

Aerodynamic Analysis of Car body with Aerodynamic Devices to Improve Performance

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Abstract - This research is about analysis of the effects of different Aerodynamic add on devices on the vehicle to reduce drag and make the vehicle fuel efficient. The 3D model is developed in ANSYS Space claim. Computational fluid dynamics (CFD) is performed to understand the effects of these add on devices. CFD is performed in ANSYS Fluent module. Drag Coefficient, lift coefficient, drag force and lift force are calculated and compared. The results are analyzed and it was observed that optimized body has better drag coefficient and lift coefficient which helps improving the fuel economy and stability of the car.

Keywords: Aerodynamics, Drag Coefficient, Lift Coefficient, Computational fluid dynamics, Stream lined body.

1. INTRODUCTION

Aerodynamics plays crucial role in Automobile's performance. Initially, aerodynamics was used in racing to increase performance of the race cars to increase the race pace. But when fuel economy became a factor in road vehicles due to high prices of fuel, automobile manufacturers started to make changes to road cars by making them more streamlined and adding diffusers to reduce drag and improve fuel economy.

There will be different types of forces acting on a vehicle when it is moving. One of the forces that is acting against the flow of the vehicle is Drag Force. Reduction of this drag force helps in making a vehicle more fuel efficient and stable vehicle. The basic formula to calculate the overall drag is given by:

$$D = \frac{\rho}{2} C_d A V^2$$

Where,

C_d = Coefficient of Drag

A = Frontal area

V = Relative velocity of the object w.r.t. fluid medium

ρ = Density of air

So, our aim is to reduce the drag and lift forces acting on the car. We have analyzed 3 different models.

- Bluff model
- Streamlined model
- Streamlined model with diffuser.

And the results were noted and due to changes in the shape of the car body the drag reduction was observed which in return will increase the fuel efficiency of the car.

Computational Fluid Dynamics

CFD analysis consists of three main steps: Pre-Processing, Processing and Post-Processing. It is used to simulate fluid flow using computers with accurate results. We have used ANSYS Space Claim to design the Car models and ANSYS Fluent module to analyze the pressure contour, velocity contour, drag coefficient, lift coefficient, drag and lift forces of the models.

Concept of Streamlining

A body is stream lined when the air flow separation is low when compared to a bluff body whose air flow separation is high which causes a lot of pressure drag. A stream lined body has less pressure drag which in turn results in overall reduction in drag. A stream lined body is sleek and much easier to force such body through a fluid. So, we designed a car model with streamlined shape.

Diffuser

A diffuser, in an automobile, is a curved section of the car rear which improves the car's aerodynamic properties by improving the transition between the high-velocity airflow underneath the car and the much slower velocity in ambient atmosphere. The aft part of the car is where usually the diffuser is located. The diffuser helps in making the air flow at the exit is at the same pressure and same speed of the ambient.



Modification of Bundle Former Piston by Failure Analysis to withstand the Fatigue

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ABSTRACT

The failure analysis of bundle former piston rod with a detailed study of various reasons regarding the failures. The different approaches of design parameters are considered and suitable regulation is specified. The present work compares the results of the theoretical design calculations against the experimental work. And an analysis will be done in ANSYS Software.

KEYWORDS: Solid works, Ansys

1. INTRODUCTION

1. Description of Bundle Former Bar Separating Unit

The steel TMT bars from the rolling mill area would be transferred to bar separating mill by means of rollers. The bar separating unit will separate the bar into discretized units from where they are separated by means of bundles. The number of bars that are allotted to a bundle would be based from the operation characteristics like the size or the diameter of the individual bar unit.

Bar Collecting Unit

The steel bars from the separating area are transferred to a collecting unit called Bar Collecting Unit. In this unit the bars from the rolling chain are made to fall into a hook shaped collecting tray operated by means of hydraulic cylinder and piston Unit. The number of bars that are collected into the tray is calculated by means of a sensor mounted on the rolling chain unit at the

beginning of the bar that is falling into the tray. The Function of this collecting unit is to collect the bars falling from the separating unit and transfer the same to the rollers where the bundle former presses the bulk of bars to make it a bundle and then a strapping machine puts straps to the bundle.





Fabrication of Water Heater/Cooler using Refrigeration system

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ABSTRACT

This water heater cum cooler makes the study of water-cooling system using a compressor in Refrigerator system. The main aim in developing this device is to develop a multifunctional unit which can provide both hot water and cold water using the regular refrigeration cycle. The refrigeration cycle is a thermodynamic heat pump cycle which is a conceptual and Mathematical model for heat pump, air conditioning refrigeration systems.

