A

Dissertation Report

On

Dissimilar metal joining of austenitic stainless steel to duplex stainless steel and mild steel by Fiber laser beam

Submitted in partial fulfilment of the requirements for the Degree of

Master of Technology in Metallurgical Engineering and specialization in Process Metallurgy

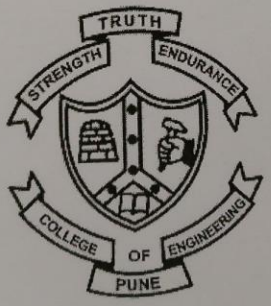
By

Indrajeet Bhausaheb Bhosle

MIS No: - 121427002

Under The Guidance of

Prof. M. J. Rathod



Department of Metallurgy and Materials Science

Govt. College Of Engineering, Pune

(An Autonomous Institute of Government of Maharashtra)

Abstract

Laser welding is a high energy beam fusion welding process used to weld two similar or dissimilar materials. It has main advantage of flexibility, minimum weld and heat affected zone and low distortion. In present work, laser butt welding of two different pairs of dissimilar steels have been attempted. One pair of steels was duplex stainless steel (SAF 2205 grade) and austenitic stainless steel (AISI 304) and the other pair was austenitic stainless steel (AISI 304) and mild steel. Laser welding was done by using 400 W fiber laser system in argon gas shield. The effect of various process parameters such as power density, heat input per unit length and interaction time on the joint microstructure and their mechanical properties was investigated. It was found that increase in laser power density leads to the transition of laser welding mode from conduction to keyhole. Keyhole was formed at power density values above 93 W/mm^2 for the pair of duplex stainless steel: austenitic stainless steel joints. For the pair of mild steel: austenitic stainless steel weld joint keyhole was formed at power density values above 119 W/mm^2. Formability of the laser welded sheet joints was measured by Erichsen cupping test. Depths of drawing for both the pairs of joints was almost same in the range of 13.5 and 14.0 mm when heat input was 144 J/mm. Hard martensite (738 $HV_{0.1}$) was found in the weld metal of joint of mild steel : austenitic stainless steel sheets. The tensile strength values for varied in the range of 168-604 MPa and 133-345 MPa for pairs of duplex stainless steel: austenitic stainless steel and mild steel: austenitic stainless steel weld joints, respectively.

Dissertation report

On

"OPTIMIZATION OF RESISTANCE BUTT WELDING PROCESS FOR HIGH CARBON STEEL WIRE"

For stage 2

Submitted in partial fulfillment of requirement of the degree of

Master of technology

By

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2015-16

ABSTRACT

Resistance upset butt welding is a solid state process and two similar or dissimilar metals are joined before melting temperatures are reached. High carbon steel filament wire of diameter 0.3 mm was welded by resistance upset butt welding. The work was aimed at optimisation of post weld heat treatment parameters, to achieve desired strength and ductility in the wire for hose reinforcement.

The wire joining was done by resistance upset butt welding followed by stress relieving and two cycles of annealing. The failure analysis of weld joints showed that failure appearance to be brittle and it occurred in the weld zone before optimization. Since the wire diameter is small, cooling rate is fast, hence process control becomes difficult. The weld joint must have good combination of breaking load and bend ductility. Due to earlier wire drawing, there is severe plastic deformation resulting in hardness of 600 $HV_{0.3}$. Welding optimization was carried out by changing annealing power and time by self-resistance heating in the welding jaws and in the separate jaws. Their effect on microstructure, hardness, tensile breaking load and bend ductility were studied. The optimum properties were found when annealing power 1 was 350W and annealing time was 8seconds and annealing power 2 was 150W and annealing time was 10seconds. The tensile breaking load and bend ductility achieved was 71N and 44 number of cycles respectively. The resultant joints failed in heat affected zone instead of weld zone on tensile and bend test.

