ACADEMIC YEAR (2022-2023)						
	J.K.K.MUNIRAJAH COLLEGE OF TECHNOLOGY T.N.Palayam(po),Gobi(tk)-638506, Erode(dt).					Metric No 1.3.2
S.No	Name of the course	Course code	programme offering	project work	internship	Number of students
(2022-2023 Regulation-2017						
1	Advanced in Manufacturing Technology	MF5101	MANUFACTURING ENGINEERING	✓	✓	1
2	Computer Integrated Manufacturing Systems	MF5102	MANUFACTURING ENGINEERING	✓		1
3	Advances in Metrology and Inspection	CM5251	MANUFACTURING ENGINEERING	✓	✓	1
4	Materials Testing and Characterization Techniques	MF5016	MANUFACTURING ENGINEERING	✓	✓	4
5	Project Work Phase I	MF5311	MANUFACTURING ENGINEERING	✓		2
6	Project Work Phase II	MF5411	MANUFACTURING ENGINEERING	✓		2

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JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
GOBI (Tk), ERODE (Dt).

J.K.K. MUNIRAJAH COLLEGE OF TECHNOLOGY

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Accredited by NAAC with "A" grade

T.N. Palayam (Po), Gobi (Tk), Erode (Dt) – 638 506

MANUFACTURING ENGINEERING

2022-2023

S.NO	REG.NO	STUDENT NAME	PROJECT	INTERNSHIP
1.	731221410001	DEEPA S	✓	
2.	731221410002	DENNIS MATHEW	✓	
3.	731221410004	GOWTHAM V	✓	
4.	731221410005	GURUPRABHU K	✓	
5.	731221410006	JENITH CHRISTOBER J	✓	
6.	731221410007	PERIYASAMY N	✓	
7.	731221410008	SIVASANKAR A	✓	
8.	731221410009	VINOTH A	✓	

PRINCIPAL
JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
GOBI (Tk), ERODE (Dt).

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T.N. Palayam (Po), Gobi (Tk), Erode (Dt) – 638 506

MANUFACTURING ENGINEERING

2022-23

S.No	Name of the Course that include experiential learning through Project Work/Internship/Field Visit
1	Advanced in Manufacturing Technology
2	Computer Integrated Manufacturing Systems
3	Advances in Metrology and Inspection
4	Materials Testing and Characterization Techniques
5	Project work phase-I
6	Project work phase-II

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GOBI (Tk), ERODE (Dt).

PROJECT WORK

MF5101 **ADVANCES IN MANUFACTURING TECHNOLOGY** **L T P C**
3 0 0 3

OBJECTIVE:

- The students are expected to understand special machining processes, unconventional machining processes, micro machining process, nano fabrication processes and rapid prototyping.

UNIT I **UNCONVENTIONAL MACHINING** **10**

Introduction-Bulk processes - surface processes- Plasma Arc Machining- Laser Beam Machining-Electron Beam Machining-Electrical Discharge Machining – Electro chemical Machining-Ultrasonic Machining- Water Jet Machining-Electro Gel Machining-Anisotropic machining-Isotropic machining-Elastic Emission machining – Ion Beam Machining.

UNIT II **PRECISION MACHINING:** **10**

Ultra Precision turning and grinding: Chemical Mechanical Polishing (CMP) - ELID process – Partial ductile mode grinding-Ultra precision grinding- Binderless wheel – Free form optics. aspherical surface generation Grinding wheel- Design and selection of grinding wheel-High-speed grinding-High-speed milling- Diamond turning.

UNIT III **ADVANCES IN METAL FORMING** **7**

Orbital forging, Isothermal forging, Warm forging, Overview of Powder Metal techniques –Hot and Cold isostatic pressing - high speed extrusion, rubber pad forming, Hydroforming, Superplastic forming, Peen forming-micro blanking –Powder rolling – Tooling and process parameters.

UNIT IV **MICRO MACHINING AND NANO FABRICATION** **10**

Theory of micromachining-Chip formation-size effect in micromachining-microturning, micromilling, microdrilling- Micromachining tool design-Micro EDM-Microwire EDM-Nano fabrication:LIGA, Ion beam etching, Molecular manufacturing techniques –Atomic machining- Nano machining techniques – Top/Bottom up Nano fabrication techniques - Sub micron lithographic technique, conventional film growth technique, Chemical etching, Quantum dot fabrication techniques – MOCVD – Epitaxy techniques.

UNIT V **RAPID PROTOTYPING AND SURFACE MODIFICATION TECHNIQUES** **8**

Introduction – Classification – Principle advantages limitations and applications- Stereo lithography – Selective laser sintering –FDM, SGC, LOM, 3D Printing-Surface modification Techniques: Sputtering-CVD-PVD-Diamond like carbon coating-Plasma Spraying Technique.-Diffusion coatings-Pulsed layer deposition.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course the students are expected

1. to produce useful research output in machining of various materials
2. use this knowledge to develop hybrid machining techniques
3. Application of this knowledge to manage shop floor problems

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JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
GOBI (Tk), ERODE (Dt).

STUDY THE EFFECT OF BIONIC STRUCTURE IN LIGHT WEIGHT POLYMER MATERIAL

PHASE II REPORT

Submitted by

DEEPA S

In partial fulfillment for the award of the degree of

MASTER OF ENGINEERING IN

MANUFACTURING ENGINEERING

J.K.K MUNIRAJAH COLLEGE OF TECHNOLOGY

T.N. PALAYAM, GOBI-638506.

DEPARTMENT OF MANUFACTURING ENGINEERING

ANNA UNIVERSITY, CHENNAI

OCTOBER 2023

PRINCIPAL
JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
GOBI (Tk), ERODE (Dt).

ANNA UNIVERSITY, CHENNAI

BONAFIDE CERTIFICATE

Certified that this Report titled **"STUDY THE EFFECT OF BIONIC STRUCTURE IN LIGHT WEIGHT POLYMER MATERIAL"** is the bonafide work of **DEEPA S (Reg.No.731221410001)** who carried out the work under my supervision. Certified further that to the best of my knowledge and the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

SIGNATURE
Mr.V.MAGESH M.E.,
HEAD OF THE DEPARTMENT
Assistant Professor
Dept of Manufacturing Engineering
JKK Munirajah College of Technology
T.N.Palayam.

SIGNATURE
Mr.V.MAGESH M.E.,
SUPERVISOR
Assistant Professor
Dept of Manufacturing Engineering
JKK Munirajah College of Technology
T.N.Palayam

Submitted for the Viva-Voce examination held on 9.10.23 - FN

Internal Examiner

9/10/2023
External Examiner

PRINCIPAL
JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
GOBI (Tk), ERODE (Dt).