The refrigerant R-22 /F-22 (FLORON – 22) is used as medium which absorbs and removes heat from the water and subsequently rejects the air in the atmosphere. The Main difference between this water cooler & Heater and Traditional water Heater & Cooler used domestically is this comprises of a compressor functioning of this system. Whereas, that Traditional Heater, Cooler has condenses and has 2 switches to combine working & it's a Non – Cyclic process. Their capacity is less. Circuit is different Power consumption is more. This is more effective and controllability is more. Constant refilling of water is necessary.

This is a cyclic process which uses both condenser and evaporator. Water storage space is more. Power consumption is less. Usage is easy usage.

KEYWORDS: Compressor, Refrigerant, Condenser, Evaporator, Accumulator, Water heater/Cooler.

1. INTRODUCTION

Refrigeration involves the process of removing heat from a body and cooling it to a lower temperature than the actual. Refrigerators are used for the refrigeration process.

Heat and cold are two different entities associated with temperature. Body temperature is measured by a thermometer. We prefer to wear light coloured cotton clothes when it is hot. We prefer to wear light coloured cotton clothes when it is hot. We prefer to wear dark-coloured polyester clothes when it is cold as per

the weather. Heating is the process of upkeeping the heat in the body. Refrigeration is the process of cooling space.

Any substance capable of absorbing heat from another required substance can be used as refrigerant i.e. ice, water, air or brine. A mechanical refrigerant is a refrigerant which will absorb the heat from the source and dissipate the same to the sink or in the form of latent heat. The physical properties will enable them to repeat continuously a liquid to gas and gas to liquid transformation. Air was used as a refrigerant in many

Fabrication and Performance of Thermo-Electric Refrigerator

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ABSTRACT

Advancement in technological field led to the most valuable invention i.e., refrigeration and air conditioning system but its prolonged and effects the environment. CFC'S, HFC's are released from the conventional refrigeration systems which is caused major environmental issues then it results the increase in global warming. These refrigerants also deplete the ozone layer that allows the ultraviolet rays directly coming to the earth's surface and their effect is for a longer period of time. Nearly thousands of O₃ molecules can be destroyed by a single molecule of the HFC and the percentage of the HFC's discharge from the conventional refrigeration and air-conditioning systems is less compared to the discharging of CO₂. So that's why we created this eco-friendly refrigerator to stable the environment.

The impact of ongoing progress in science and technology the refrigeration effect is created by using refrigerants but in this system, we are using thermo-electric modules to produce the refrigeration effect. A Thermoelectric module is used in the place of compressor so that it become less weight and portable, as it is based on the principles of Peltier effect. The use of Peltier effect is to create two junctions they are hot and cold junctions opposite to each other.

1. INTRODUCTION

When the temperature gradient is passed between the two dissimilar semi-conductors, the electric current would be flow. This is known as the Seebeck effect. Jean. C. Peltier, a French watchmaker and an amateur scientist discovered a reserve effect of Seebeck. He discovered that joined metals heat pump can be made. He found that, when the electric current is passed between the two dissimilar electric conductors, caused the heat to be either emitted or absorbed at the junctions of the materials. This is called as Peltier effect and it maintains the effectiveness on both heat and cold junctions.

THERMOELECTRIC REFRIGERATOR

Thermoelectric coolers are solid state heat pumps that operate on the Peltier effect. The thermos-electric module consists of a positive and negative terminal. The theory that the electric current passes through two dissimilar conductors then there is a heating or cooling effect produced. The temperature difference is created when the voltage applied to the free ends of two dissimilar materials. This temperature difference will cause the heat so this heat is moved from one side to another side. This thermo - electric module contains an arrangement of P - type and N - type semiconductors. These elements that act as the two dissimilar conductors. The arrangement of these elements is fastened between two ceramic plates, electrically in series but thermally in parallel. When DC current passes through one or more pairs of elements from N-type to P-type, there is a drop in temperature at a cold junction, resulting in the absorption of heat from the surroundings. The heat is transfer through the cooler and released on the hot side as the electrons move from a high to low energy state. The heat pumping capacity of a cooler is proportional to the current and the number of pairs of N-type and P- type elements.

