Performance Analysis of Depth Hardness of EN41B Material using Gas Nitriding Process-A Review

Mr. Dipen B. Prajapati[1] Mr. Dixit M. Patel[2]
[1]PG Scholar [2]Assistant Professor
[1,2]Department of Mechanical Engineering
[1,2]SAL College of Engineering, Ahmedabad, India

Abstract— Gas nitriding is wide wont to turn out onerous and wear resistant surface. It's performed within the temperature vary 480 to 580 °C. If the substrate material needs heat treatment, it should be performed before nitriding. The gas is typically a combination of ammonia and a carrier gas, e.g., nitrogen to extend the depth hardness of EN41B material exploitation gas nitriding method. Gas nitriding method is heat treatment method used for rising wear resistance, corrosion resistance and to boost mechanical properties nearly applies to the vary of steels containing nitride-forming component like metallic element, molybdenum, metallic element and al. With the utilization of chamber the gas ntriding method is feasible by exploitation completely different input parameter as method management, method chamber maintenance, time, temperature, gas activity management, gas flow, carbon content, chamber temperature etc, and observe its effects on output parameter like layer thickness, hardness, wear resistance, corrosion resistance, mechanical properties. To perform the experiment, associate degree experiment style matrix was habitual exploitation the planning of the experiments.

Keywords: Hardness, Gas Nitriding, EN41B Material, Depth Harness, Taguchi Techniques, Optimization, Process Variables

I. INTRODUCTION

A. Fatigue of nitrided En41B steel: effect of internal stress distribution

In this research paper they showed The axial fatigue properties of nitrided En41 B steel specimens of differing diameters however with constant case depth are studied. The tensile residual stress within the specimen core is inflated because the case/core space quantitative relation rises. No relaxation of those stresses was detected when stressing near to the fatigue limit, though at higher stress levels a 10% reduction was measured when 50% of the expected fatigue life. vital enhancements in fatigue properties were determined when nitriding; near to the fatigue limit the best improvement occurred in larger (5 mm dia.) specimens, however the littlest specimens (3 mm dia.) showed the best increase in fatigue strength at lives below 105 cycles. The mechanisms of failure were known metallographically in every case; Yielding of the core happens once the total of the applied tensile stress and also the axial core residual stress exceeds the yield stress of the non-nitrided material, and this result in a distribution of stresses between case and core. Once the strain distribution is taken under consideration, the fatigue-limit information for all specimen sizes tend to lie on a typical curve between the Goodman line and Gerber conic. Decreasing the specimen diameter ends up in a rise within the tensile residual core stress for a given gas-nitriding treatment applied to En41B steel. The magnitude of the rise could also be foreseen from the equations of equilibrium of forces between case and core. Specimens subjected to fatigue deformation at stress levels near to the fatigue limit don't show any relaxation in residual stresses from nitriding. At higher stress levels a little relaxation in axial residual core stress occurs approximately 10% when 2· 5 x 104 cycles (50% of expected life) at a stress amplitude of 575 MN m-2•Nitriding results in vital enhancements within the direct stress fatigue properties of En 41B steel for the vary of specimen sizes tested - 3, 4, and 5mm dia. near to the fatigue limit the best enhancements in properties occurred in larger specimens. At concerning 105 cycles the S-N curves cross over and also the smallest specimens showed the best increase in fatigue strength at lives below this. The fatigue limit of the nitrided material is inflated by applying a mean compressive stress, and bated by a mean tensile stress. The bigger improvement in fatigue properties of smaller specimens at lives below 10S cycles can even be explained by the strain distribution occurring higher than the core yield stress. The particular stress performing on the core are less for smaller specimens and also the impact becomes a lot of.

B. Hardness and Case Depth Analysis through Optimization Techniques in Surface Hardening Processes

In this research paper they showed Surface engineering and surface designed materials realize wide applications in engineering industries in recent years. Inconsistency in hardness and case depth has resulted within the additional optimization of the method variables concerned in surface hardening. Within the present study, the subsequent operational parameters viz. preheating, carbon potential, holding position, chamber temperature, carburizing time, termination medium, termination temperature, termination time, tempering temperature and tempering time were taken for optimization exploitation the Taguchi and Factorial style of experiment ideas. From the experiments and optimization analysis conducted on EN29 and EN34 materials it absolutely was determined that chamber temperature and termination time had equal influence in getting a more robust surface integrity of the case hardened elements exploitation gas carburizing. Preheating before gas carburizing additional increased the surface hardness and also the depth of hardness. Within the case of induction hardening method, power potential vie an important role in optimizing the surface hardness and also the depth of hardness.

C. Performance Evaluation of Mechanical Properties of EN41B using Gas Nitriding Process

In this research paper they showed the main objective of this project is to develop and establish a gas nitriding method and investigation of Gas nitriding characteristics of most typically used EN41B steel. Gas nitriding method is heat treatment method used for rising wear resistance, corrosion resistance

and to boost mechanical properties virtually applied to the range of steels containing nitride-forming parts like metallic element, molybdenum, metal and aluminum. With the utilization of chamber the gas nitriding method is feasible by exploitation completely different input parameter as method management, method chamber maintenance, Time, Temperature, Gas activity management, Gas flow, Carbon content, chamber temperature etc, and observe its effects on output parameter like layer thickness, hardness, wear resistance, corrosion resistance, mechanical properties. To perform the experiment, associate degree experimental style matrix was accepted exploitation the planning of the experiments

1) Experiment Procedure:

Parameter	Unit	Level 1	Level 2	Level 3
Nitriding temperature	°C	480	500	520
Soak time	Hour	10	11	12
Ammonia flow rate	mm^3/hr	48	54	60

