. P. Harsha , et al-*[3]-** Three body abrasive wear is the wear in which particles are trapped between two solid surfaces but are free to roll as well as slide. With increase in sliding distance and load, wear volume increases for three-body abrasive wear. The specific wear rate increases with increase in load in case of three-body wear. Archard's equation is generally used to describe the abrasive wear. The equation states that,

V= K*L*D/H
Where, V- Wear worn out volume
K- Wear coefficient
L- Load applied
D- Sliding distance
H- Hardness of the blade
The behavior of wearing of blade due to sand is well understood. Also achard's equation will be useful to find out wear worn out volume.

Delia Garleanu,,et al [4]- In order to simulate and compute wear with ANSYS, the creep may be used. The wearing strain based on the final configuration of the surface at the end of theloading step is determined by using explicit creep computed after that for elastic and plastic creep. For modeling, three elements are used : SOLID5 ,CONTA 174 and TARGE17. Geometry is created by activating preprocessor from main menu and analysis is performed.

Harvinder Singh [5]- Hardfacing, also known as "Hardsurfacing", is the application of build-up of deposits of specialized alloys by means of welding process to resist abrasion, corrosion, high temperature, or impact. Shielded metal arc welding (SMAW) is most commonly used process for hardfacing due to its easy availability and versatility.From this paper, a detailedstudy was done to study the effect of different compositions of iron based hardfacing electrodes on stainless steel, deposited by SMAW process.

5. COMPARISONS OF ALL ABOVE PAPERS

By referring above papers it has been observed that wearing of blade of sand mixer is calculated by using shear stress concept. Modeling of the blade should be done using modeling software like CATIA. Analysis of wearing is done by using ANSY's software in which creep strain will be useful concept. Surfacing hard facing will be done by using special welding technique to improve the life of the blade.

6. CONCLUSION

From the above papers various causes for wearing of the blade were known. Also by performing finite element analysis, wear can be calculated. Hardfacing is one of the way for improvement of life of blade by using special electrodes like hardalloy III electrodes. Wear test like pin on disc will be performed to know reliability of blade.

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