DESIGN AND ANALYSIS OF TWIN SHAFT SHREADER USING PRO-E AND HYPERWORKS SOFTWARE

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ABSTRACT - This project deals with design and analysis of twin shaft shredder blades. The model of the twin shaft shredder is designed using PRO E CREO software, and the systematic analysis of the designed model is done using

HYPERWORKS/ANSYS software.

The model selected is twin shaft shredder from heavy machinery equipments manufacturing industries. In this model 16 blades are been used and material is used commonly for the blades is heat threatened alloy steels-20MnCr5 steel. Now we are replacing the material to EN8, EN31, EN19& EN36. Then the model is analysis for the deflection, max stress induced and shear stress for both all materials under same load.

I.INTRODUCTION

The twin shaft shredder is commonly used for various kinds of shredding operations in heavy machinery & high level products manufacturing industries. In those types of applications their scrap and waste materials has observed in various operations of machining, fabrication and etc. The twin shaft shredder is accommodate this waste scraps into small blocks of steel cubes in small portable chambers.

The mechanical shredding of waste is a tough job, so electrical drive systems for shredders must be especially sturdy and reliable. This also applies to the gearedmotors from WEG’s subsidiary Watt Drive, which the recycling machinery manufacturer uses todrive its new twin-shaft shredder.In the twin shaft shredder the material to be shredded is pulled between two shafts rotating slowly in opposite directions, each fitted with cutter discs.

The process is monitored by a PLC controller. If the machine is overloaded or foreign objects get into the cutting mechanism, the controller reverses the rotation. The gap between the cutter discs is precisely defined to reduce the shredding force. A top-mounted stripping comb holds down the shredded material and prevents it from winding around the shafts. The size of the output material is determined by the cutter width or the number of blades.

1.1 NEED FOR ANALYSIS

Recently, manufacturing industry requires higher level of design and calculation almost in every part in both fabrication and testing which can make it possible to improve and develop products. So the twin shaft shredder blades life need to increase for the heavy load & mass production of shredding the various kinds of parts like can be used for cost-effective shredding of all sorts of industrial waste, rubber metal and plastic waste, special waste, metal swarf, electronic scrap ,etc

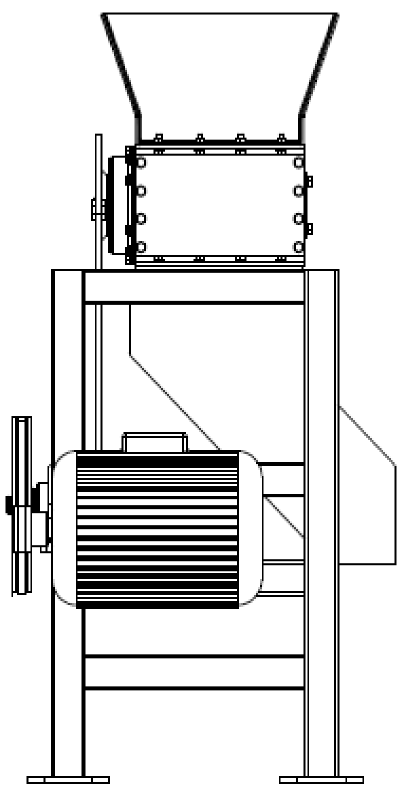


Fig.1.1.Twin shaft shredder machine

In this method of twin shaft shredder has contains the blades in the action on the line of 16 nos. the blades havethe life of maximum of the limits based on the materials shredding in the twin shaft shredder.

The method developed, especially nonlinear analysis, makes it possible to accurately design of blades. A research using nonlinear analysis to solve blades problem was discussed by heavy machinery equipments, however, only single blades model was considered. The purpose of design development for the shredding blades are not only to reduce weight, quality and reliability, improve durability when subjected to cyclic loading, or improve quality of blades material and processing, but also to reduce time and manufacturing cost in the design process to gain the highest economic benefit.

Computer technology in terms of CAD/CAE (Computer-Aided Design and Engineering) has been applied to solve engineering problems for several decades.

Finite element method is an effective part of CAD/CAE applied in design and analysis to solve complicated problems.

Twin shaft Shredder blades simulation using commercial code such as HYPERWORKS, ANSYS, MSC/NASTRAN and MDI/ADAMS by employed beam elements to model leaf spring showed accurate behavior prediction. Currently, the design of multi-leaf springs and the prediction of behaviors are more efficient using finite element methods as presented in Ref.

1.2 MATERIALS ANALYSIS

In the state generally the alloy steels has used of 20MnCr5 for manufacture the twin shaft shredder blades.Theblade hastaken in the process of laser cutting and hardening process. Then after the hardening the blades has under the controls of tool or bench grinding operations in bench grinding. Generally the alloy steels has under heat treatment process up to 900°C to 960°C.

We are going to change the materials of EN8, EN19, EN36&EN41instead of 20MnCr5 alloy steels to improve the production cost of this material.And to improve the durability of twin shaft shredder blades.

After the analysis which one of the materials has cost effective & process effective and easy availability. That material has going to take instead of Blades manufacturing. The blades has design in the view of PRO E CREO and analysis with the help of Hyperworks/ANSYS.

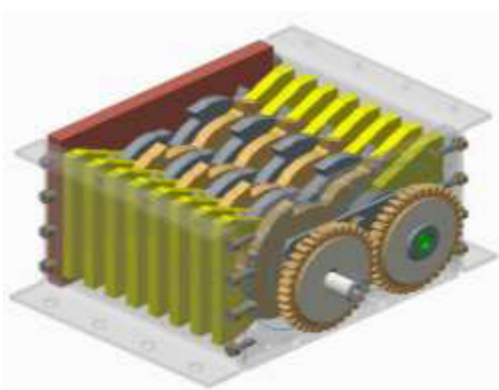


Fig.1.2 Twin blade shredding unit

CHAPTER 2

LITERATURE REVIEW

D. A. Fadare, T. G. Fadara and O. Y. Akanbi , Effect of Heat Treatment on Mechanical Properties and Microstructure of NST 37-2 Steel , Journal of Minerals & Materials Characterization & Engineering, 10(3), 2011, 299-308. This Study is based upon the empirical study which means it is derived from experiment and observation rather than theory.