ABSTRACT

Research into the manufacture of lightweight automobiles is driven by the need to reduce fuel consumption to preserve decreasing hydrocarbon resources without compromising other attributes such as safety, performance, recyclability and cost. Design of structure plays an important role against this background, since significant weight decrease is made possible through the development o various bionic strictures and more precise adjustment of material parameters to the functional requirements of components. They are finding that every 10% reduction in vehicle weight can cut fuel consumption by about 7%. In concept automobile components which have the scope of weight reduction identified the survey. As a pilot study five automobile components such as car window handle, gear rod, steering core, steering column, and alloy wheel where selected.bionic stricture was developed and analyzed to all five components using solidworkes design software. Specimen for a gear rod, steering column and steering core is manufacture in 3D printer for existing and honey comb structure. Both specimens ware analyzed to evaluate the mechanical properties such as compressive, hardness and tensile strengths. The result is honeycomb specimen mechanical properties are almost very nearly too solid specimen. So it is concluded that by using bionic honeycomb structure for all five components which gives equivalent strength.

Keywords: Automobile Components, Redesigning, Weight Reduction

CHAPTER 1

1. INTRODUCTION

1.1 Introduction

The automotive industry has in recent years invited to build lighter vehicles with more fuel-efficient engines for both time reduce fuel consumption and CO_2 emissions. And improved fuel consumption, driving comfort, environmental responsiveness, and protection are very important one therefore feature among the sales point of view many vehicle manufacturers at present using lightweight materials. The automotive manufacturer carries in developing modern lightweight materials, designs and current technologies. As there is a high emphasis on greenhouse gas reductions, reduction of emission and improving fuel efficiency this criterion is most important one for an automotive company.

The research and development of ecological technologies for vehicle is becoming increasingly important for the automotive industries. It is seen as one of the greatest trend of this century to conserve the natural resources and minimize the air pollution. One of the ways to achieve this is by reducing the weight of the vehicle therefore lowering the rate of fuel consumption and air pollution's a result, several approaches have already been accomplished by the automotive industry. The reduction in consumption and emissions remains the greatest technological challenge for the automotive industry. A lightweight body can be achieved through any combination of three different approaches to lightweight design (Fig.1.1), categorized into lightweight engineering, lightweight manufacturing and weight reduction through material selection.

CHAPTER 8

CONCLUSION

8.1 CONCLUSION

The main goal with this work has been to develop honeycomb structures for automobile parts by computational design and analysis. The work has shown that honeycomb structures such as are weight efficient. The bionic honeycomb structures are given more efficient of weight and strength. The sample 3D printing specimen solid and honey comb weight is 28.4g and 15.1g. The reduce weight will be around 46 % but they are compared strength and weight ratio the bionic honeycomb structures less weight and also give equivalent strength. So in this concept to apply bionic honeycomb structures for gear rod, window handle, steering column, steering core, alloy wheel to reduce 17.3 kg of weight .The automobile survey report find 100 kg mass reduction achieved on a car saves 9 grams of exhaust gas per km. Reducing weight by 100 kg leads to a fuel savings of 0.35l lit /100 km and 8.4 g CO_2/km with gasoline engines if taking into account an adjustment of the gear shifting without a change in elasticity and acceleration values due to the lower weight. So 17.3 kg of weight reduction in a car saves 1.7 grams of exhaust gas and 1.5g CO_2 per km. To use advance manufacturing method 3D printing is reduce material cost, machine cost, post processing and minimizing the overall cost. And also using advance manufacturing technology like 3D printing to get better result for minimizing overall cost.

EXPERIMENTAL INVESTIGATION ON PERFORMANCE OF SINGLE CYLINDER DIESEL ENGINE WITH MULLITE AND ALUMINUM TITANATE AS THERMAL BARRIER COATING

PHASE II REPORT

Submitted by

DENNIS MATHEW

in partial fulfillment for the award of the degree of

MASTER OF ENGINEERING IN

MANUFACTURING ENGINEERING

J.K.K MUNIRAJAH COLLEGE OF TECHNOLOGY

T.N. PALAYAM, GOBI-638 506.

DEPARTMENT OF MANUFACTURING ENGINEERING

ANNA UNIVERSITY, CHENNAI

OCTOBER 2023

PRINCIPAL
JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
GOBI (Tk), ERODE (Dt).

ANNA UNIVERSITY, CHENNAI

BONAFIDE CERTIFICATE

Certified that this Report titled **"EXPERIMENTAL INVESTIGATION ON PERFORMANCE OF SINGLE CYLINDER DIESEL ENGINE WITH MULLITE AND ALUMINUM TITANATE AS THERMAL BARRIER COATING"** is the bonafide work of **DENNIS MATHEW (Reg.No.731221410002)** who carried out the work under my supervision. Certified further that to the best of my knowledge and the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

SIGNATURE
Mr.V.MAGESH M.E.,
HEAD OF THE DEPARTMENT
Assistant Professor
Dept of Manufacturing Engineering
JKK Munirajah College of Technology
T.N.Palayam.

SIGNATURE
Mr.V.MAGESH M.E.,
SUPERVISOR
Assistant Professor
Dept of Manufacturing Engineering
JKK Munirajah College of Technology
T.N.Palayam

Submitted for the Viva-Voce examination held on 9.10.23

Internal Examiner

External Examiner

PRINCIPAL
JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
GOBI (Tk), ERODE (Dt).

ABSTRACT

The thermal efficiency of most commercially used engine ranges from 38% to 42%, as nearly 58% to 62 % of energy is lost of heat. Nearly 30% is retained in exhaust gas and the remaining is removed in cooling water/air, in order to save that energy the hot parts are insulated TBC.TBC is that ceramic is better than the conventional materials. CaZrO3, Mullite and Al2O3 –ZrO2 are some of the ceramic materials used as TBC. A four stroke single cylinder Kirloskar diesel engine is selected for carrying out of the experiment. Mullite and aluminum titanate is used on the piston head by plasma spray process for the performance characteristics of the engine with and without TBC under various loading condition. Thermal barrier coatings (TBC) provide the potential for higher thermal efficiencies of the engine, improved combustion and reduced emissions. The purpose of using these materials is to reduce the heat loss from engine. As the experimental investigation results of significant reduction in specific fuel consumption is 1.4% and effective improvement in brake thermal efficiency is 1.1%.

CHAPTER 1

INTRODUCTION

A recent development trend for heat engines is improvement of their energy efficiency, as in the case of the internal combustion engine. The rapid increase in fuel expenses, the decreasing supply of high-grade fuels in the market and environmental concerns necessitates engines with acceptable emission characteristics.