A

DISSERTATION REPORT

ON

3D printing of Bronze powder with variation in powder size distribution

Submitted in partial fulfillment of the requirements

of the degree of

Master of Technology

(Process Metallurgy)

By

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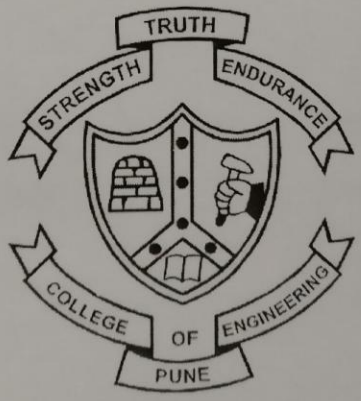

DEPARTMENT OF METALLURGY AND MATERIALS SCIENCE

College of Engineering, Pune

(An Autonomous Institute of Govt. of Maharashtra)

2015-2016

Abstract

There are different manufacturing techniques used in industry such as casting, forging, welding, rolling, machining and powder metallurgy route (PM). 3D printing by selective laser sintering is one of the new techniques in which component is directly fabricated from powder material using CAD model. Advantage of 3D printing is that it can produce complex shaped component in less time. In this work. 3D printing by selective laser sintering is done using bronze powders of varying particle size distribution. A fibre laser was used to study effect of. laser power density, interaction time and average particle size (D50) on sintered density, surface roughness, hardness, chemical composition across the sintered particles and microstructure. For this eight types of powder mixtures were prepared having D50 from 34 µm to 92 µm. The constant parameter used were layer thickness of 0.5 mm, laser beam diameter of 0.3 mm and argon gas flow of 30 litres/minute. The sintered density obtained was between 60 to 89%.

A

Dissertation Report on

Sinterability of a premix Al-4.5Mg-0.8Mn-0.5Fe-0.5Si (Al5083) alloy

Submitted in partial fulfilment of the requirements for the Degree of

Master of Technology in **Metallurgical Engineering**

(Process Metallurgy)

By

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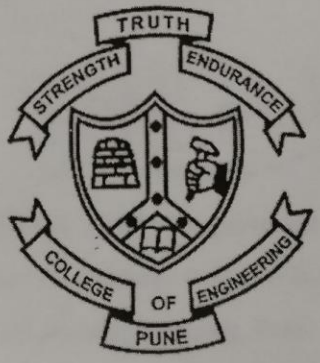

Department of Metallurgy and Materials Science

College of Engineering, Pune

(An Autonomous Institute of Government of Maharashtra)

Year 2015-2016

ABSTRACT

Aluminium powder metallurgy due to its light weight and better physical properties comparative to other materials is finding promising applications in automotive as well as aerospace industry. Al-4.5%Mg (Al5083) alloy being a corrosion resistant alloy, it can be used in marine applications as well. In the present work, the processing parameters viz. mixing period for elemental blending, compaction pressure, sintering atmosphere and sintering period were optimized. For elemental blending, the mixing period was varied between 2 h to 10 h with a time interval of 2 h. The powder blended for 6 h was then compacted at 400 MPa and sintered at 535°C in argon and ultra-high purity nitrogen atmosphere for varied time period of 30 min, 60 min and 90 min to optimize the sintering atmosphere. The mixing time of 6 h and compaction pressure of 500 MPa gave 98% theoretical density and hardness of 70 HRH for sintering at 535°C for 60 min of sintering period. Longitudinal and radial shrinkage was also observed in the compacts sintered for optimized parameters, which can be attributed to the formation of liquid phase during sintering.

A
Dissertation report
On

"Corrosion and Wear behavior of medical grade AISI 316L stainless steel in Hank's solution"

Submitted in partial fulfilment of the requirement
Of the degree of

Master of Technology

(Process Metallurgy)
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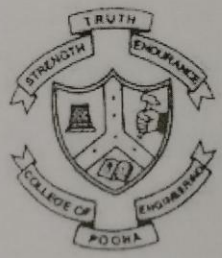

DEPARTMENT OF METALLURGY AND MATERIAL SCIENCE
College of Engineering, Pune
(An autonomous institute of Govt. of Maharashtra)
July 2016

ABSTRACT

Passive alloys require not only high resistance to corrosion but also excellent tribological properties for biomedical applications. In this research work, the wear behavior of AISI 316L stainless steel sliding against EN31 steel were investigated using a pin on disc machine in the presence of lubricants such as Hanks and salt solutions. For investigating the electrochemical properties of the material corrosion tests were carried out in both the solutions.

The results showed that the coefficient of friction were larger for the material sliding in Hank solution as compared to salt water. With increase in normal both coefficient of friction and volume loss were increased for both the solution. The volume loss for AISI316L was greater in Hank solution as compared to salt water. For lower normal loads the loss was lesser but with increasing loads it increases. For the intermediate loads more loss of 25% had seen. The synergistic effect between wear and corrosion was significant. Potentiostatic polarization curves showed that the loss of material due to corrosion was more in case of salt water and this may be due to more aggressive nature of salt water. In SEM analysis nearly same surface morphology had been seen as of earlier researcher.