Main Objective is to Study the Effect on the Hardness of three Sample Grades of Tool Steel i.e. EN-36, EN-8, EN19 and EN41after Heat Treatment Processes Such As Annealing, Normalizing, and Hardening & Tempering.[1]

Nirav M. Kamdar, Prof. Vipul K. Patel (2012),"Experimental investigation of machining parameters of EN36 steel using tungsten carbide cutting tool during hot machining", International Journal Of Engineering Research And Application, Vol.2 (3), pp.1833-1838.

This survey helps to find out the place of the work to be carried out i.e. availability of setup, techniques used for such, estimated time, various cutting parameters, surface roughness& cost requires for such study carried out for such industrial survey to be carried out we designed a Survey questioner and selects various places who offers heat treatment services Ludhiana based.

After literature review and industrial survey indicate for optimal cutting parameter, minimum surface roughness (Ra) and maximum material removal rate were obtained and developed model can be used to increase the machine utilization at low production cost in manufacturing environment.[2]

A.S.Dhavale, V.R.Muttagi, (2012) Study of Modeling and Fracture Analysis of Camshaft, International Journal of Engineering Research and Applications, Vol. 2, Issue 6.After selection of material & heat treatment processes further aims to perform mechanical & chemical analysis i.e. composition testing of the two tool steel EN-41, EN-19, before treatment. After composition testing aims to do heat treatment processes i.e. Annealing, Normalizing, and Hardening & Tempering to be carried on such material & after treatment aims to perform harness testing on the treated and untreated work samples.[3]

S. Ranganathan and T. Senthivelan (2010), “Optimizing the process parameters on tool wear of WC inert when hot turning of AISI 316 Stainless steel,“Asian Research Publishing Network (ARPN), Vol. 5, No.7, pp. 24-35.In this work, the EN 36 Steel specimens heated with gas flame were machined on a lathe under different cutting conditions of Surface temperatures, Cutting speeds and Feed rates. Cutting force, feed force and surface roughness were studied under the influence of machining parameter at 200 °C, 300 °C, 400 °C, 500 °C and 600 °C at constant depth of cut 0.8 mm.

The optimum result was achieved in the experimental study by employing Design of experiments with Taguchi. . In present study, Analysis found that varying parameters are affected in different way for different response. The ANOVA analysis was used to obtain optimum cutting parameters.[4]

Nirav M. Kamdar, Prof. Vipul K. Patel (2012),“Experimental investigation of machining parameters of EN36 steel using tungsten carbide cutting tool during hot machining”,

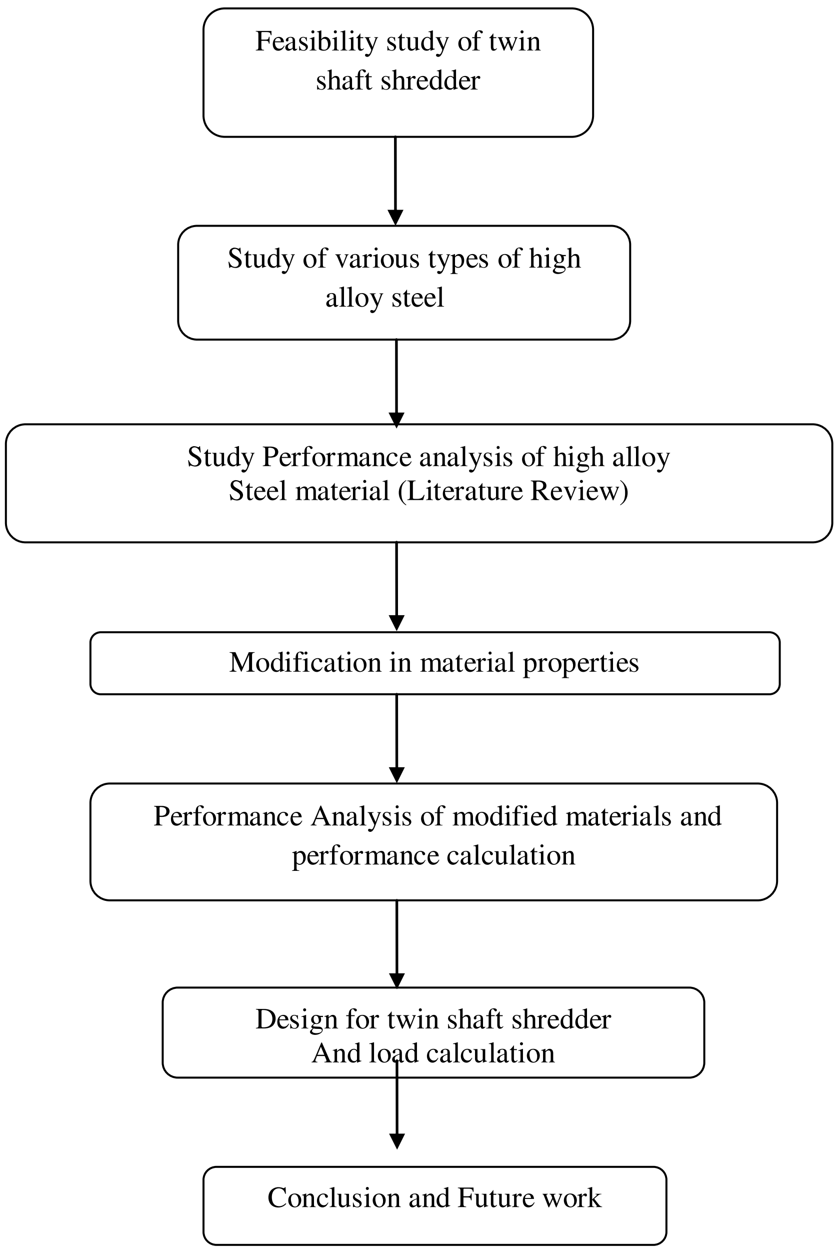
International Journal Of Engineering Research And Application, Vol.2 (3), pp.1833-1838.In this research work, L18 orthogonal array based Taguchi optimization technique is used to optimize the effect of various cutting parameter for surface roughness and Material Removal Rate (MRR) of EN 36 work material in turning operation.