In the case of internal combustion engine, one of the ways to achieve this aim is engine adiabatization. One of the methods to adiabatize an engine is to cover the surface of the combustion chamber with thermal barrier coatings (TBCs). The thermal insulation thus obtained is supposed to lead, according to the second law of thermodynamics, to an improvement in the engine's heat efficiency and a reduction in consumption. Higher temperature in the combustion chamber can also have a positive effect; due to the reduction in delay of engine operation an increase in the emission of nitrogen oxides (NOx) may be expected.

THERMAL BARRIER COATING

Nowadays several research programs, in automotive industries, are carrying out in order to decrease engine fuel consumption and pollution. Design of diesel engines with lower heat rejection, by applying thermal barrier coating (TBC) is increasing according to fast increase in fuel costs, decrease in fuel production with high quality and environmental problems. Normally, in diesel engines about 19-22 percent of fuel energy is rejected to coolant fluid. Using TBC can reduce this heat loss and lead to better thermal efficiency. Also engine components durability can be improved. Therefore, better combustion, lower pollution, higher thermal efficiency and good fatigue lifetime are the results of using proper TBC in engine combustion chamber and exhaust system.

A major breakthrough in diesel engine technology has been achieved by the pioneering work done by thermally insulating materials such as silicon nitride for

CHAPTER 7
CONCLUSION

7.1 CONCLUSION

The main conclusions drawn from present experimental investigation on (Mullite + aluminum titanate coated) and conventional diesel engines are as follows.

Coated engine with 0.35 mm of Mullite+ aluminum titanate insulation coating on piston crown exhibits lower brake specific fuel Consumption than the conventional diesel engine. This insulation coating exhibits the brake specific fuel consumption very close to conventional engine with deviation by about 1.4% higher at full engine load. The brake thermal efficiency for LHR engine is higher by about 1.1 % than the conventional diesel engine at full engine load level. The Reduction in heat transfer leads to increase in combustion temperature, which leads to Better combustion. The higher combustion temperature will lead to more expansion Work. Finally the combustion chamber temperature increases the thermal efficiency of the engine also increases.

MF5102 **COMPUTER INTEGRATED MANUFACTURING SYSTEMS** L T P C
3 0 0 3

OBJECTIVES:

This course will enable the Student

- To gain knowledge about the basic fundamental of CAD.
- To gain knowledge on how computers are integrated at various levels of planning and manufacturing understand computer aided planning and control and computer monitoring.

UNIT I COMPUTER AIDED DESIGN 9

Concept of CAD as drafting and designing facility, desirable features of CAD package, drawing features in CAD – Scaling, rotation, translation, editing, dimensioning, labeling, Zoom, pan, redraw and regenerate, typical CAD command structure, wire frame modeling, surface modeling and solid modeling (concepts only) in relation to popular CAD packages.

UNIT II COMPONENTS OF CIM 9

CIM as a concept and a technology, CASA/Sme model of CIM, CIM II, benefits of CIM, communication matrix in CIM, fundamentals of computer communication in CIM – CIM data transmission methods – seriel, parallel, asynchronous, synchronous, modulation, demodulation, simplex and duplex. Types of communication in CIM – point to point (PTP), star and multiplexing. Computer networking in CIM – the seven layer OSI model, LAN model, MAP model, network topologies – star, ring and bus, advantages of networks in CIM

UNIT III GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 9

History Of Group Technology – role of G.T in CAD/CAM Integration – part families- classification and coding – DCLASS and MCLASS and OPTIZ coding systems – facility design using G.T – benefits of G.T – cellular manufacturing. Process planning - role of process planning in CAD/CAM

UNIT IV SHOP FLOOR CONTROL AND INTRODUCTION TO FMS 9

Shop floor control – phases – factory data collection system – automatic identification methods – Bar code technology – automated data collection system.

FMS – components of FMS – types – FMS workstation – material handling and storage system – FMS layout- computer control systems – applications and benefits.

UNIT V COMPUTER AIDED PLANNING AND CONTROL AND COMPUTER MONITORING 9

Production planning and control – cost planning and control – inventory management – material requirements planning (MRP) – shop floor control. Lean and Agile Manufacturing. Types of production monitoring systems – structure model of manufacturing – process control and strategies – direct digital control.

OUTCOMES:

At the end of this course the students are expected

1. to produce useful research output in computer integrated manufacturing
2. use this knowledge to develop computer techniques
3. Application of this knowledge to functionalise computer aided planning.

TOTAL: 45 PERIODS

REFERENCES:

1. Chris McMahon and Jimmie Browne, "CAD CAM Principles, Practice and Manufacturing Management", Pearson Education second edition, 2005.Ranky, Paul G., "Computer Integrated Manufacturing", Prentice hall of India Pvt. Ltd.,2005.
2. James A. Regh and Henry W. Kreabber, "Computer Integrated Manufacturing", Pearson Education second edition, 2005.
3. Mikell. P. Groover "Automation, Production Systems and Computer Integrated Manufacturing", Pearson Education 2001.

PRINCIPAL
JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
GOBI (Tk), ERODE (Dt).

ANALYSIS OF HEAT TRANSFER ENHANCEMENT IN DUAL PURPOSE SOLAR COLLECTOR FOR VARIOUS PARAMETERS

PHASE II REPORT

Submitted by

GOWTHAM V

in partial fulfillment for the award of the degree of

MASTER OF ENGINEERING IN

MANUFACTURING ENGINEERING

J.K.K MUNIRAJAH COLLEGE OF TECHNOLOGY

T.N. PALAYAM, GOBI-638 506.

DEPARTMENT OF MANUFACTURING ENGINEERING

ANNA UNIVERSITY, CHENNAI

OCTOBER 2023

PRINCIPAL
JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
GOBI (Tk), ERODE (Dt).

ANNA UNIVERSITY, CHENNAI

BONAFIDE CERTIFICATE

Certified that this Report titled **"ANALYSIS OF HEAT TRANSFER ENHANCEMENT IN DUAL PURPOSE SOLAR COLLECTOR FOR VARIOUS PARAMETERS"** is the bonafide work of **GOWTHAM V (Reg.No.731221410004)** who carried out the work under my supervision. Certified further that to the best of my knowledge and the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

SIGNATURE
Mr.V.MAGESH M.E.,
HEAD OF THE DEPARTMENT
Assistant Professor
Dept of Manufacturing Engineering
J.K.K Munirajah College of Technology
T.N.Palayam.

SIGNATURE
Mr.S.GANESHKUMAR M.E.,
SUPERVISOR
Assistant Professor
Dept of Manufacturing Engineering
J.K.K Munirajah College of Technology
T.N.Palayam.