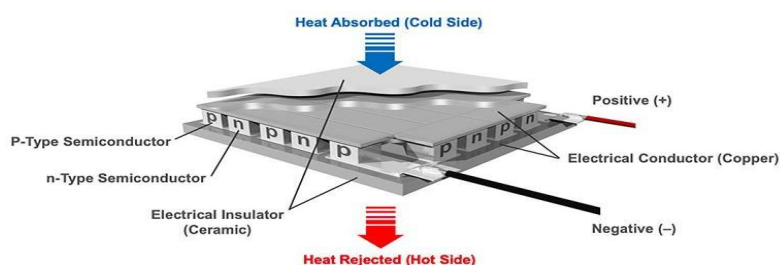


Figure 1: Diagram of a typical thermoelectric couple



DESIGN AND FABRICATION OF ELECTROMAGNETIC BRAKING SYSTEM

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ABSTRACT: An electromagnetic brake is a new and revolutionary concept. These are totally frictionless Electromagnetic brakes are the brakes working on the electric power & magnetic power. An Electromagnetic Braking system uses Magnetic force to engage the brake, but the power required for braking is transmitted manually. Electromagnetic braking system is a modern technology braking system used in light motor & heavy motor vehicles. This system is a combination of electro-mechanical concepts. The frequency of accidents is now-a-days increasing due to inefficient braking system. The concept helps in reducing or eliminating sources of heat generation, friction, noise, and wear of materials. There is no involvement of fluids as used in hydraulic braking systems. Electromagnetic brakes work on the principle of repulsion and attraction between two electromagnet field coils. The repulsion between the field coils opposes the motion of the wheel. This repulsion is initiated within the field coils by a switch or a lever that allows current to be supplied to the coils. Each coil is separately spaced evenly on both the outer and inner array of field coils. The disc is connected to a shaft and the electromagnet is mounted on the frame. When electricity is applied to the coil a magnetic field is developed across the armature because of the current flowing across the coil and causes armature to get attracted towards the coil. As a result, it develops a torque and eventually the vehicle comes to rest.

Introduction:

A brake is a device, where it restricts motion. It is commonly known that the brakes use friction to convert kinetic energy into heat. But the Electromagnetic brakes have been used as supplementary retardation equipment in addition to the regular friction brakes on heavy vehicles. They work on the principle of electromagnetism. The working principle of this system is that when the magnetic flux passes through and perpendicular to the rotating wheel the eddy current flows opposite to the rotating wheel/rotor direction.

Design and Thermal Analysis on Transformer Fin Using CFD

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Abstract: The design problem considers minimization of the short circuits and explosions due low heat reduction through fins. The transformer design involves the optimum transfer of heat through fins to minimize the leakage field, short circuits and explosions. While designing the transformer, original dimensions of the transformer should be taken and not consider the before used materials of manufacturing the transformer. The design of transformer involves in considering the two different materials one is alumina 96% and another one is structural steel to get the temperature distribution and temperature changes within the transformer by giving the boundary conditions of transformer including atmospheric temperature. Then compare both the materials with present used material of the transformer using software analysis. Then choosing the best material for better heat reduction (to atmosphere) through the fins (extended surface) of transformer. Generally mild steel is better than the aluminum as it in a strength. The analysis has proved that mild steel has better strength than the aluminum materials. Comparing the mild steel with the aluminum on the transformer for better heat rejection by conducting the steady state thermal analysis, transient analysis. The results of comparing these two different materials on the transformer is that the mild steel has better strength and good temperature capacity for high capacity of transformers than the aluminum. Results based on equivalent stress, static deformation and natural frequencies shows that mild steel transformer performed better in that it has high strength and good temperature bearing capacity and will deflect far less than aluminum. The aluminum materials are assigned to the transformer body and fins will become melts and damaged because aluminum has low strength and low temperature bearing capacity than the mild steel material. So that aluminum is used only for low heat sink or rejection of the fins. Mild steel is better suited for the high temperature holding transformer because mild steel is more rigid. These structural analysis results are gained through experimental work. These structural analysis results are gained through experimental work.

Keywords: Transformer fin.

1. Introduction

Transformer is a unit which helps in step up and step down the voltage. While doing the operation, transformer core gets heated up to a temperature ranging from 105 degree Celsius to 220 degrees Celsius. Transformer consists fins which helps in transmitting the heat generated inside core to outside

atmosphere. If the temperature is increased beyond the mentioned temperature, even in 1 degree rise in temperature also reduces the efficiency by 50%. So, in order to minimize the losses caused to overheating, we are developed a project which can withstand a temperature ranging from 220 degree Celsius to 335 degrees Celsius. In order to get that output we redesigned the fins by changing the material as well as dimensions.