The orthogonal array, the signal to noise ratio and analysis of variance are employed to study the performance characteristics in both dry and wet machining conditions of cylindrical work pieces using Tin coated tungsten carbide cutting tool on CNC lathe. Five machining parameter such as spindle speed, feed rate, depth of cut, nose radius and the cutting environment (wet & dry) are optimized with consideration of surface roughness.

Results of this study indicate for optimal cutting parameter, minimum surface roughness (Ra) and maximum material removal rate were obtained and developed model can be used to increase the machine utilization at low production cost in manufacturing environment.[5]

CHAPTER 3

METHODOLOGY



CHAPTER 4

EXPERIMENTAL PROCEDURES

Selection of the materials to manufacture the twin shaft shredder blades is to basically identify the mechanical and chemical composition of the each different alloy steel materials. The mechanical properties expose the values of maximum shear stress and strain, Ultimate tensile load, Elongation, yield strength and maximum temperature withstand limit.

4.1 PROPERTIES OF 20MnCr5

Plasma nitriding is a thermo chemical process extensively applied in metallic materials science and surface engineering due to its well–known potential for improving properties such as hardness, wear and corrosion resistance of metallic parts. This surface treatment technique consists of the implantation of nitrogen species at low energy into the steel substrate and their subsequent diffusion into the bulk at temperatures above 300 °C.

The interaction of nitrogen and steel surface leads to the formation of different types of metallic nitrides, which form the so-called ‘‘nitride layer”. Starting from the solid surface, such a modified layer usually comprises an oxide layer, a compound zone and a diffusion zone. The resulting structure of these zones depends on several processing parameters such as the concentration of alloying elements, exposure time, substrate temperature and gaseous mixture. The presence of a nitride layer obviously changes the mechanisms of interaction between metallic materials and their surroundings, thus affecting their stability in aggressive environments.

The incorporation of nitrogen imparts better mechanical properties (friction and wear resistance), but the dissolution kinetics (corrosion resistance) remains closely related to the composition of the corrosive medium. In this context, the 20MnCr5 steel is largely employed in industrial processes that take place in aggressive environments. Hard iron nitrides are originated during the plasma treatment owing to nitrogen diffusion in the near surface region at temperatures below the eutectic point (593 °C).

Usually, two different phases corresponding to the ε-Fe2-3N and γ’- Fe4N nitrides are obtained, whose high hardness improves the strength, friction and wear resistance. However, the highest wear resistance is normally achieved when the close-packed hexagonal ε-Fe2-3N phase is primarily at the surface of the specimens. This is so because the mixed nitride layer of the ε- Fe2-3N and γ’-Fe4N phases is, in fact, stressed due to a crystal lattice mismatch. Recent work have shown that the pitting corrosion resistance of the steel can be significantly improved by nitride layers consisting of ε-Fe2-3N and γ’-Fe4N phases. However, the effect of the nitride layer microstructure on the pitting corrosion behavior of steel is still not fully understood.

In this study, we address this question by analyzing the influence of plasma processing at optimal parameters (temperature 500 °C, exposure time 4h and gaseous mixture 20 % H2, 80 % N2) on the corrosion, wear behavior and microstructure of plasma-nitrided 20MnCr5 steel.

4.2 COMPOSITION OF STEEL MATERIALSEN41, EN8,EN19 AND EN36

Selection of the materials to manufacture the twin shaft shredder blades is to basically identify the mechanical and chemical composition of the each different alloy steel materials. The mechanical properties expose the values of maximum shear stress and strain, Ultimate tensile load, Elongation, yield strength and maximum temperature withstand limit.

Chemical Composition is Important Testing for making sure that the Chemical Composition of the Purchased Material Matches with that of the International Standards of Materials. This Testing is done By Using the Glow Discharge Spectrometer. Surface finishing of Single Sample of Each material is done on the Belt Grinding Machine of 100Grit Belt. After Grinding and giving the material a good Surface finish Sample EN-8 is inserted in the Machine. The Machine Holds the Material by Vacuum Holder of the machine .

Table No.4.1 Composition of Tool Steel as per AISI Standard

MATERIAL COMPOSITION									
***MARK**	**C%**	**Si%**	**Mn%**	**P%**	**S%**	**Cr%**	**Mo%**	**AL%**	**Ni%**
EN-8	0.45	0.30	0.50	0.024	0.025	1.40	_	_	_
EN-19	0.38	0.21	0.91	0.01	0.01	1.04	0.23	4.21	0.23
EN-36	0.70	0.25	0.42	0.012	0.01	1.05	0.14	_	3.2
EN-41	0.40	0.30	0.60	_	_	1.60	0.35	1.20	_

Then the Door is closed for further Operation to be performed on the material and command is given to the Specific Software on the Computer.

This is done by using the glow discharge method, sample material is uniformly sputtered Spit up in an explosive manner] from the surface.