Submitted for the Viva-Voce examination held on 09/10/23

Internal Examiner

External Examiner

PRINCIPAL
JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
GOBI (Tk), ERODE (Dt).

ABSTRACT

The use of solar thermal systems in the agricultural sector to preserve egetables, fruits and other crops has shown to be practical, economical and nvironmental friendly. Solar drying refers to a technique that utilizes incident olar radiation to convert it into thermal energy required for drying purposes. Solar nergy is available in abundance in most part of our country throughout the year. n India, the annual average daily solar radiation received over the whole of the ountry is around 1800 J/cm^2/day. The Ministry of Food Processing Industries has framed a vision for the year 2015 to increase the processing of perishables from 6 o 20%. This can viewed as an opportunity for solar dryers or air heating systems o penetrate the food processing industry. Hence, the twin objectives of solar agricultural drying are to reduce agricultural wastage through remote independent solar drying (with innovative financial mechanisms and institutional structure) and to reduce the energy consumption through solar air heating systems

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JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
GOBI (Tk), ERODE (Dt).

CHAPTER 1

INTRODUCTION

Solar energy is an inexpensive source of energy for most countries. Use of this source of energy can be spread with the increase of efficiency of solar systems. In liquid flat plate collectors, inlet fluid temperature and in air flat plate collectors, air flow rate are two basic decisive parameters in heat delivery. In the thermosyphon system with the increase in water temperature, heat delivery decreased and performance diminishes. In this context, studied on the increase in heat delivery of thermosyphon systems and investigated on the performance of solar storage collector. For air collectors, enhancing heat transfer from the surface area is the main objective. Studied on roughness geometry used in solar air heater. Performed the analysis of finned collector and collector with tubes for drying applications. Investigated the evaluation of a V-groove solar collector. Analyzed the effect of chamfering on heat transfer and friction characteristics of solar air heater. Presented the analysis of four types of air collectors with various channel's geometry. Showed effective efficiency of solar air heater with different types of roughness elements on the absorber plate. Studied the performance evaluation of solar air heater having expanded metal mesh as artificial roughness on absorber plate.

1.1 COMPUTATIONAL FLUID DYNAMICS

Computational fluid dynamics (CFD) is the science of predicting fluid flow, heat transfer, mass transfer, chemical reactions, and related phenomena by solving the mathematical equations which govern these processes using a numerical process.

CHAPTER 6

CONCLUSIONS

The analysis was made for dual purpose solar collector (DPSC) by using Fluent-14 Software with various profiles like Triangle, Rectangle, Circular and Circular zig-zag. This model has simple structure and can be used for both liquid and air collectors with any geometry and shape. This model was designed and made analysis; finally the result indicated that DPSC has more efficiency relative to single water and air collectors. In the comparison base case air inlet 318k air outlet 327k rectangle case air inlet 318k air outlet 326k circular case air inlet 318k air outlet 330k circular zig-zag case air inlet 318k air outlet 334k from the combination absorption circular zig-zag profile, has more efficiency. Compare to other profile because, the profile path is zig-zag manner the air flow rate is minimized. So heat transfer enhancement will increase at each bent of zig-zag profile.

PERFORMANCE OF SINGLE CYLINDER DIESEL ENGINE WITH COPPER AND P-BRONZE COATING OVER PISTON CROWN

PHASE II REPORT

Submitted by

GURUPRABHU K

in partial fulfillment for the award of the degree of

MASTER OF ENGINEERING IN

MANUFACTURING ENGINEERING

J.K.K MUNIRAJAH COLLEGE OF TECHNOLOGY

T.N. PALAYAM, GOBI-638 506.

DEPARTMENT OF MANUFACTURING ENGINEERING

ANNA UNIVERSITY, CHENNAI

OCTOBER 2023

PRINCIPAL
JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
GOBI (Tk), ERODE (Dt).

ANNA UNIVERSITY, CHENNAI

BONAFIDE CERTIFICATE

Certified that this Report titled **"PERFORMANCE OF SINGLE CYLINDER DIESEL ENGINE WITH COPPER AND P-BRONZE COATING OVER PISTON CROWN"** is the bonafide work of **GURUPRABHU K (Reg.No.731221410005)** who carried out the work under my supervision. Certified further that to the best of my knowledge and the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

SIGNATURE
Mr.V.MAGESH M.E.,
HEAD OF THE DEPARTMENT
Assistant Professor
Dept of Manufacturing Engineering
JKK Munirajah College of Technology
T.N.Palayam.

SIGNATURE
Mr.P.ESWARAN M.E.,
SUPERVISOR
Assistant Professor
Dept of Manufacturing Engineering
JKK Munirajah College of Technology
T.N.Palayam

Submitted for the Viva-Voce examination held on 09-10-2023

9/10/23
Internal Examiner

9/10/2023
External Examiner

PRINCIPAL
JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
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ABSTRACT

The thermal efficiency of most commercially used engine ranges from 38% to 42%, as nearly 58% to 62 % of energy is lost of heat. Nearly 30% is retained in exhaust gas and the remaining is removed in cooling water/air, in order to save that energy the hot parts are insulated TBC.TBC is that ceramic is better than the conventional materials. CaZrO3, Mullite and Al2O3 –ZrO2 are some of the ceramic materials used as TBC. A four stroke single cylinder Kirloskar diesel engine is selected for carrying out of the experiment. Mullite and aluminum titanate is used on the piston head by plasma spray process for the performance characteristics of the engine with and without TBC under various loading condition. Thermal barrier coatings (TBC) provide the potential for higher thermal efficiencies of the engine, improved combustion and reduced emissions. The purpose of using these materials is to reduce the heat loss from engine. As the experimental investigation results of significant reduction in specific fuel consumption is 1.4% and effective improvement in brake thermal efficiency is 1.1%.

CHAPTER 1
INTRODUCTION

A recent development trend for heat engines is improvement of their energy efficiency, as in the case of the internal combustion engine. The rapid increase in fuel expenses, the decreasing supply of high-grade fuels in the market and environmental concerns necessitates engines with acceptable emission characteristics.

In the case of internal combustion engine, one of the ways to achieve this aim is engine adiabatization. One of the methods to adiabatize an engine is to cover the surface of the combustion chamber with thermal barrier coatings (TBCs). The thermal insulation thus obtained is supposed to lead, according to the second law of thermodynamics, to an improvement in the engine's heat efficiency and a reduction in consumption. Higher temperature in the combustion chamber can also have a positive effect; due to the reduction in delay of engine operation an increase in the emission of nitrogen oxides (NOx) may be expected.