Table 1: Range of Process Parameters

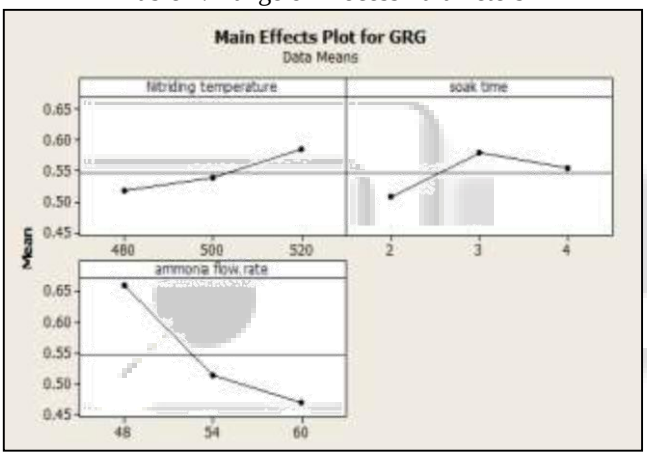

Fig. 1: Main effect of factor on Grey Relational Grade

The response table of Taquchi-Grey methodology analysis was accustomed optimize the impact of method parameters on EN41B. the best gray relative grade of 0.8125 was determined in experiment run 22 that indicates that the optimum combination of management factors for mentioned responses. The optimum parameter values are at nitring temperature 520 ºC, soak time 3hrs and ammonia rate of flow 48 m3/hr. At these parameters the values of yield strength 882 MPa, tensile strength 1062 MPa and hardness 300 BHN respectively.

D. Study of the Effect of Gas Nitriding Time on Microstructure and Wear Resistance of 42CrMo4 Steel

In this research paper they showed the damage behaviour of 42CrMo4 steel has been studied per the nitriding time used throughout gas nitriding. The foremost necessary conclusions obtained are:

1) Nitriding ends up in a substantial increase of hardness and also the formation of compressive residual stress. ε (Fe2+3N) and γ' (Fe4N) nitrides square measure indispensable to supply the best hardness. The nitrided case supports sufficiently the hard coating.
2) Compared to the bottom line, quenched and tempered samples, adhesive wear tests incontestable that the applying of gas nitriding was effective in enhancing the hardness and adhesive wear resistance of the samples composed of the low alloy 42CrMo4 steel. The formation of a skinny compound layer resulted in optimum wear properties. it's found that the compound layer is eliminated terribly quickly. it's so liable to delamination. The ensuing particles represent a 3rd onerous body that contributes to the damage by diffusion layer.
3) it's doable to get the required compound of hardness, structure and thickness of the compound layer resulting in optimum wear resistance of the 42CrMo4 steel rumored here, by dominant the gas nitriding time.
4) Adhesive wear resistance will increase with hardness increasing. once compound was created on the worn surface, the governing wear mechanism was tribooxidation, that causes less wear. On the contrary, once compound was absent the governing wear mechanisms were abrasion and adhesion.

By relating the experimental results of this study, the damage rate will be foreseen by numerical models supported the neural network to higher describe wear resistance behaviour of nitrided specimens as a perform of the conditions take a look at.

E. Analysis of Mechanical Properties of En19 Steel and En41b Steel Used In Diesel Engine Camshaft

In this research paper they showed the acceptable alternate material chemical compound steel EN41B has been known and analyzed for the diesel shaft rather than EN19 Steel material. Since the prevailing material necessitates frequent replacement resulting in loss of your time and cash. Mechanical properties like hardness, toughness and wear resistance of chemical compound steel nut 41B were studied. Additionally stress analysis was allotted exploitation ANSYS.

The results obtained from hardness take a look at indicated that the hardness of the chemical compound steel En41B is 31% more than EN19 Steel before induction hardening and also the hardness of the chemical compound steel EN41B is 45% more than EN19 steel when induction hardening with 1.5mm case depth. Impact take a look at indicated that the toughness of chemical compound steel EN41B is 38% more thanEN19 steel. Additionally, ANSYS results showed that chemical compound steel EN41B shaft suffered lower displacement than EN19 steel shaft for all load conditions. From these results it will be determined that shaft created exploitation chemical compound steel EN41B has higher service life.

F. Effect of Process Parameters on Gas Nitriding of Grey Cast Iron

In this research paper they showed Based on the gas nitriding experiments and numerical simulations, the subsequent conclusions will be drawn.

1) The numerical simulations, taking under consideration the influence of threshold worth of nitriding potential, will chemical element concentration profile.
2) With the rise in nitriding temperature and time, the thickness of case depth will increase to some extent,

whereas the chemical element concentration on the surface decreases as nitriding temperature will increase.

3) For the analyzed gray forged iron, the nitriding potential has very little impact on the thickness of case depth however includes a comparatively nice influence on the chemical element concentration of work surface and composition of nitriding layer. The planned numerical simulations for nitriding layer prediction and analysis will be a reference for sensible engineering applications.

II. CONCLUSION

After reviewing the paper I found that whereas learning the result of the process parameters on the yield strength, it absolutely was ascertained that sock time play crucial roles within the result on the yield strength. The role of each the nitriding temperature and ammonia rate of flow isn't crucial to a similar extent.

Contribution of ammonia rate of flow square measure terribly high tensile strength and hardness. So it's been seen that value of ammonia rate of flow ought to high for fascinating value of lastingness and hardness. Through use of regression of y on x, engineering will manipulate vary of method parameter for this particular work- material conjointly it's been determine and at any combination of method parameter

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