Industrial survey conduction are found to be very useful approach for selection of tool steel grade which will more beneficial for industrial point of view. From the literature review,

It is observed that less research work has been seen for Tool Steel i.e. EN19, EN8, EN36, and EN41 after Heat Treatment Processes Such

As Annealing, Normalizing, and Hardening & Tempering.

4.3EXPERIMENTAL PROCEDURE

20MnCr5 steel samples with nominal composition of 96.995% Fe, 0.20% C; 0.40 % Si; 1.25 % Mn; 1.09% Cr; 0.005 % Mo; 0.025% P; and 0.035 % S. (In wt. %) were used in this study. Before plasma nitriding, samples were polished with diamond powder and ultrasonically cleaned in ethanol and during the heating step to reach the processing temperature; the specimens were ion-bombarded for 4 h in Ar/H2 80/20 v/v plasma for cleaning purposes.

Specimens were nitrided in a vacuum furnace pumped down to low pressure (3 mbar) to minimize the oxygen contamination. The temperature of the samples is measured with the use of a thermocouple. The nitriding parameters were fixed similar to previous works. After processing, the samples were left to cool down slowly (during 8h) inside a vacuum chamber. The morphology of the samples surfaces was observed by Jeol 5900 Scanning Electron Microscope (SEM). The samples for SEM analyses were mirror-polished with colloidal silica (mesh size = 0.05 μm). The nitrided layers were revealed at room temperature by chemical etching with Nital (2% v/v nitric acid in absolute ethanol).

Wear tests were carried out with a pin-on-disk tester, using a 5 mm diameter 100C6 steel ball as the pin. Unlubricated wear tests were performed at room temperature (≈20 °C) with a relative humidity of about 25%, a rotation speed of 60 rpm, a normal load of 5 N and a wear track diameter of 3 mm. The wear rate is determined using the Archard equation

$$Ku= Vu/FN.D$$

Ku: the wear rate (m3N-1m-1); Vu: the wear volume (m3); FN: the applied normal force (N); D: the sliding distance (m). The wear volume was calculated by measuring the mass lost. After the wear tests, the worn regions were examined using a Jeol 5900 SEM.

Analysis has been collected by referring various journals, books, papers etc. for the purpose of the Selection of tool steels grades material on and work piece material on which lesser study will be carried out. Another objective selection of Place where to Perform Experiment, Market availability of the recommended tool steel & their Cost Analysis, Time Analysis to complete the experiment etc.

The purpose of Selecting Tool Steel is that they are Mostly Used in the Manufacturing Industry. Tool Steel Grades like EN-8, EN19, EN41 and EN36 is selected for project. These steel grades were suggested to be the best during Surveying Various Industries for that objective we designed an industrial based questioner. The Carbon Composition is different from each other in these materials. So we can easily differentiate between selected Parameters after Heat Treatment. These three Materials are purchased

From Material Shop of C.T.R Ludhiana. For defining the objective of study to be carried out more effectively and specific we designed Heat Treatment Performance Index HTPI 2012.

There was a Requirement for 6 Samples of Each Material for the Treatment and Testing Purpose. So we cut the Samples Using Power Hack-Saw .All the Samples are 20mm in Diameter and 2.5" to 3.5" in length. Chamfering was done using Bench Grinder. During Chamfering we also Performed Spark Testing of the material which is commonly used in the Industries to analyze Different Material on the basis of the Intensity of Spark Produced and Flowers evolved during Spark Testing. Figure Below shows the three Material undergoing Spark testing.

Chemical Composition is Important Testing for making sure that the Chemical Composition of the Purchased Material Matches with that of the International Standards of Materials. This Testing is done By Using the Glow Discharge Spectrometer. Surface finishing of Single Sample of Each material is done on the Belt Grinding Machine of 100Grit Belt. After Grinding and giving the material a good Surface finish Sample EN-8 is inserted in the Machine. The Machine Holds the Material by Vacuum Hold.

EN8 EN19 EN41

Fig.4.1Pictorial View of Spark Testing for Various Materials

Then the Door is closed for further Operation to be performed on the material and command is given to the Specific Software on the Computer. This is done by using the glow discharge method, sample material is uniformly sputtered Spit up in an explosive manner] from the surface.

It takes about 5-6 minutes for the chemical composition testing of a single material. The readings of the test are shown on the Display of Computer in Tabulated Form. It Shows the Percentage Composition of Each Element .After Testing Chemical Composition of the material, the values Compared with that of Values as per International Standards.

Fig.4.2 Marks of Argon Gas after Composition Testing

The Testing of a Single Sample is done 2-4 times from Different point on the smooth surface of the sample. The same Procedure for chemical testing is also done for EN-31 and D-3 also. The figure below show the Specimen where the Chemical Composition Testing is done leaving behind the impact of Argon Gas used at the time of testing. We can see three marks which states that Testing is Performed 3 times on the Material.

4.4 MATERIAL PROCESS METHODOLOGY

Before treatment EN8 hardness value is 10 HRC .Hardness of untreated material is less due to low carbon % in EN8. After done three treatments.

Annealing: After annealing value of hardness of specimen is 55 HRA as compared to untreated specimen annealed specimen becomes softer.

So machine-ability properties of specimen increase due to annealing we used HRA scale because after annealing EN-8 becomes soft and below 20 HRC. Value HRC scale is not gives the accurate value and also value is not valid.

Normalizing: After normalizing hardness is 25 HRC given on Rockwell testing machine.It shows after the normalizing the specimen becomes harder then annealing specimen .this is due to formation of pearlite is more as compared to ferrite.

