INVESTIGATION OF MECHANICAL PROPERTIES FOR HARDENED & TEMPERED EN8 METAL COMPOSITE

Mr. Dipak S.Patil
Research Scholar
JJT University
dipakpatil.mechanical@gmail.com

Dr. S. Chakradhar Goud
Research Guide
JJT University
anveshanacgoud@gmail.com

Abstract:
Un-tempered martens condition steels, are hard for most of the applications. It requires that quenching parts to be tempered, so to impact some toughness and then improve ductility and hardness. This work performed on variously heat treated medium carbon steel, to achieve an optimum heat treatment strategy for combination of hardness and tensile properties. The conduct of Tensile and hardness test components are fabricated using various machining process on machine. These components are subjected to various heat treatment processes, consisting of annealing, hardening, quenching, and tempering at different temperatures. Heat treated components were mechanically tested for Rockwell hardness and tensile properties like yield strength, ultimate tensile strength, ductility and structure and grain size and its elongation.
Mechanical testing of medium carbon steel components with increasing temper temperatures: (a) first yield strength decreases, then increases, and then decreases again; (b) first hardness increases to a maximum and then gradually decreases; (c) first ductility (% elongation) increases, and then decreases before continue to increases. (d) first Ultimate strength increases to a maximum and then steadily decreases.

1. INTRODUCTION

Steering system of car is important for safety as well as enhances the comfort of car's ride. The present work based on the testing of metal under various hardening & tempering conditions. This work is sponsored by the Lotus Engineering Works, Satpur Nashik. The current development of the industry at the present time especially the machinery industry also spurs the development of basic material manufacturing technology such as steel. Using this conditions sufficient mechanical properties, so that the life of component can be increased. Engine components are usually treated by heat treatment. Proper heat treated of steels material is most important factors in determining the performance of object in actual practice. Some engineering materials, like steel are heat treated based on under controlled conditions of heating and then cooling to change their physical and mechanical properties to meet expected engineering applications for better performance in service life. Basically heat treatment operation is a controlled heat treating and cooling process of materials, In order to changes their mechanical properties.

To checking mechanical properties of steel, used the tensile test which gives detail information on the steel alloys on strength and ductility during applied loading conditions. This information is useful for a design engineer to select proper materials under different conditions used in industrial and construction applications. Steel is alloy of iron- carbon content with also other alloy elements to improve mechanical properties. Generally steel is most important engineering materials mostly used in industrial applications for manufacturing of components, building structures for foundation and slab work, automotive industries for chassis and

other body parts fabrications and power plant engineering applications in the form of various shapes as beams, rods, plates, tubes, and sheet metal etc.

These Investigations is carried out to find out the effects of heat treatment on the hardness and mechanical properties of medium carbon steel. First to select the suitable material of steel like which is currently used is EN-3 is to be hardened and tempered at suitable conditions to enhance the better hardness and mechanical properties of materials under working conditions. The construction about a Steering Column Sleeve basically consists of the outer tube which is fitted to the bodywork and the steering shaft. The steering shaft connects to the steering wheel through the steering gear and is supported in an outer tube. The steering sleeve may contain universal joints for allowing it to deviate somewhat from a straight line, so as to access the best position on the steering gear assembly. One of the most important about parts of the overall steering mechanism is the steering sleeve. The steering sleeve is a fixed, tube-like cover which works the rotatable steering shaft is connected to the steering wheel at the top end and the steering box at the other end. Fig.1.1 shows the assembly of steering sleeve.

The motivation for this research is based in an industrial interest in the tackling the trade-off between strength and hardness of steel so as to provide the designers and users in various metal working industries with good guidelines to select proper tempering temperature for heat treating medium carbon steel for optimum combination of mechanical properties.

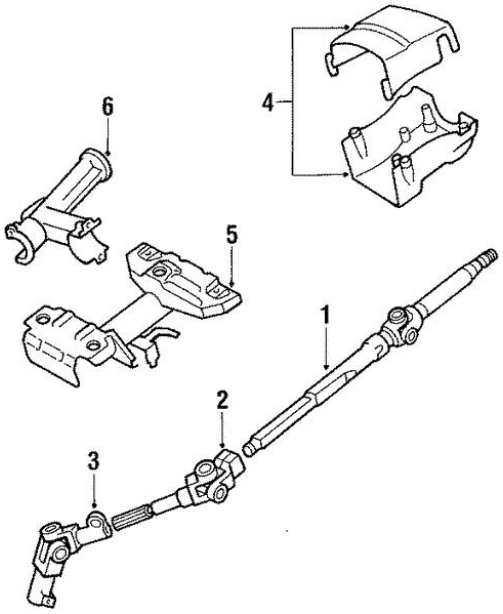

Fig.1.1 Assembly of Steering Sleeve

It was observed that mechanical properties of steel are connected to their microstructure obtained after heat treatments which are performed to achieve good hardened and tensile strength with sufficient ductility.