A

DISSERTATION REPORT

ON

A Study on Sintering Characteristics and Electrical Properties of $BaTiO_3$ - Al_2O_3 Ceramics

Submitted in partial fulfilment of the requirements

of the degree of

Master of Technology

(Process Metallurgy)

By

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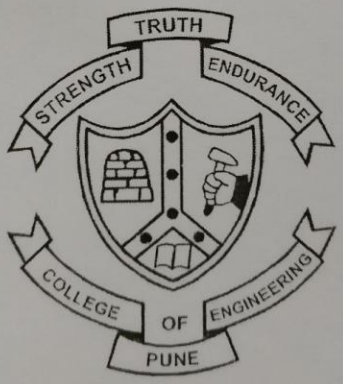
Mr. K. R. Kambale



DEPARTMENT OF METALLURGY AND MATERIALS SCIENCE

College of Engineering, Pune

(An Autonomous Institute of Govt. of Maharashtra)

July-2016

Abstract

Barium titanate is a ceramic widely used in electronic industry because of its high dielectric constant and low tangent losses. Barium titanate used in electronic circuits is not in powder form but it is a sintered product with shape formed as per component design. Thus, it becomes important to study sintering characteristics of barium titanate. This dissertation presents the literature review in light of sintering theory, synthesis methods of barium titanate, effect of various additives on electrical properties of barium titanate and the dielectric and piezoelectric properties of barium titanate. The main objective of the research work was to study the electrical characteristics of $BaTiO_3$-xAl_2O_3 composite ceramic (where x = 5, 10, 15, 20, 25 and 30wt % Al_2O_3) system synthesized by commercially available barium carbonate, titanium oxide and alpha alumina powders. The barium titnate was synthesized by conventional solid state reaction route by using $BaCO_3$ and TiO_2 powders. The $BaTiO_3$ was calcinied at 1150 °C and sintered at 1300 °C/4h while the $BaTiO_3$-xAl_2O_3 composite ceramics were sintered in between 1200-1300 °C. The liquid phase sintering was observed due to the presence of alumina. The dielectric constant of $BaTiO_3$-Al_2O_3 composite ceramics was decreased with increasing the alumina content. For the lower content of Al_2O_3 (i.e. 5 and 10 wt%) in BT, T_c of these ceramics stood at 110 and 120 °C respectively. However, upon further increasing Al_2O_3 content in BT, T_c rose to 130 °C and remained constant there. Slight increase in T_c of BT – xAl_2O_3 at higher concentration of Al_2O_3 can be attributed to presence of secondary phases (viz. $Ba_4Ti_{10}Al_2O_{27}$ and $BaTiAl_6O_{12}$) which could have possibly delayed tetragonal to cubic transformation of parent BT. The dissipation factor was found to be 0.1 for almost all the ceramics. Addition of Al_2O_3 caused reduction in saturation as well as remnant polarization. PE loop went on shrinking with increase in Al_2O_3 concentration resulting in reduction in energy loss in hysteresis. Overall reduction in ferroelectric properties with increase in Al_2O_3 can be attributed to increase in formation of non ferroelectric secondary phases.

Keywords: Barium titanate, particle size, calcination, sintering, dielectric, and ferroelectric.

A

Dissertation Report

On

Study of isothermal and cyclic oxidation on thermal barrier coating

Submitted in partial fulfillment of the requirements for the Degree of

Master of Technology in Metallurgical Engineering

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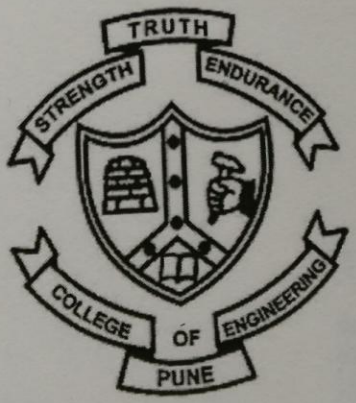

Department of Metallurgy and Materials Science

Govt. College Of Engineering, Pune

2015-2016

ABSTRACT

The need for higher efficiencies in gas turbine is increasing. The operating temperature has to be increased. The components of gas turbine have to sustain to these high temperatures. Thermal barrier coating consists of four layers made up of different materials. To increase the performance of the coating, new material such as defect cluster TBC, pyrochlores, perovskites, hexa-aluminates are developed. It was found that use of alumina and LTA increased the performance of the coatings.