1.1 THERMAL BARRIER COATING

Nowadays several research programs, in automotive industries, are carrying out in order to decrease engine fuel consumption and pollution. Design of diesel engines with lower heat rejection, by applying thermal barrier coating (TBC) is increasing according to fast increase in fuel costs, decrease in fuel production with high quality and environmental problems. Normally, in diesel engines about 19-22 percent of fuel energy is rejected to coolant fluid. Using TBC can reduce this heat loss and lead to better thermal efficiency. Also engine components durability can be improved. Therefore, better combustion, lower pollution, higher thermal efficiency and good fatigue lifetime are the results of using proper TBC in engine combustion chamber and exhaust system.

A major breakthrough in diesel engine technology has been achieved by the pioneering work done by thermally insulating materials such as silicon nitride for

CHAPTER 7
CONCLUSION

7.1 CONCLUSION

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CM5251 **ADVANCES IN METROLOGY AND INSPECTION** **L T P C**
3 0 0 3

OBJECTIVES:

- To teach the students basic concepts in various methods of engineering measurement techniques and applications, understand the importance of measurement and inspection in manufacturing industries.
- To make the students capable of learning to operate and use advanced metrological devices with ease in industrial environments.

UNIT I **CONCEPTS OF METROLOGY:** **8**

Terminologies – Standards of measurement – Errors in measurement – Interchangeability and Selective assembly – Accuracy and Precision – Calibration of instruments – Basics of Dimensional metrology and Form metrology

UNIT II **MEASUREMENT OF SURFACE ROUGHNESS:** **9**

Definitions – Types of Surface Texture: Surface Roughness Measurement Methods- Comparison, Contact and Non Contact type roughness measuring devices, 3D Surface Roughness Measurement, Nano Level Surface Roughness Measurement – Instruments.

UNIT III **INTERFEROMETRY:** **8**

Introduction, Principles of light interference – Interferometers – Measurement and Calibration – Laser Interferometry.

UNIT IV **MEASURING MACHINES AND LASER METROLOGY:** **10**

Tool Makers Microscope – Microhite – Coordinate Measuring Machines – Applications – Laser Micrometer, Laser Scanning gauge, Computer Aided Inspection techniques - In-process inspection, Machine Vision system-Applications.

UNIT V **IMAGE PROCESSING FOR METROLOGY:** **10**

Overview, Computer imaging systems, Image Analysis, Preprocessing, Human vision system, Image model, Image enhancement, gray scale models, histogram models, Image Transforms - Examples.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course the students are expected to

1. Understand the advanced measurement principles with ease.
2. Operate sophisticated measurement and inspection facilities.
3. Design and develop new measuring methods.

REFERENCES

1. "ASTE Handbook of Industries Metrology", Prentice Hall of India Ltd., 1992.
2. Bewoor, A.K. and Kulkarni,V.A.,"Metrology and Measurement", Tata Mc Graw-Hill, 2009.
3. Galyer, F.W. and Shotbolt, C.R., "Metrology for engineers", ELBS, 1990.
4. Gupta, I.C., "A Text Book of engineering metrology", Dhanpat Rai and Sons, 1996.
5. Jain ,R.K.,"Engineering Metrology", Khqanna Publishers, 2008.
6. Rajput,R.K., "Engineering Metrology and Instrumentations", Kataria & Sons Publishers, 2001.

FABRICATION AND TESTING OF NATURAL FIBER HYBRID COMPOSITE MATERIAL

PHASE II REPORT

Submitted by

JENITH CHRISTOBER J

in partial fulfillment for the award of the degree of

MASTER OF ENGINEERING IN

MANUFACTURING ENGINEERING

J.K.K MUNIRAJAH COLLEGE OF TECHNOLOGY

T.N. PALAYAM, GOBI-638 506.

DEPARTMENT OF MANUFACTURING ENGINEERING

ANNA UNIVERSITY, CHENNAI

OCTOBER 2023

PRINCIPAL
JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506
GOBI (Tk), ERODE (Dt).

ANNA UNIVERSITY, CHENNAI

BONAFIDE CERTIFICATE

Certified that this Report titled **"FABRICATION AND TESTING OF NATURAL FIBER HYBRID COMPOSITE MATERIAL"** is the bonafide work of **JENITH CHRISTOBER J (Reg.No.731221410006)** who carried out the work under my supervision. Certified further that to the best of my knowledge and the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

SIGNATURE
Mr.V.MAGESH M.E.,
HEAD OF THE DEPARTMENT
Assistant Professor
Dept of Manufacturing Engineering
J.K.K Munirajah College of Technology
T.N.Palayam.

SIGNATURE
Mr.V.MAGESH M.E.,
SUPERVISOR
Assistant Professor
Dept of Manufacturing Engineering
J.K.K Munirajah College of Technology
T.N.Palayam.

Submitted for the Viva-Voce examination held on 9.10.23 FN

9/10/23
Internal Examiner

9/10/2023
External Examiner

PRINCIPAL
JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
GOBI (Tk), ERODE (Dt).

ABSTRACT

In this project by using a natural fibers of coconut and hair fiber are combined in the same matrix (unsaturated polyester) to make coconut/hair fiber hybrid composites. The Tensile, Flexural, Impact strength and Thermo gravimetric analysis properties of hybrid reinforced composite were described as per ASTM standards. Fabricate the hybrid polyester composite with varying aspect ratio of fibers and Volume fraction (20%, 30% and 40%). The fibers were kept under alkali treatment to improve the mechanical properties of the fiber significantly as compared to untreated fibers. The fibers were extracted from coconut and hair fiber by manual processes and fabrication processes were done by Hand layup method. In this work, water absorption pattern of these fabricated composite at room temperature was to found and also the characterization of fibers are analysed by Scanning Electron Microscope (SEM). Compare the mechanical properties and thermal properties of hybrid reinforced composite with plastics materials, wood and other natural fibers etc.

CHAPTER 1

1. INTRODUCTION

The use of advanced composite materials has increased considerably in the fabrication of structural elements. Advanced composite materials progressively substitute traditional materials, such as steel, aluminium or wood, due to their better specific properties. The excellent stiffness to weight and strength to weight ratios of polymeric matrix composite materials, particularly those reinforced with glass or carbon fibres make them very attractive for certain manufacturing sectors.

With the vast and rapid progress in science and technology, modern industry has introduced a new generation of composite materials having low density and very light weight with high strength, hardness and stiffness to meet the current needs of modern technology and the challenges against liberalization and global competitiveness in market.