Heat transfer in transformer generally takes place in 3 modes.

1. Conduction
2. Convection
3. Radiation

Conduction: Conduction is a mode of heat transfer in which heat is transferred through direct physical contact between two or more solid bodies. In transformer this mode of heat transfer occurs in transformer core. Heat generated inside the transformer core get transferred to outside atmosphere by means of conduction.

Convection: Convection is also a mode of heat transfer in which heat is transferred within the fluid itself. In transformer this mode of heat transfer occurs within the coolant (mineral oil).

Radiation: Radiation is a special mode of heat transfer in which heat is transferred in form of electromagnetic waves. For this mode of heat transfer does not require any medium. In transformer this phase of heat transfer occurs at transformer fins and air. Heat from transformer fins is dissipated to atmosphere through radiation process.

By redesigning the transformer fins, the area of contact of fins to outside atmospheric air gets increases, due to increase in area of contact to outside atmosphere heat transfer rate increases.

In this design we make use of aluminium as transformer material, so that weight of the transformer gets reduced.

Aluminium has excellent corrosion resistant property and also has good thermal conductivity.

A. Problem Definition

Day by day number of research works are going on thermal stream to proper utilization of thermal energy.

1. Its time to proper utilization of thermal energy, cooling

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Enhancement of Design and Fabrication of a Composite Automobile Body Based on Integrated Structure and Analysis of Gases using Gas Analyser

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ABSTRACT

In this project we have Designed and fabricated a Composite Automobile Body Based on Integrated Structure by our self-interest-based racing car model. The Design of the car was carried out using CATIA software and the analysis is done by using ANSYS Software. The car was fabricated in one of our laboratories at our Institute. The car has been tested for its performance.

KEYWORDS: Composites, CATIA, Ansys

1. INTRODUCTION

A car (or automobile) is a wheeled motor vehicle used for transportation. Most definitions of cars say that they run primarily on roads, seat one to eight people, have four wheels, and mainly transport people rather than goods. Cars came into global use during the 20th century, and developed economies depend on them. The year 1886 is regarded as the birth year of the car when German inventor Carl Benz patented his Benz Patent Motorwagen. Cars became widely available in the early 20th century. One of the first cars accessible to the masses was the 1908 Model T, an American car manufactured by the Ford Motor Company. Cars were rapidly adopted in the US, where they replaced animal-drawn carriages and carts. In Europe and other parts of the world, demand for automobiles did not increase until after World War II.

Cars have controls for driving, parking, passenger comfort, and a variety of other features. Over the decades, additional features and controls have been added to vehicles, making them progressively more complex. These include rearviewing cameras, air conditioning, navigation systems, and in-car entertainment. Most cars in use in the early 2020s are propelled by an internal combustion engine, fuelled by the combustion of fossil fuels. Electric cars, which were invented early in the history of the car, became commercially available in the 2000s and are predicted to cost less to buy than gasoline cars before 2025.

2. METHODOLOGY

According to the report of KPM Indian automobile industry is a developed industry that is having high opportunities when we compare among the others



Experimental Analysis of Heat Transfer of a Fin by using Compressed Graphite Sheet

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ABSTRACT

An experimental investigation of heat transfer from a square fin using graphite sheets is addressed in the present work. The test has been performed on three different thickness of graphite sheet having 1mm, 3mm and 6mm thickness placed in the slotted fin. The experimental setup comprises centrifugal blower, test section, heater and test panel. Results are obtained for local fin temperature distribution, rate of heat flux. The local fin temperatures of a fin with graphite sheet are higher than that of a plane square fin due to an increased rate of heat conduction. The rate of heat flux is also increased with the increase in the thickness of graphite sheet. The Effectiveness and Efficiencies of fin with Graphite sheet are also increased

KEYWORDS: Square fin, Graphite sheets, Thermal Conductivity, Effectiveness.