Different layer composition with varying layer thickness was applied on the superalloy substrate. The performance of the coating was studied by observing the results of the tests performed on coatings. The hot oxidation of coatings was checked by isothermal and cyclic oxidation of samples. The mechanical properties were studied by doing micro-hardness test. Surface morphology study was done by SEM. Obtained results are correlated, discussed and presented in the report. Among all the different types of coatings, LTA 150 showed a minimum oxidation weight gain of 0.01428 mg/cm^2 in case of isothermal oxidation and 0.02854 mg/cm^2 in case of cyclic oxidation. The surface morphology of LTA 150 showed some cracks. The cross sectional SEM image of the coating show that the cracks are mostly on the outer layer and all layers are intact showing good thermal expansion coefficient match between layers. These results showed that LTA 150 coating was better amongst all the other coatings.

A

DISSERTATION REPORT

ON

The effect of shot peening treatment on nitriding behavior of Austenitic stainless steel AISI 304L

Submitted in partial fulfillment of the requirements

of the degree of

Master of Technology

(Process Metallurgy)

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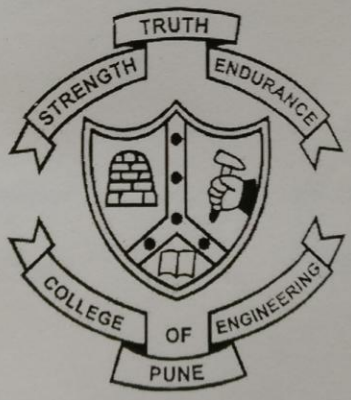

DEPARTMENT OF METALLURGY AND MATERIALS SCIENCE

College of Engineering, Pune

(An Autonomous Institute of Govt. of Maharashtra)

2015-2016

Abstract

Generally a clear beneficial effect of nitriding duration on resultant mechanical characteristics is reported in the literature. Considering the high energy cost in the competitive business environment, this work explores any opportunities to reduce nitriding duration while not sacrificing the resultant mechanical characteristics. To this end prior shot peening is applied with particularly severe parameters to generate ultra-fine grains and nano-structures in the surface layers. Plasma nitriding is carried out at 500°C for 8hrs.It was recently shown that the thickness of nitride layer improvement by different technique is not so effective and we are able to get low nitride thickness. In the present research combination of severe shot peening with nitriding at 8 hrs is assessed. It is affirmed that improvement by hybrid treatment can be actively exploited in the form of duration reduction. The characterization is carried out by optical and scanning electron microscopy observation, micro-hardness test, surface roughness measurement and X-ray diffraction measurement of residual stress. A critical comparison between the hybrid process with 50% nitriding duration reduction and the original nitriding process is presented. Based on the result of this study, nitriding duration can be successfully reduced and thickness of nitride layer can be increased without losing improvements in mechanical characteristics and if a suitable prior severe shot peening, aimed to surface nano crystallization, is performed.