Particle-reinforced with e-glass fiber have the potential to be used in a wide range of engineering applications due to their higher stiffness and strength. Therefore it is essential to look for the possibilities of fabricating e-glass based composite materials using waste or recycling materials like Coir and Human hair. Most of energy needs in the century is relied on the fossil fuels. Combustion of coal energy produces waste by product, i.e., Coir and Human hair in abundance. The disposal of this Coir and Human hair is a major challenging task.

In this work, an attempt has been made to fabricate a hybrid composite material from commercial pure material and waste product. Short e-glass fibres are used as commercially pure material and Coir and Human hair as waste product. Epoxy is used as matrix material for the fabrication of Epoxy-e-glass-Coir and Human hair as hybrid composite material.

CHAPTER 5

5. CONCLUSION

The mechanical and chemical properties of E-glass fiber, Coir and Human hair &Epoxy composites were investigated. Three ratios of 60:40, 65:35 and 70:30 epoxy-glass fiber, Coir and Human hair respectively were used to make the specimens. The volume of the Coir and Human hair is kept constant in the entire three specimen i.e. 6%byweight. The impact test, flexural test, compression test, tensile test, ftir test and sem analysis were conducted on the specimen and following conclusions were arrived at.

- Out of the three specimens the impact strength of 65:35 hybrid polymer matrix samples was found improved upto 15% than the rest of the samples.
- The flexural strength of 70:30 ratio samples was found improved upto 30% than the remaining sample. The flexural strength is noticed as 175.854N of this sample.
- The compression strength of 65:35 was observed as 12586.15N and it was noticed that the compression strength of this specimen was improved upto 20%.
- The tensile strength of 60:40 specimen was found better than the other two specimen. Similarly the Eng stress values corresponding to the strain values of 60:40 specimen was better than other.
- The fourier transform infrared spectroscopy conformed the existence of O-H bonds at the peaks between 3000$cm^{-1}$to 3500cm^{-1} this indicates strong bonding strength of this composites.
- The SEM analysis revealed the good bonding strength of glass fiber with the matrix. The fiber breakage, presence of debris also confined the same.

MECHANICAL BEHAVIOUR OF NATURAL FIBER HYBRID COMPOSITE MATERIAL

PHASE II REPORT

Submitted by

PERIYASAMY N

in partial fulfillment for the award of the degree of

MASTER OF ENGINEERING IN

MANUFACTURING ENGINEERING

J.K.K MUNIRAJAH COLLEGE OF TECHNOLOGY

T.N. PALAYAM, GOBI-638 506.

DEPARTMENT OF MANUFACTURING ENGINEERING

ANNA UNIVERSITY, CHENNAI

OCTOBER 2023

PRINCIPAL
JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
GOBI (Tk), ERODE (Dt).

ANNA UNIVERSITY, CHENNAI

BONAFIDE CERTIFICATE

Certified that this Report titled **"MECHANICAL BEHAVIOUR OF NATURAL FIBER HYBRID COMPOSITE MATERIAL"** is the bonafide work of **PERIYASAMY N (Reg.No.731221410007)** who carried out the work under my supervision. Certified further that to the best of my knowledge and the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

SIGNATURE
Mr.V.MAGESH M.E.,
HEAD OF THE DEPARTMENT
Assistant Professor
Dept of Manufacturing Engineering
J.K.K Munirajah College of Technology
T.N.Palayam.

SIGNATURE
Mr.V.P.ARULMURUGAN M.E.,
SUPERVISOR
Assistant Professor
Dept of Manufacturing Engineering
J.K.K Munirajah College of Technology
T.N.Palayam.

Submitted for the Viva-Voce examination held on 09.10.2023

Internal Examiner

9/10/2023
External Examiner

PRINCIPAL
JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
GOBI (Tk), ERODE (Dt).

ABSTRACT

This project is focused on the evaluation of Mechanical properties of palmyra fiber reinforced hybrid composites. The composites were developed using 5% alkali treated and raw Borassus fruit fibers of 5 mm length with epoxy resin by using the hand layup and compression mould technique. Specimens were cut from the fabricated laminate according to the ASTM (American society for Testing & Materials) standards for different experiments. The mechanical testing of composite structures to obtain parameters such as strength and stiffness is a time consuming and often difficult process. Tensile test and compressive test are used to determine the mechanical properties of the materials. Also the mechanical properties were obtained by using the impact, flexural and the hardness test. The izod impact testing showed the impact strength was improved by decreasing the fiber length and by increasing the friction stress between the fiber and the matrix. Fiber morphology and the fiber/matrix interface were further characterized by Scanning Electron Microscopic (SEM) Test.

Keywords: Palmyra Fiber, Glass Fiber, Epoxy Resin, Mechanical properties, SEM

PRINCIPAL
JKK MUNIRAJAH COLLE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
GOBI (Tk), ERODE (Dt).

CHAPTER 1

INTRODUCTION

1.1 DEFINITION OF COMPOSITE

A composite is combination of two materials in which one of the materials, called the reinforcing phase, is in the form of fibres, sheets, or particles, and is embedded in the other materials called the matrix phase. The reinforcing material and the matrix material can be metal, ceramic, or polymer. Composites typically have a fiber or particle phase that is stiffer and stronger than the continuous matrix phase and serve as the principal load carrying members. The matrix acts as a load transfer medium between fibers, and in less ideal cases where the loads are complex, the matrix may even have to bear loads transverse to the fiber axis.

The matrix is more ductile than the fibers and thus acts as a source of composite toughness. The matrix also serves to protect the fibers from environmental damage before, during and after composite processing. When designed properly, the new combined material exhibits better strength than would each individual material. Composites are used not only for their structural properties, but also for electrical, thermal, tribological, and environmental applications. Composite materials offer many desired properties for engineering design over conventional materials such as metals. The significant advantages of composites include high specific strength, low density, and excellent resistance to corrosion and temperature.

This has lead to a great interest in the research and development of composite materials in the past decades especially for aircraft and automobile applications where weight reduction is of major concern. The use of composite

CHAPTER 7

CONCLUSION

The mechanical properties of composites were investigated. The impact test, flexural test, Hardness test, tensile test, and SEM analysis were conducted on the specimen and following conclusions were arrived at.

- Out of the six specimens the impact strength of T3 hybrid polymer matrix samples was found improved upto 15% than the rest of the samples.
- The flexural strength of T3 ratio samples was found improved upto 30% than the remaining sample. The flexural strength is noticed as 48.7N of this sample.
- The tensile strength of T3 specimen was found better than the other five specimen. Similarly the Eng stress values corresponding to the strain values of T3 specimen was better than other.
- The fourier transform infrared spectroscopy conformed the existence of O-H bonds at the peaks between $3000cm^{-1}$ to $3500cm^{-1}$ this indicates strong bonding strength of this composites.
- The SEM analysis revealed the good bonding strength of glass fiber with the matrix. The fiber breakage, presence of debris also confined the same.

