Review on Properties of Heat Treated Low Steel

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Abstract – This paper is focusing on the study of carburizing which is most widely user heat treatment process in many industries . Carburizing is employed in order to improve hardness and wear resistance. This study involve effect of carburizing on mechanical and wear properties of low carbon steel.

Keywords – Carburizing ,wear, hardness.

I. INTRODUCTION

Many research study involves in the area of surface treatment in order to improve properties of material subjected to friction and wear . one of the surface treatment is carburizing which is widely used in industry to produced extremely hard and wear resistance surface. There are number of carburizing method for obtaining wear protected surface in which solid, liquid and gases are applied. Carburizing is often used when hardenbility is required. Carburizing process employed for manufacturing of gear ,cam shaft , crank shaft in order to achieve extreme hardness at the surface and toughness at the core.

II. CARBURIZING

Carburizing is one of the most widely used surface hardening process. The process involves diffusing carbon into a low carbon steel alloy to form a high carbon steel surface. Carburizing steel is widely used as a material of automobiles, form implements, machines, gears, springs and high strength wires. Carburizing is the addition of carbon to the surface of low carbon steels at temperatures generally between 850 and 9500C,at which austensite, with its high solubility for carbon, is the stable crystal structure. Carburizing consist of enrichment of surface layers of low carbon (carbon less than equal to 0.30%)with carbon up to 0.8 % to 1% by this way the good wear and fatigue resistance to superimposed on a tough low carbon steel core.

III. WEAR

Wear is commonly defined as the undesirable deterioration of a component by the removal of material from its surface. It occurs by displacement and detachment of particles from surface. The mechanical properties of steel are sharply reduced due to wear. The wear of material may be due to the friction of metal against each other, eroding effect of liquid and gaseous media, scratching of solid particles from the surface and other surface phenomena.

Wear test are generally carried out with plate-on-disc configuration on a standard Tlint universal wear tester. After test samples are fixed on the wear tester as the upper member of the friction pairs and loaded with test loads, the counter face disc, the lower member, is rotated by making contact with the test sample. The wear tests is carried out with constant speed of 3.6 m/s under loads of 55.6N, 109N, and 147.5N.To determine the wear behavior of the test samples as a function of sliding distance ,test duration are chosen as 10,30,45,60,90,180,300,420,540s.

Fig 3.2.1: Specimen for wear test

Fig 3.2.2 : Specimen for tensile test as per ASTM Standards

IV. LITERATURE REVIEW

Motoo Egawa, Nobuhiro Ueda, Kazuhiro Nakata, Masato Tsujikawa, Manabu Tanaka[1] In this study, various

austenitic stainless steels were low-temperature plasma nitrided and carburized, and the effect of additive alloying elements on the S-phase characteristics was investigated by various analyzing techniques: observation using an optical microscope, transmission electron microscope, X-ray diffraction analysis, an anodic polarization measurement in 5% H2SO4 solution, and a friction and wear test using a ball-on-flat friction apparatus. The thickness of the nitrided and carburized layers increased with an increase in the process temperature, and the thickness of the layer formed on the AISI316 steel is thickest in all substrate steels

B. Selc,uk,*,R. Ipek, M.B. Karamis, V. Kuzucu[2] In this study, the wear behaviour of the borided and carburized AISI 1020 and 5115 steels are investigated. Some of the samples prepared from test materials are carburized and some borided. The microstructure, worn surface and hardness distribution of the samples are examined. After and before wear testing, the surface phases of the treated samples are determined by X-ray diffraction method. Fe2B phase is obtained on the borided surface. The wear tests are conducted with plate-on-disc sample conguration under dry sliding conditions. The wear behaviour and friction characteristics of the samples are determined as a function of sliding distance and the load. The results are compared with each other. It is observed that the weight loss of the borided AISI 1020 steel is lower than that of carburized AISI 5115 steels.

Sheng-guang Zhang,Wen-zhongWang, Hai-boZhang, Zi-qiangZhao[3]This paper aims to investigate the hardness distribution by the carburizing on the contact behavior. A develop elastic-plastic contact model based on semi-analytical method is used. The effect of hardness contact behaviors is considered by means of the linear hardness-yielding strength relationship.Different hardness distributions are considered to simulate the possible results obtained in heat treatment. The results show that the hardness distribution and carburizing time/ case depth have different influence on the plastic strain under different loads and roughness, while its influence on the maximum contact pressure and contact are a ratio is very limited.

Osman Asi,*, Ahmet Çetin Can , James Pineault, Mohammed Belassel[4] The bending fatigue performance of high temperature gas carburized SAE 8620 steel was evaluated and compared to conventional temperature gas carburization.The results indicate that the fatigue performance of the high temperature gas carburized specimens was relatively poor compared to the conventionally gas carburized specimens.

P. Cavaliere, G. Zavarise , M. Perillo [5] The thermo-chemical diffusional process of carburizing and nitriding was modeled in this study. The analysis led to the prediction of surface hardened layers dimensions and hardness in commercial steels. Diffusion model based on Fick's laws was applied to such steels in order to describe the growth kinetics of layers, then the analytical model was employed to perform finite element calculations. In such way it was possible to calculate the carbon and nitrogen concentration in the cross sections of cylindrical samples and the consequent hardness profiles coupled with the residual stresses ones. The results from analytical model and FE calculations were compared with experimental data.

Olanike Mary OLUWAFEMI, Samuel Ranti OKE, Iyiola Olatunji OTUNNIYI, and Fatai Olufemi ARAMIDE[6] The effects of varied carburizing temperatures and holding time on the mechanical properties of AISI/SAE1020 steel have been investigated. Standard test samples prepared from the steel sample were subjected to pack hardening process using carbonized palm kernel shell as a carburizer at 800°, 850°, 900° and 950°C and held for 60, 90 and 120 minutes, quenched in oil and temper at 500°C for 60 minutes. After pack hardening process, the test samples were subjected to tensile, impact and hardness tests. and from the data obtained Ultimate tensile strength (UTS) and impact strength were calculated, it was observed that the UTS increases with increase in holding time. It was concluded that the optimum combination of mechanical properties is achieved at the carburizing temperature of 950°C soaked for 120 minutes followed by oil quenching and tempered at 500°C for 60 minutes.

N.A. Astunkar, A.S. Bonde[7]In this paper the over view of carburizing process and its effect on wear properties various types alloy steels. Carburising is one of the process of surface hardening and sufficient toughness at the core for increasing hardness over the surface of steel component so that wear resistance at the surface of steel component of steel component can be improve. Aim of carburizing is to increasing carbon content in low carbon steel at the surface.

V. CONCLUSION

Carburizing process widely used in manufacturing of automotive gears. By using carburizing process I have to increase carbon content so that, I investigate their mechanical properties like hardness, friction wear resistance properties increase & their failure limit increase to some extent. different types of low carbon steel carburized in different heat condition &their microstructure change according their microscopic study.

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