A

DISSERTATION

ON

STUDY ON HIGH PERFORMANCE POLYMER NANOCOMPOSITES PREPARED BY PLANETARY BALL MILL

Submitted in partial fulfilment of the requirements of the degree of

Master of Technology in **Process Metallurgy**

Submitted By

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DEPARTMENT OF METALLURGY AND MATERIALS SCIENCE

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July 2016

ABSTRACT

Polyaryletherketone (PAEK) is a high temperature semi-crystalline thermoplastics polymer which has high glass transition and melting point. In present work, planetary ball milling was used for premixing PAEK and graphene powder. PAEK-graphene nanocomposites were fabricated successfully using hot pressing and cold compaction followed by sintering. Density of the nanocomposites was found close to the theoretical density in hot pressing and in case of cold compaction 95% achieved. In case of cold compaction followed by sintering decrease in % crystallinity of the nanocomposites compared to pure PAEK. DC and AC conductivities were found to increases with increasing graphene content in the PAEK matrix. Percolation threshold was found between 0.754 and 0.905 vol. % of graphene. Dielectric constant and dissipation factor of the nanocomposites were increased with increasing graphene content. For cold compaction thermal stability of the PAEK-graphene nanocomposites was increased by 11 ^{o}C compared to that of pure PAEK. Specific wear rate was reduced due to the addition of graphene up to 2 wt % of graphene. The specific wear rate for pure PAEK and 2 wt % was 160 × 10^{-6} mm^3/Nm and 13 × 10^{-6} mm^3/Nm respectively. Coefficient of friction first increases and then reduced with further addition of graphene. Microhardness of the nanocomposites was increased slightly with increasing graphene content. DC and AC conductivities were increased with increasing graphene content in the PAEK matrix. Dielectric constant and dissipation factor of the PAEK-Gr nanocomposites were increased with increasing graphene content. It is important to note that highest achieved electrical conductivity (dc) for the nanocomposites (5 wt %) prepared by single step hot pressing was 230.5 S/cm which is higher than that of by two stage method (cold compaction followed sintering). Storage modulus of the nanocomposites increased up to 5 wt % of graphene and then decreased with further addition of graphene. Loss of modulus and tan delta of the nanocomposites increased with increasing graphene contents in the PAEK matrix. Coefficient of thermal expansion decreased significantly with addition of graphene content in the PAEK matrix.

A

Dissertation Report

On

Fabrication of β-$FeSi_2$ Thermoelectric material and Evaluating Thermoelectric Properties

Submitted in partial fulfilment of the requirements for the Degree of

Master of Technology in Metallurgical Engineering and specialization in Process Metallurgy

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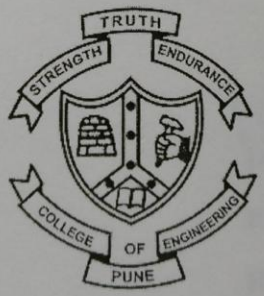

Department of Metallurgy and Materials Science

Govt. College Of Engineering, Pune

(An Autonomous Institute of Government of Maharashtra)

ABSTRACT

Thermal management and energy crisis have been two major problems in this 21st century. Amongst the thermoelectric materials, β-$FeSi_2$ is emerging as an alternative promising high temperature semiconductor useful for temperature from 600-900°C.

Mechanical Alloying process has been used to produce iron-silicide. The powders of pure electrolytic iron (98.9%) and silicon (99.9%) were blended in a Attritor mill (AM) and Cryo mill (CM) for 4-8 h. As milled powders were of metastable state and fully transformed to β-$FeSi_2$ phase by subsequent isothermal sintering at 800°C. Then it was compacted at 700 MPa and subjected to different heat treatment cycles. Phase transition during the process was investigated using DTA, XRD, SEM and EDS.

As consolidated iron silicide consisted of untransformed α-$FeSi_2$ and ε-FeSi phases. Subsequent isothermal sintering at 800°C in vacuum led to thermoelectric β-$FeSi_2$ phase transformation. Fraction of β-$FeSi_2$ increased with sintering period as well as milling period.

Keywords: Particle Size, Phase Transformation, Density, Electrical Conductivity.

A

Dissertation Report

On

Minimization of Distortion in Heat Treated Automotive Stabilizer Bars (55Cr3)

Submitted in partial fulfilment of the requirements for the Degree of

Master of Technology in Metallurgical Engineering

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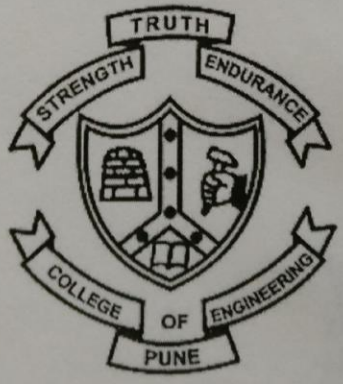

Department of Metallurgy and Materials Science

Govt. College Of Engineering, Pune

2015-2016

ABSTRACT

Heat Treatment of steels has always been an influential factor in the manufacturing of metal components since yore. And infamously known for the distortion occurred during the heat treatment the benefits of the process prevail against distortion. This leaves is to manage/rework the distorted parts even in high precision and highly controlled manufacturing processes. There is ample research available on minimizing and predicting the distortion, yet we struggle to keep the distortion in the limited range.