MF5016 MATERIALS TESTING AND CHARACTERIZATION TECHNIQUES L T P C
3 0 0 3

OBJECTIVE:
This course aims to impart knowledge on various techniques of material characterization.

UNIT I MICRO AND CRYSTAL STRUCTURE ANALYSIS 10
Principles of Optical Microscopy – Specimen Preparation Techniques – Polishing and Etching – Polarization Techniques – Quantitative Metallography – Estimation of grain size – ASTM grain size numbers – Microstructure of Engineering Materials - Elements of Crystallography – X- ray Diffraction – Bragg's law – Techniques of X-ray Crystallography – Debye – Scherer camera – Geiger Diffractometer – analysis of Diffraction patterns – Inter planer spacing – Identification of Crystal Structure, Elements of Electron Diffraction.

UNIT II ELECTRON MICROSCOPY 9
Interaction of Electron Beam with Materials – Transmission Electron Microscopy – Specimen Preparation – Imaging Techniques – BF & DF – SAD – Electron Probe Microanalysis – Scanning Electron Microscopy – Construction & working of SEM – various Imaging Techniques – Applications- Atomic Force Microscopy- Construction & working of AFM - Applications .

UNIT III CHEMICAL AND THERMAL ANALYSIS 9
Basic Principles, Practice and Applications of X-Ray Spectrometry, Wave Dispersive X-Ray Spectrometry, Auger Spectroscopy, Secondary Ion Mass Spectroscopy, Fourier Transform Infra Red Spectroscopy (FTIR)- Proton Induced X-Ray Emission Spectroscopy, Differential Thermal Analysis, Differential Scanning Calorimetry (DSC) And Thermo Gravitymetric Analysis (TGA)

UNIT IV MECHANICAL TESTING – STATIC TESTS 8
Hardness – Brinell, Vickers, Rockwell and Micro Hardness Test – Tensile Test – Stress – Strain plot – Proof Stress – Torsion Test - Ductility Measurement – Impact Test – Charpy & Izod – DWTT - Fracture Toughness Test, Codes and standards for testing metallic and composite materials.

UNIT V MECHANICAL TESTING – DYNAMIC TESTS 9
Fatigue – Low & High Cycle Fatigues – Rotating Beam & Plate Bending HCF tests – S-N curve – LCF tests – Crack Growth studies – Creep Tests – LM parameters – AE Tests-modal analysis - Applications of Dynamic Tests.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course the students are expected to be knowledgeable in microstructure evaluation, crystal structure analysis, electron microscopy, Chemical Thermal Analysis, static and dynamic mechanical testing methods.

REFERENCES:

1. ASM Hand book-Materials characterization, Vol – 10, 2004.
2. Culity B.D., Stock S.R& Stock S., Elements of X ray Diffraction, (3rd Edition). Prentice Hall, 2001.
3. Davis J. R., Tensile Testing, 2nd Edition, ASM International, 2004.
4. Davis, H.E., Hauck G. & Troxell G.E., The Testing of engineering Materials, (4th Edition), McGraw Hill, College Divn., 1982.

PRINCIPAL
JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
GOBI (Tk), ERODE (Dt).

EXPERIMENTAL INVESTIGATION OF PROCESS PARAMETERS INTERACTION IN MICRO DEEP DRAWING

PHASE II REPORT

Submitted by

SIVASANKAR A

in partial fulfillment for the award of the degree of

MASTER OF ENGINEERING IN

MANUFACTURING ENGINEERING

J.K.K MUNIRAJAH COLLEGE OF TECHNOLOGY

T.N. PALAYAM, GOBI-638 506.

DEPARTMENT OF MANUFACTURING ENGINEERING

ANNA UNIVERSITY, CHENNAI

OCTOBER 2023

ANNA UNIVERSITY, CHENNAI

BONAFIDE CERTIFICATE

Certified that this Report titled **"EXPERIMENTAL INVESTIGATION OF PROCESS PARAMETERS INTERACTION IN MICRO DEEP DRAWING"** is the bonafide work of **SIVASANKAR A (Reg.No.731221410008)** who carried out the work under my supervision. Certified further that to the best of my knowledge and the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

SIGNATURE
Mr.V.MAGESH M.E.,
HEAD OF THE DEPARTMENT
Assistant Professor
Dept of Manufacturing Engineering
J.K.K Munirajah College of Technology
T.N.Palayam.

SIGNATURE
Mr.P.ESWARAN M.E.,
SUPERVISOR
Assistant Professor
Dept of Manufacturing Engineering
J.K.K Munirajah College of Technology
T.N.Palayam.

Submitted for the Viva-Voce examination held on 09.10.2023

Internal Examiner

9/10/2023
External Examiner

PRINCIPAL
JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
GOBI (Tk). ERODE (Dt).

ABSTRACT

Deep drawing is one of the most important sheet metal forming process, which produce cups, cones, boxes and shells. The requirements of miniature components extremely high members for electronic components in microsystem technologies (MST) and micro electro mechanical systems (MEMS).Moreover metal forming offers some excellent characteristics that are superior to those of other processes for example machining, chemical etching considering such feature as high production rates, good material integrity, less wastage, etc but there are problems in production of micro components but there are problems in production of micro components due to the miniature size and manufacturing difficulty in micro machining and micro forming technologies. To overcome these difficulties lots of researches and developments have been done in micro forming. In this Project, some of the frictional and geo metric conditions are taken into account, to determine the influence of process parameters and formability of sheet material when scaling down the size from meso to micro level. The work focuses on the design and development of a micro Deep Drawing for Titanium sheet materials. The setup consists of die sets, linear actuators for punch force, and spring for blank holding. The setup will be tested for micro deep drawing of materials such as TitaniumTi6 Al4V Grade 5, Grade2, SUS304 and Brass.

CHAPTER 1

INTRODUCTION

1.1 SHEET METAL PROCESSING

Sheet metal is simply metal formed into thin and flat pieces. It is one of the fundamental forms used in metalworking and can be cut and bent into a variety of different shapes. Countless everyday objectives are constructed of the material. Thicknesses can vary significantly, although extremely thin thickness are considered foil or leaf and pieces thicker than 6mm (0.25") are considered as plate. The raw material for sheet metal manufacturing processes is the output of the rolling process. Typically, sheets of metal are sold as flat, rectangular sheets of standard size. If the sheets are thin and very long, they may be in the form of rolls. Therefore the first step in any sheet metal process is to cut the correct shape and sized blank from larger sheet.