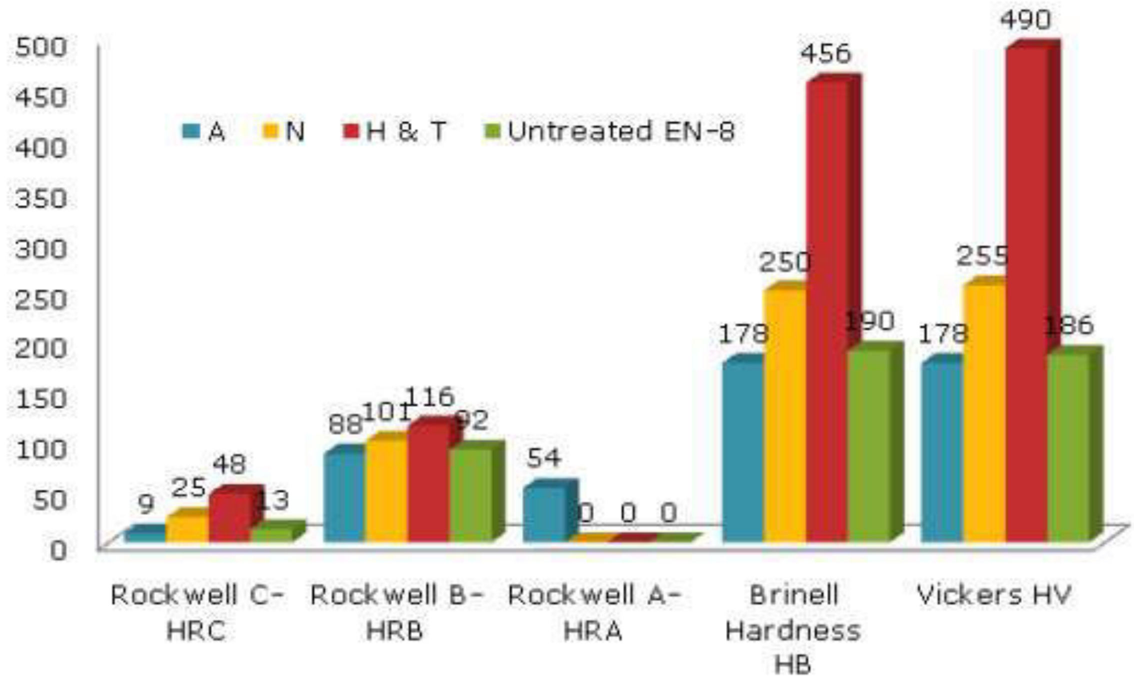


Fig.4.3 Hardness Comparison of EN-8 Treated & Untreated

Hardening and Tempering: After H&T treatment specimen hardness is 48 HRC it shows H&T treatment makes hardest then other two treatments. This means material has more wear and tear as compared two other two heat treatments.

Comparison: After annealing specimen becomes more softer then untreated specimen as hardness value shown. After normalizing hardness is more as compared to untreated specimen. After hardening and tempering specimen are hardest then other three specimens due to formation of fine tempered martensite.

EN36 steel is an easily available and cheap material that is acceptable for heavy duty applications. Heat treatment on EN36 steel is improved the ductility, toughness, strength, hardness and relive internal stress in the material. X-ray diffraction (XRD) method is used to analyze the composition and the phase of the alloy material.

The experimental results of hardness and microstructure are done to get idea about heat treated EN36 steel. It is found that the hardness of the EN36 steel is improved after the heat treatment and the microstructure is changed from ferrite to martensite.

En 36 steel has carbon content of 0.17% and the most common form of steel as it’s provides material properties that are acceptable for many automobile applications such as heavy duty gear, shaft, pinion, cam shafts, gudgeon pins [1,8]. It is neither externally brittle nor ductile due to its lower carbon content and lower hardness. As the carbon content increases, the metal becomes harder and stronger.

The process of heat treatment is carried out first by heating the metal and then cooling it in water or oil or air. The purpose of heat treatment is, to enhances the transformation of austenite to martensite i.e. (soft material to hard material), to change the grain size, to modify the structure of the material and relive the stress set up in the material. It is a one-time permanent treatment process and it is change the entire cross section of the material [5, 7]. The martensitic phase transformation is usually used to increase the hardness of the steels.

The various heat treatment processes are annealing, normalizing, hardening, quenching and tempering. According to this work basically focus on carburizing; it is a process of improving carbon on case. These are done by exposing the part to carbon rich atmosphere at the high temperature (close to melting point) and allow diffusion to transfer the carbon atoms into the steel. So, these work concentrations go through pack carburizing which can easily do in experimental setup. The carburizing process does not harden the steel it only increases the carbon content.

In heat treatments, both chemical composition and microstructure properties of a case can be changed. The aim of this paper is to examine the hardness, XRD and effect of microstructure of before and after heat treatment on EN36 steel. In heat treatment, the machined specimens are loaded in the chamber at below 800°C. Carburizing takes places at 920°C for 120 minutes then it is cooled by air and relaxing time is 75 minutes.

The purpose of the relaxing time is to arrest the in and out of the carbon and it is followed by oil quenching at 820°C for 30 minutes, oil temperature is below 80°C then by tempering at 250°C for 90 minutes. In general, the untemper material structure has the high hardness and also more brittle. Hence the tempering process should be done to reduce the brittleness, to relieve the internal stress and to increase the toughness and ductility of the material.

4.5 MATERIAL COMPARISON

After annealing specimen becomes more harder then untreated specimen. After annealing hardness is more as compared to untreated specimen. But specimen has not obtained good microstructure. After hardening and tempering specimen are hardest then other three specimens also having a good corrosion resistance.

Industrial survey conduction are found to be very useful approach for selection of tool steel grade which will more beneficial for industrial point of view. From the literature review, it is observed that less research work has been seen for Tool Steel i.e. EN19, EN8, EN36, and EN41 after Heat Treatment Processes Such

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Fig.4.4 Overview of all specimens related with project

Also very less work has been reported for AISI EN19 Die Steel. It is observed that the effect of hardness of work piece material after treatment of Tool Steel i.e. EN41, EN8, and EN36 have not been explored yet, so it‘s interesting to Study the Effect on the Hardness of three Sample Grades of Tool Steel i.e. EN19, EN8, and EN36 after Heat Treatment Processes Such As Annealing, Normalizing, and Hardening & Tempering.