The distortion can be managed by the effective and detailed planning of the manufacturing process in this case the stabilizer bars of the automotive suspension system. Due to various factors affecting the final shape and size of the component it becomes important to micromanage the critical factors affecting the final dimensions of the component.

The stabilizer bars with material 55Cr3 are subjected to heavy distortion in heat treatment process while manufacturing and thus aftermaths include heavy bend correction and rework. In the present work various experiments are performed to account the critical factors. These factors include the effect on the geometry, variation in chemical composition, microhardness and microstructure with respect to the tensile and compressive zone in the bend, effect of heat treatment on the bend angle of the stabilizer bar, Residual stresses in the stabilizer bars at different and angles and different conditions. Further 60% distortion is minimized by the successful reduction of residual stresses in the bars after cold bending of stabilizer bars and no bend correction is required to these bars, bend correction time is also reduced as the bars are not heavily distorted. This helped in improving the quality of the stabilizer manufacturing process.

A

DISSERTATION REPORT

ON

MECHANICAL BEHAVIOUR OF F22 STEEL AT HIGH TEMPERATURES

Submitted in partial fulfilment of the requirements

of the degree of

Master of Technology

(Process Metallurgy)

By

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Under the Guidance of

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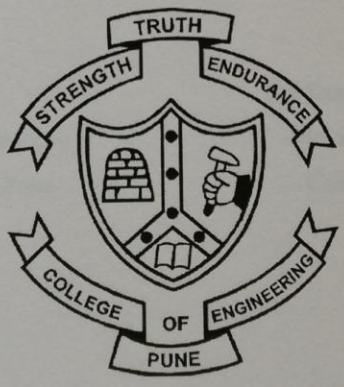

DEPARTMENT OF METALLURGY AND MATERIALS SCIENCE

College of Engineering, Pune

(An Autonomous Institute of Govt. of Maharashtra)

July-2016

ABSTRACT

F22 steel containing 2-2.5% of Cr-1%Mo is mainly used in nuclear and fossil-fuelled power generation industries which operate at elevated temperatures. F22 steel which is forged steel has a microstructure of elongated ferrite with finely dispersed carbides. Tensile tests were carried out on heat treated F22 alloy steel, using strain rate of 0.001/s, at room temperature, 200°C, 400°C, 550°C, and 700°C to characterize the mechanical properties such as yield strength, UTS, % elongation, % area reduction and fracture toughness. The yield strength and ultimate tensile strength was found to decrease with increase in test temperature. The stress-strain curves were fitted using Hollomon equation to determine the strain hardening exponent values. The strain hardening rate decreases with increase in temperature.

To understand the deformation and fracture behaviour of F22 steel at various temperatures, microstructural characterization of 10% deformed samples and fracture surface is carried out. It is observed that up to 550°C strength decreases gradually and rapidly above that because of microstructural instability i.e. breakdown of ferrite matrix under thermal influence in tensile test. Deformed sample shows lot of slip bands after 10% deformation which indicates deformation due to slip mechanism. Fracture surfaces show the dimples with different sizes along with cavities under scanning electron microscope. The presence of dimple appearance of fracture surface indicates that fracture occur by ductile mechanism. The increase in size and depth of cavity with decrease in fracture toughness for increase in temperature indicates that early fracture at high temperature is because of rapid growth of cavity.

A Dissertation Report On

ZINC PHOSPHATING PROCESS OPTIMIZATION FOR CORROSION RESISTANCE USING TAGUCHI TECHNIQUE

Submitted in partial fulfilment of the requirements

of the degree of

Master of Technology

(PROCESS METALLURGY)