1.2 SHEET METAL FORMING PROCESSES

Sheet metal processes can be broken down into two major classifications and one minor classification

1.2.1 Shearing process

This processes which apply shearing forces to cut, fracture, or separate the material. Shearing process are

- Punching: Shearing process using a die and punch where the interior portion of the sheared sheet is to discarded.
- Blanking: Shearing process using a die and punch where the exterior portion of the sheared sheet is to discarded.
- Perforating: Punching a number of holes in a sheet.
- Parting: Shearing the sheet into two or more pieces.
- Notching: removing pieces from the edges.

CHAPTER 12

CONCLUSION

Thus by conducting experiment with different strength materials like Titanium, Brass, Stainless Steel for different cup diameters and the formability are evaluated. From the experiments high strength materials like Brass and Stainless steel have good formability for the cup diameters 12mm and 16mm respectively. High Strength material 304 also have good formability by cold forming for 12mm diameter cup. Among these three types of high strength materials the Titanium have more strength compare to other materials. By selecting process parameters we can get good formability during cold forming (deep drawing). In future we improve the formability of Titanium by using warm forming. This is because Titanium has less elongation properties and is brittle in nature.

THERMAL BEHAVIOUR OF NATURAL FIBER REINFORCED HYBRID COMPOSITE MATERIAL

PHASE II REPORT

Submitted by

VINOTH A

in partial fulfillment for the award of the degree of

MASTER OF ENGINEERING

IN

MANUFACTURING ENGINEERING

J.K.K MUNIRAJAH COLLEGE OF TECHNOLOGY

T.N. PALAYAM, GOBI-638 506

DEPARTMENT OF MANUFACTURING ENGINEERING

ANNA UNIVERSITY, CHENNAI

OCTOBER 2023

PRINCIPAL
JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506
GOBI (Tk), ERODE (Dt).

ANNA UNIVERSITY, CHENNAI

BONAFIDE CERTIFICATE

Certified that this Report titled **"THERMAL BEHAVIOUR OF NATURAL FIBER REINFORCED HYBRID COMPOSITE MATERIAL"** is the bonafide work of **VINOTH A (Reg.No.731221410009)** who carried out the work under my supervision. Certified further that to the best of my knowledge and the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

SIGNATURE
Mr.V.MAGESH M.E.,
HEAD OF THE DEPARTMENT
Assistant Professor
Dept of Manufacturing Engineering
J.K.K Munirajah College of Technology
T.N.Palayam.

SIGNATURE
Mr. M.MAGESH M.E.,
SUPERVISOR
Assistant Professor
Dept of Manufacturing Engineering
J.K.K Munirajah College of Technology
T.N.Palayam.

Submitted for the Viva-Voce examination held on 9.10.23

Internal Examiner

External Examiner

PRINCIPAL
JKK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
GOBI (Tk), ERODE (Dt).

ABSTRACT

This project mainly deals with the analysis of moisture absorption effect and the thermal properties of palmyra fiber reinforced epoxy composites. The hybrid composites were prepared using raw and alkali treated Palmyra fiber and glass fibers with epoxy resin and three different compositions by using hand layup technique. Specimens were cut from the fabricated laminate according to the ASTM (American society for Testing & Materials) standards for different experiments. Water absorption studies of Palmyra fiber composites shows that raw fiber absorbed more water than treated fiber. Thermogravimetric analysis (TGA) was used to measure the rate of change in the weight of composites as a function temperature. The TGA of the specimen with alkali treated and untreated fiber shows that T2 composite shows higher thermal stability. The thermal behaviour further characterized by means of differential scanning calorimetric analysis. The Glass transition temperature of the T3 proportion better than the other proportion. Thermal conductivity of the composites were found from various physical models and heat transfer rate of these physical models were analyzed through Ansys.

Keywords: Palmyra fiber, Glass Fiber, Epoxy resin, Moisture absorption, TGA, DSC, Thermal conductivity

PRINCIPAL
KK MUNIRAJAH COLLEGE
OF TECHNOLOGY
T.N. PALAYAM (Po)-638 506.
GOBI (Tk), ERODE (Dt).

CHAPTER 1

INTRODUCTION

The long term vision of this project is to develop composites with reduced thermal stresses to avoid catastrophic failure and creating environmental friendly atmosphere. Many of the polymer composites have glass fiber as reinforcement even the polymers in usage process polluted environment. Since the glass fiber or fabrics are non-degradable property, in recent years the use of natural (lingo-) cellulosic fibers, e.g.: flax, sisal, banana, jute, coir, hemp, has been gaining a noteworthy attention in polymer composites, as an alternative to traditional fibers such as glass, carbon and aramid. The increasing interest in this material is due to the inherently environmentally friendly nature of natural fibers, leading to carbon dioxide mitigation, their low cost and low density. Other advantages include biodegradability, recyclability and significant processing advantages. In particular, equipment abrasion, energy consumption, and respiratory irritation are all reduced.

Epoxy is widely used in industrial applications, such as adhesive, coatings, electronics and aerospace structure. Due to its excellent mechanical and chemical properties, epoxy is also one of the important materials using as the matrices for FRP. It has low shrinkage upon curing, good chemical resistance. Thermal properties and good performance at elevated temperatures.
It is observed that, some of the natural fibers got degraded thermally, at the melting point of thermoplastics. So it is desirable to study the thermal stability of the natural fibers before they are considered as reinforcement in thermoplastic matrices.

CHAPTER 6

CONCLUSION

The Thermal behaviour of Palmyra fiber, E-glass fiber, & Epoxy composites were investigated. Six different ratio of Palmyra fiber (Treated and untreated), epoxy-glass fiber, Epoxy resins were used to make the specimens. The Moisture absorption test, Thermogravimetric Analysis, Differential Scanning Calorimetric Analysis were conducted on the specimen and following conclusions were arrived at.

- The treated palmyra fiber composite absorbed less water than the untreated palmyra fiber Composite.
- Out of the six specimens the moisture absorption behaviour of T3 specimens has 5-15% less than the other samples.
- The moisture absorption behaviour increases with increase of natural fiber content present in the composites.
- The initial and final degradation temperature of palmyra fiber composites were measured in the temperature range 225 °C – 530 °C. From these values it can be concluded that the thermal stability of fibers was improved by alkaline treatment.
- The thermal stability of the T2 composite specimens has better than the other composite Specimens.
- The degradation temperature range was reduced with the increase of natural fiber content present in the composites.
- The glass transition temperature of the composites was found from 57.4 °C to 69.6 °C. The glass transition temperature of T3 specimen was found better than the other Specimens.
- From the Thermal conductivity values, addition of natural fibers reduces the thermal conductivity.