In fig.1.2 shows the heat treatment furnace for heating a steel component at suitable temperature.

Fig.1.2 Heat Treatment Furnace

2. OBJECTIVES

The study is proposed to achieve the following objectives for Experimental investigation of mechanical properties to

find out suitable conditioning material for an automotive steering sleeve component**.**

To check the Mechanical Properties of currently used automotive steering sleeve.

1. To find out suitable material for automotive steering sleeve.

2. Experimental investigation of selected material for automotive steering sleeve.

3. To validate the results.

4. METHODOLOGY

To achieve the objectives, defined in objectives section following methods will be applied

1. To check the Mechanical Properties of currently used automotive steering sleeve.

To satisfy the above objective, following tests are conducted.

I. Chemical testing on currently used steel material in automotive steering sleeve.

II. Tensile testing on currently used steel material in automotive steering sleeve.

III. Hardness Testing on Currently used steel material in automotive steering sleeve.

In this testing methods first I have selected a particular type of steering sleeve, and then observe there manufacturing process from raw material to finish of component. Take the sample of sleeve in without hardening and tempered condition and check it laboratory to find out the material and their contents, and then take another sample for checking hardness of sleeve, and finally that sample done on tensile testing to check their mechanical properties.

Then second part of this work I have take one sample piece of steering sleeve with hardened and tempered conditions which is already defined by company. Then checking hardness of that sleeve, and finally that sample done on tensile testing to check their mechanical properties. After testing, prepare the reports for testing for further work.

2. To find out suitable material for automotive steering sleeve.

To satisfy the above objective, I have detailed study on testing report of currently used sleeve. Then study of Literature Review, Research Papers, and all other sources to get the detail information about materials. Then find out some type of materials which having hardness is same or more than the currently used sleeve for in a unhardened and tempered conditions. Then detail study done on that all type of materials and select best one material for suited the steering sleeve.

One sample of steering sleeve is prepared for selected material. After manufacturing of sleeve check this sleeve material in lab for hardness and tensile testing. After the testing report compare the result with currently used material sleeve if you find better result then finalized that component material.

3. Experimental investigation of selected material for automotive steering sleeve.

To satisfy the above objective, we have done experimentation on selected material under different tempering conditions, on the basis of material properties we have to decide the hardening temperature and different tempering range to achieve better

hardness and ultimate strength of materials. First we have done software testing and then done testing in laboratory.

I. Software Testing.

First to done modeling of object, and then that object to check the hardness and ultimate strength on suitable heat treatment simulation software under giving hardening and tempering conditions. Generate the report of steering sleeve done in software testing.

II. Laboratory Testing

The actual machining sample, done the hardening and tempering of that component for selected temperature range and conditions. Then this hardened tempered samples done on hardness and tensile testing in laboratory. Generate the report of steering sleeve done in laboratory testing.

Compare the results for software testing and laboratory testing. And find out the error.

4. To validate the results.

The results obtained from experiments will be compared with the currently used steering sleeve results. Graphs will be plot for more clarity and understanding for results. Recommend the company for fined suitable conditioning metal for further processing and fined results approved by sponsored steering sleeve manufacturing company.

Results and discussion

The work involved simulation and lab experimentation of steering sleeve. Trials were conducted for performance of material during the process of various tempering conditions. The same was found satisfactory. The trail and testing of steering. The comparative results obtained are Ultimate tensile strength, Elongation and BHN for EN-3 Material is 673.93 N/mm2, 7.64 mm, 240-245 and EN-8 materials is 834.82 N/mm2, 8.92 mm, 250-255

Sleeve by simulation method and lab experimentation is satisfactorily completed. The recommended material for steering sleeve component is EN-8 with Hardening 8400C, Tempering 3500 C and Quenching 600C at 7200 sec.

REFERENCES

1. Muswar Ali Farhad, Qadir Bakhsh Jamali, Abdul Sattar Jamali, Asif Rao, 2019. Analysis Mechanical Properties of Carbon Steel using different Heat Treatment Processes. QUEST RESEARCH JOURNAL, VOL. 17, NO. 2, 61–65,

2. Prashant S.D, sushil dange, 2019, To check the Effect of Tempering Process on the EN-24 Steel Alloy, International Research Journal of Engineering and Technology, Volume 06 Issue 03, 3919-3929.

3. Unueroh Ufuoma Georgina, Igbinomwanhia Noel Osabuohien, 2019. Effect of Austenite Temperature on the Tensile Property of AISI Steel. Journal of Science and Technology Research. 1(3). 50-57.

4. Viplav Bhagat, Avinash Desai, 2020. Design, Analysis and Optimization of Steering System. International journal innovative research in technology, Volume 6 Issue 8. 19-27.

5. Md Wali Ahmad, M Anas, Syed Asghar 2020, To Study of Mechanical Property and Corrosion Behavior of Heat Treatment on Carbon Steel, International Journal Research in Applied Science & Engineering Technology, Volume 8 Issue IX, 148-152.