by

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2015-16

ABSTRACT

Phosphating is common and efficient industrial pre-treatment before painting for the corrosion protection of ferrous metals and alloys. However, dissolution of zinc during phosphating is serious problem as it adversely affects corrosion protection performance of subsequent paint system. Attempts are made to reduce zinc dissolution and to enhance the performance of phosphate primer. It is anticipated that addition of nano metal oxide particles may improve the performance of the primer. In present work, therefore, optimization of the zinc phosphating process variables- current density, deposition time and quantity of nano titanium dioxide for addition in the bath is carried out using Taguchi experimental design method and validated by electrochemical techniques. Use of Taguchi Design Technique for optimization is found out to be very significant in this work. Twenty seven configurations were reduced to nine experiments. Results are analyzed for surface responses in terms of coating resistance and corrosion rate using MINITAB 15 software. Regression analysis is done and regression model is developed. It was found that the experimental results and predicted results are in agreement. Analysis of variance (ANOVA) is carried out for predicting contribution of each process variable. It reveals that deposition time contributes 55% followed by current density contributes 28% and wt% TiO_2 contributes 5%. Finally, Multiobjective optimization is done by calculating signal to noise ratio and rank of each process variable is predicted. Zinc phosphate coatings obtained on low carbon steel samples by galvanostatic deposition technique using optimized process variables current density 4 mA/cm^2, deposition time 60 mins and 0.5 wt% TiO_2 found to have optimal coating resistance of 389.9 Ω and corrosion rate 1.38 mpy. Corrosion rate of nano TiO_2 incorporated phosphate coated low carbon steel sample is found to be six times less than that of uncoated low carbon steel (~12 mpy) in 3.5% NaCl solution which supports the electrochemical impedance spectroscopy studies.

Key Words: Electro deposition, Nano TiO_2, Phosphate coating, Taguchi Method, Regression analysis, Multiobjective optimization, Signal to Noise ratio

High Temperature Tensile Properties of Cryotreated AISI 4340 Steel

Submitted in partial fulfillment of the requirements

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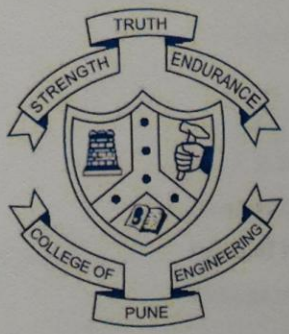


Department of Metallurgy & Materials Science

COLLEGE OF ENGINEERING PUNE

August, 2016

ABSTRACT

AISI 4340 Ni-Cr-Mo grade high strength alloy steel find applications in press dies, landing gears of aircraft, shaft, crank shafts, connecting rods, heavy duty axels etc. In most of these applications, AISI 4340 is used in hardened and tempered condition. Hence, this steel is subjected to hardening at 900°C followed by tempering treatment at 500°C. The samples are also subjected to cryogenic treatment before and after tempering. Its effect on the mechanical properties and high temperature tensile properties in the temperature range from room temperature to 400°C is also studied. Mechanical tests including hardness, impact toughness and wear rate are investigated. The hardness values are noted to vary from 229Hv for as received samples to 401Hv for HCT (Hardened-Cryo-Tempered) samples. The introduction of cryotreatment has caused remarkable improvement in hardness values. This hardness values get improved by almost 24Hv for HCT samples and 73Hv for HTC (Hardened-Tempered-Cryo) samples. The cryotreatment of the samples causes improvement by almost 30% in room temperature tensile strength as well as high temperature tensile strength. The HTC samples delivered the best performance in high temperature tensile test. However, the % elongation of 15% value is the highest for as received samples which is reduced almost to half after the heat treatment. The impact energy value 30J is noted for the as received sample. This value is reduced to 20J on hardening increases to 24J on simple hardening tempering, which gets further improved to 27J following HCT sequence. The impact values for the HCT sequence are higher than those noted for HTC. The wear rate value is noted 1.83×10^{-3} mm^3/mm for as received and 1.27×10^{-3} mm^3/mm for HT samples. The wear rate value noted is 0.63×10^{-3} mm^3/mm for HCT samples, which is lower than HTC (0.93×10^{-3} mm^3/mm), as received and other HT samples. The cryotreatment causes improvement in wear rate values.

A

DISSERTATION REPORT

ON

Effect of particle size of B_4C on mechanical properties of Al 6061 MMC

Submitted in partial fulfillment of the requirements

of the degree of

Master of Technology

(Process Metallurgy)

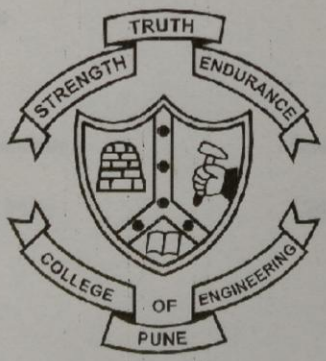
By

Londhe Amit Nilkanthrao

(121427018)

Under the Guidance of

Mrs. S. U. Dangrikar



DEPARTMENT OF METALLURGY AND MATERIALS SCIENCE

College of Engineering, Pune

(An Autonomous Institute of Govt. of Maharashtra)

July-2016

ABSTRACT:

Effect of reinforcement on properties of Al6061 powder composite was studied. Boron carbide was used for reinforcement of Al6061. As received B_4C powder was milled in attrition milling machine to reduce particle size of B_4C. Al6061 and B_4C were mixed in different combinations of % B_4C, particle size of B_4C, and particle size of Al6061. Characterisation and mechanical testing were done on sintered samples. Results confirmed that addition of B_4C as reinforcement increases mechanical properties of Al6061. And those properties are also affected by particle size of reinforcement.