All these aspects will be addressed in research work. Indexing of HTPI 2012 is found to be very effective to defined objective function. After annealing specimen of EN19 becomes more softer then untreated specimen as hardness value shown. After normalizing hardness is more as compared to untreated specimen. After hardening and tempering specimen are hardest then other three specimens. After annealing specimen of EN-8 becomes more softer then untreated specimen as hardness value shown.

After normalizing hardness is more as compared to untreated specimen. After hardening and tempering specimen are hardest then other three specimens due to formation of fine tempered martensite. After annealing specimen of EN41 becomes more harder then untreated specimen. After annealing hardness is more as compared to untreated specimen. But specimen has not obtained good microstructure.

After hardening and tempering specimen are hardest then other three specimens also having a good corrosion resistance. Future Aspects of this study to carry out further is very wide. Selecting of different tool steel material and compare them the effects on their mechanical properties. Recommended material for further work done to be carried out for similar study EN41, mild steel, HC HCR cold working tool steel grades as so many.

HSS found to be very tool steel grade difficult for such study as per investigation form industrial survey. Using Different analytical approaches is also making an effective outcome which is also recommended.

CHAPTER 5

MODELLING AND ANALYZING PROCEDURE

5.1 MODELING THE TWIN SHAFT SHREDDER– COMMANDS USED IN THE PRO E CREO 2.0 SOFTWARE.

- CIRCLE- This command is used to create the circle.
- Sketch – select the plane or flat surface on the graphical window – click circle icon on the side tool bar- select the center point of the circle- extend it to the required size-ok.

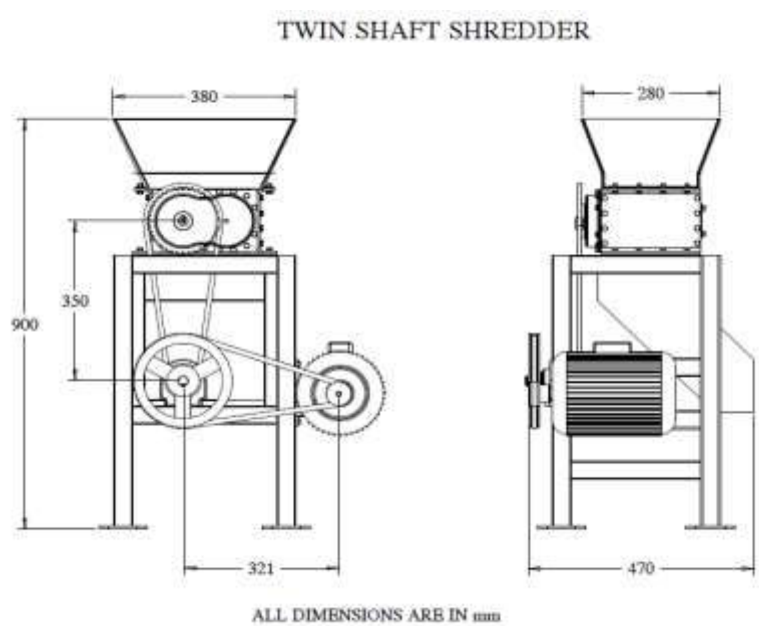

Fig.5.1 Twin blade shredding unit-CAD View

- LINE- This command is used to create the line.
- Sketch-select the plane or flat surface on the graphical window – click the line icon on the side tool bar – select the start point and the endpoint of the circle-ok.
- TRIM- This command is used to break the two or more intersecting or crossed entities. The entities may be a circle, line, arc or elipse in the window.
- Select the trim icon on the side tool bar- select the entities want to trim – ok.
- MIRROR- This command is used to create the symmetrical object of lines, circles or any drawings in the sketch
- Select the mirror icon on the side tool bar- select the entities want to mirror – click the horizontal axis or vertical axis or any axis created by manual on the graphical window – ok.
- DIMENSION CONSTRAINS- This command is used to create and modify the dimension between two entities.
- Select the dimension constrain icon on the side tool bar- select the entities want to dimension it – double click on the dimensioned line – change the dimension - ok.
- GEOMETRICAL CONSTRAIN – This command is used to constrain the two entities in perpendicular, parallel, vertical, concentric or coincide, etc,..
- Select the geometrical constrain icon on the side tool bar – select the entities want to constrain - select the required constrain – ok.
- EXIT WORKBENCH- This command is used to exit the sketcher workbench
- Select the exit workbench icon on the side tool bar – ok.
- PAD- This command is used to extrude or make the 3D object from the sketched 2D profiles in a sketcher workbench
- Click the pad icon on the part design workbench – select the profile want to pad – enter the dimension on the window - ok
- POCKET – This command is used to remove the material from the padded object

- Click the pocket icon on the part design workbench – select the profile want to pocket – enter the dimension on the window - ok
- RIB – This command is used to create the extruded object through the different shape of the curve or complex profiles (ex. Springs)
- Click the rib icon on the part design workbench – select the profile – select the center curve – ok
- Rib is created only the two profiles are created into a two separate sketches
- THREAD- This command is used to define the thread on the circular surface inside and outside (ex. used in bolts & nuts)
- Click the insert in the utility menu – dress-up features – select the thread/tap – select the lateral surface and limit surface – enter the thread diameter, thread depth and pitch value on the window – ok.
- CHAMFER – This command is used to chamfer the selected 3D object in the part design window
- Click the chamfer icon on the part design workbench – select the elements to chamfer – enter the chamfer length and angle – ok.
- INSERT-EXISTING COMPONENT- This command is used to create the assembly from the created parts in the part design
- Click the insert in the utility menu – existing component – select the component – open –ok.
- CONTACT CONSTRAIN – This command is used to mate the two flat surfaces or two circular surfaces. This project we are using this command to mate the every leafs.

Fig.5.2 Twin blade shredding unit

- Click the insert in the utility menu – contact – select the components– click ok.
- OFFSET CONSTRAIN – This command is used to constrain the two objects between the required dimensional intervals on it.

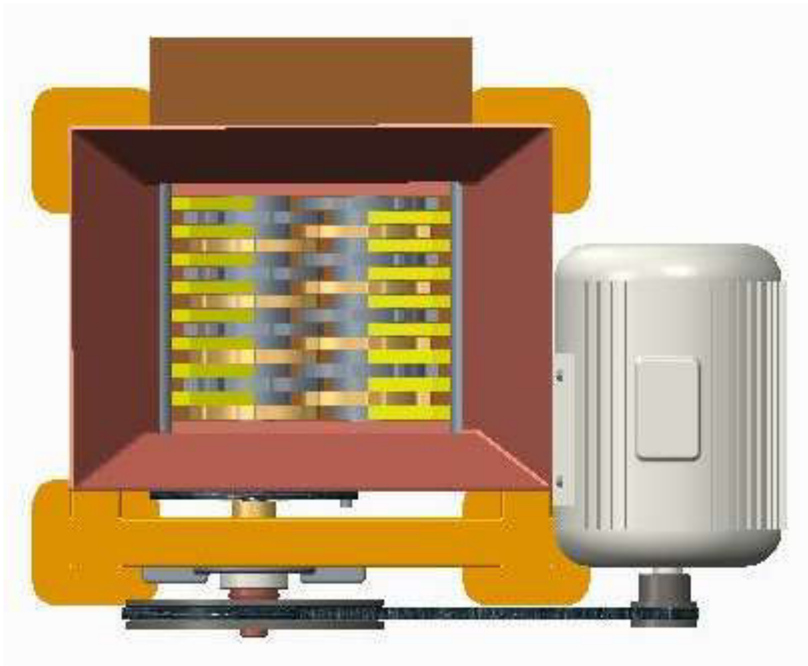

Fig.5.3 Twin blade shredder top view

- Click the insert in the utility menu – offset – select the components– enter the offset value - click ok.
- ANGLE CONSTRAIN – This command is used to constrain the object in a required angle of our need.
- Click the insert in the utility menu – angle – select the components– enter the angle value - click ok.
- UPDATE – This command is used to update the every changes in the assembly workbench
- Click the update icon on the tool