A

DISSERTATION

ON

VISCOELASTIC BEHAVIOUR OF TREATED AND UNTREATED $CaCO_3$ REINFORCED POLYMER COMPOSITES

Submitted in partial fulfilment of the requirements of the degree of

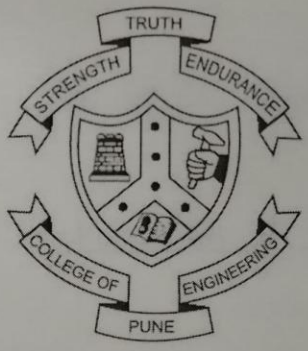
Master of Technology in **Process Metallurgy**

Submitted By

PANCHAL SHRIKANT RAJABHAU
(MIS No.: 121427019)

Under the Guidance of

Dr. R. K. Goyal



DEPARTMENT OF METALLURGY AND MATERIALS SCIENCE

COLLEGE OF ENGINEERING PUNE
(An Autonomous Institute of Govt. of Maharashtra)

2016

ABSTRACT

The polycarbonate (PC) composites containing calcium carbonate ($CaCO_3$) were prepared by film casting for creep study. The results show that the presence of $CaCO_3$ leads to significant improvement of creep resistance of PC. Creep resistance increase monotonously with increase of $CaCO_3$ contents because it is highly dependent on the dispersion of $CaCO_3$. The viscoelastic and viscoplastic parameters of PC matrix and structural parameters of $CaCO_3$ further confirmed the retardation effect by $CaCO_3$ during creep of the nanocomposite systems. The creep strain values at 60°C and at 1200 s are reduced by ~27% and ~ 40% for the composites with 5 and 10 wt% $CaCO_3$ respectively, compared to pure PC. This $CaCO_3$ content is closely related to the dispersion of $CaCO_3$ particles. From the SEM images it is confirmed that the $CaCO_3$ particles are well dispersed throughout the PC matrix which impedes the movement of polymer segments. A significant improvement in the recovered strain of PC was also obtained after the presence of $CaCO_3$ particles.

A

Dissertation report

On

"Tribological compatibility of automotive material in Biodiesel"

Submitted by

WAGH SHUBHAM V.

(M.I.S No. 121427020)

In partial fulfillment for the award of the degree

of

M. TECH (PROCESS METALLURGY)

Under the guidance of

Dr.S.T. Vagge

2015-2016

DEPARTMENT OF METALLURGY AND MATERIAL SCIENCE

COLLEGE OF ENGINEERING, PUNE

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Abstract

In the recent years, the automobile engine manufacturers are facing big challenge related to compatibility of automotive components with the most promising alternative fuel, biodiesel. The use of biodiesel is raised due to the depletion of fissile fuel and environmental problems.

In India petroleum is replaced partially or completely by biodiesel and engineers are facing the problems arising from the use of biodiesel in automobile such as corrosion, tribocorrosion, unsuitability of biodiesel properties due to the exposure of metals.

To avoid the failure of costly engine parts such as piston, piston rings, inlet and exhaust valve, fuel pump, filter, plug researcher are still working on it. In this research work on corrosion and near study of piston ring material and biodiesel had done. Thus comparative study with different blends of diesel, biodiesel is done. This finding has led us to the conclusion that the combined effect of wear and corrosion on materials and the consequent effect on biodiesel degradation could be crucial and yet to be investigated. present study also highlighted some other relevant factors which showed notable implications on wear and corrosion in biodiesel. The piston ring material nodular CI had shown corrosive loss in biodiesel than conventional diesel. Severe pits had been observed on the specimen tested in the biodiesel .Biodiesel provides better lubrication in terms of wear friction. With higher values of coefficient of friction in, material showed more wear loss with increasing amount of diesel in blends.