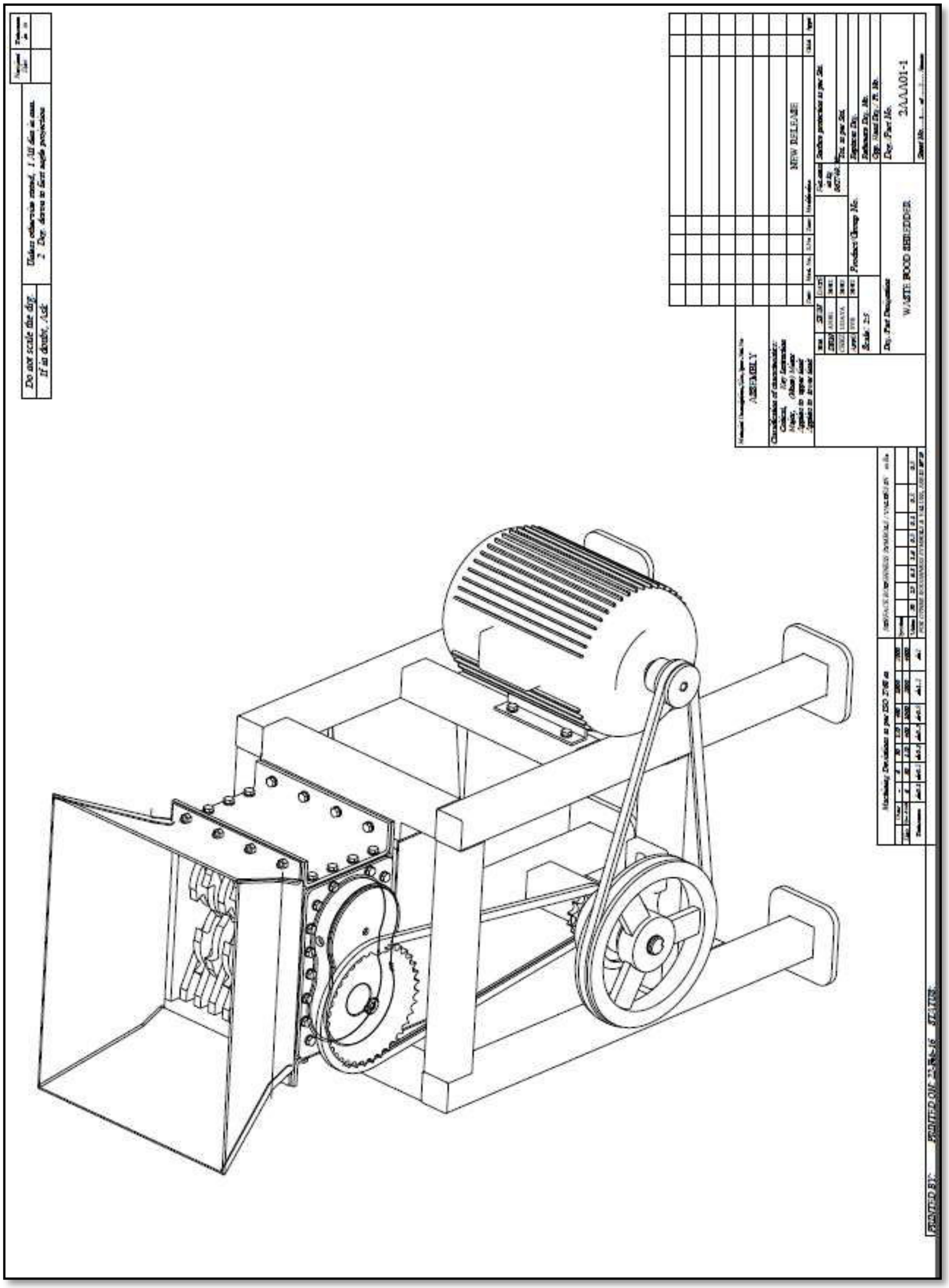

Fig.5.4 Twin blade shredding unit-CAD View-1

BILL OF MATERIALS

S.NO.	DESCRIPTION	QTY	
1	WASTE FOOD SHREDDER	1	
2	PLATE AND BRG ASSEMBLY	2	
3	BRG HSG PLATE	1	
4	BALL BEARING-61904-2RS1 (SKF)	2	
5	BLADE ASSEMBLY	1	
6	SHAFT-RH & LH	1	
7	BLADE-N1	8	
8	SPACER-1& 2	2	
9	HEX ROD SPACER	16	
10	BLADE-N	8	
11	SHAFT SUPPORT PLATE	16	
12	BLADE SIDE COVER	2	
13	BRG COVER PLATE	2	
14	SPACER-GEAR	2	
15	KEY-SHAFT LH & RH	1	
16	NOMINAL SIZE M6 SPRING LOCK WASHER	36	
17	M6X1.0X10 Hex Head Bolt	12	
18	GEAR-36T	2	
19	SPEACER-KEY	1	
20	SPROCKET ASSEMBLY	1	
21	12.7 INCH CHAIN	1	SOROCKET CD =450mm(APPROX) SPROCKET RATIO=3
22	CHAIN_SPROCKET-36T	1	
23	CHAIN_SPROCKET-12T	1	
24	SPEACER_SHAFT	2	
25	M8X1.25X22 Hex Head Bolt	2	
26	HSG ASSEMBLY	1	
27	HSG_PLATE & PLATE-2	2	
28	M6X1.0X18 Hex Head Bolt	24	
29	M6X1.0 Hex Nut	8	
30	V-BELT-(A -TYPE)	1	
31	V-BELT-PULLEY-OD200	1	
32	V-BELT-PULLEY-OD50	1	

Table No.5.1 Twin shaft shredder bill of materials

MOTOR LOAD CALCULATION

TWIN SHAFT SHREDDER LOAD CALCULATION		
PARAMETERS	**DATA**	**UNITS**
RADIUS OF THE BLADE	56	Mm
APPLIED LOAD	2	Kgs
NO OF BLADES	16	-
TORQUE	896	-
OUTPUT TORQUE	17920	N-mm
TORQUE	17.92	N-m
FACTOR OF SAFETY	1.3	-
TORQUE	**23**	**N-m**
MOTOR TORQUE	FIND	-
POWER (1 hp)	745	Kw
MOTOR POWER (2 Hp)	1490	Kw
MOTOR RPM	600	Rpm
FORMULA	P=2*3.14*N*T/60	-
TORQUE	T=(60*P)/2*3.14*N	-
TORQUE	24	N-m

Table No.5.2 Twin shaft shredder motor torque calculation

BLADE RPM CALCULATION

TWIN SHAFT SHREDDER SPEED CALCULATION		
PARAMETERS	**DATA**	**UNITS**
MOTOR INPUT RPM (N1)	600	Rpm
DRIVING PULLEY DIAMETER (D1)	180	Mm
DRIVEN PULLEY DIAMETER (D2)	30	Mm
FORMULA (R1)	R1=DRIVEN PULLEY/DRIVING PULLEY	-
RATIO (R1)	0.17	-
DRIVEN PULLEY MOTOR OUTPUT RPM	N2=R1*N1	-
OUTPUT RPM	100	Rpm
DRIVING GEAR TEETH (T1)	12	-
DRIVEN GEAR TEETH (T2)	36	-
FORMULA (R2)	R2=DRIVEN GEAR/DRIVING GEAR	-
RATIO (R2)	3	-
N2=N3 RPM	100	Rpm
DRIVEN GEAR RPM (N4)	N4=R2*N3	-
N4	300	Rpm
ROTOR IDEAL RPM	300	Rpm

Table No.5.3 Twin shaft shredder blade rpm calculation

6.CONCLUSION AND FEATURE WORKS

CONCLUSION

In this study of project the twin shaft shredder blades has generally used of 20MnCr5 material for blade manufacturing . It is capable to do the special process of heat treatment and annealing and quenching in the temperature of 910°C-960°C.

But the 20 MnCr5material Quality of Life is maximum 30,000 cycles of rotation in shredding of materials and rubbers. The process cost and service capability of this material is quite difficult on as soon as possible.So in this project we are using the EN8, EN19, EN36 &EN41 materials for manufacture the blades and reduce the process cost of this blade in shredding machine.

We have conduct the cutting, grinding, machining, hardening of major three tests hand overfeed in these materials successfully. In these test we conclude and select the materials of EN36. Cause the cost and availability of this material is simple in society. And this material is capable to our required process.

FUTURE WORKS

Design of the Twin Shaft Shredder machine & Blades has successfully completed with required design calculation. The Required level RPM of Motor also analyzed and find out as per the project of Twin Shaft Shredding Machine. In this project Design of twin Shaft Shredding Machine and Blades is completed with Creo software and the blades and shredding machine is analyzed in future with the use of Hyperworks/ANSYSsoftware. And calculate the stack up calculation of the blades assembly.

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