1. INTRODUCTION

Now a day's heat dissipation from electronic and mechanical components is the major problem. Electronic components like LED lights, CPU in computers, different electronic chips, transistors, and some mechanical devices produce heat while it is working. If this heat is not dissipating from the device properly it becomes over heated and system will have damaged and it didn't work properly. So many studies and experiments are done on this problem by using fins, heat sinks with different geometries. Typically, the fin material has a high thermal conductivity. The fin is exposed to a flowing fluid, which cools or heats it, with the high thermal conductivity allowing increased heat being conducted from the wall through the fin. Present work deals with the thermal performance of a square fin

using compressed graphite sheets by using the graphite sheets the thermal conductivity of a fin can be increased which intern increases the heat conduction from the fin. Fins are the extended surfaces, which are directly or indirectly attached to the hot body to dissipate the heat by conduction, convection and radiation. Fins are used to increase the heat transfer rate from a surface to a fluid. The heat removed by conduction from body, which it is attached, then by convection and radiation from fin. The use of fins in very common and they are designed in different shapes. Circumferential fins around the cylinder of a motor cycle engine and fins attached to the condenser tubes of refrigerator are a few examples.

Heat sinks are devices that enhance heat dissipation from a hot surface, usually the case of a heat generation



Design and Fabrication of Multidirectional Rotational Trolley

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ABSTRACT

Normal dumper vehicle unload materials only in one direction that too only at the backside of the tipper trolley by using various powerful hydraulically operated cylinders, which may cause the problems of blockage when the work area is limited. The Multidirectional dumper overcomes the problem of unloading the vehicle on side way by using Pneumatic cylinder used in our prototype but hydraulic cylinder would have to be used in a standard vehicle. By using cylinder and Geneva mechanism the material can be unloaded in as per requirement. However, the Multidirectional dumper is developed and tested for its rotation in all 360° possible angle to unload the materials in the tipper trolley and monitor the inclinations for its gradualism by using Geneva mechanism.

KEYWORDS: 360 degrees trolley, Prototype hydraulic cylinder and truck.

1. INTRODUCTION

Material handling in construction and civil works is one of the basic necessities. The material supply to civil and construction is provided through trucks, dumper etc. The material should be properly loaded, managed, stacked, transported and unloaded. The dumper carries the material which is loaded from the site, where the material is initially stored. It is then loaded to the dumper and transported to the required site and then unloaded. The major issues raises over here, the incompatibility of the site with the fully loaded dumper causes a lot of settling time for the trolley to get the material properly arranged and transportation time to reach its location.

The dumper unloads the material in only one direction. But this incapability can be full new method mechanism as the Multidirectional dumper. Gothic mechanism is an approach to reduce the idle time to settle the dumper. The material is unloaded in any direction and hence can be boldly stated as "Multidirectional Dumper." The major outcomes of Multidirectional dumper has overcome space requirement which often result in road blocking. Hence, we have inversion in the existing mechanism providing the unloading in 3600 rotations. This mechanism prevents blocking of road, saves time and enhances productivity at lowest cost. The automotive sector is fast booming section in India. There are variable in automotive industry light and heavy motor vehicle.



Fabrication and Experimental Analysis of Heat Sink Fins

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ABSTRACT

In this project we had fabricated the different types of fins like circular and square. This fins made up of aluminium because it is low cost and high heat transfer rate. The experiment is carried out on fins test rig. We took the different temperatures of fins with help of this test rig and the results of this fins has been compared with efficiency and heat transfer rate. Finally, we want to conclude that which fin has high rate heat transfer and efficiency

1. INTRODUCTION

Heat transfer is the study of the flow of heat. In chemical engineering, we have to know how to predict rates of heat transfer in a variety of process situations. For example, in mass transfer operations such as distillation, the overhead vapour has to be condensed to liquid product in a condenser, and the bottoms are boiled off into vapour in a reboiler. Often the feed stream is preheated using the bottoms product in a heat exchange.

Another example is the production and use of process steam, which is brought to various locations in a plant through steam pipes as a heating utility. Also, these steam pipes need to be insulated to minimize heat loss to the ambient air. Such insulation is also important when transporting hot fluids from one place to another.

A similar application is the transport of refrigerated liquids through piping – here we need to insulate to avoid transferring heat into the liquid from the ambient air. Chemical reactors can generate heat if the reaction is

exothermic, and this heat must be removed to avoid a runaway reaction; likewise, endothermic reactions need a supply of heat to maintain the reaction. Heat transfer also is important in our daily lives.

For example, we heat our homes in the winter using hot water in baseboard heaters. We boil water routinely for cooking purposes. If you look inside a modern personal computer, you'll see a fan that is used to cool the electrical circuitry, which becomes warm because of the flow of electrical current through resistances. Sometimes when the circuits are dense, a refrigerant is used in a sealed tube that is boiled at one end where it is warm, to take away the heat, and condensed at the other end where it is cooler.

The three basic mechanisms of heat transfer. They are conduction, convection, and radiation. Next, we discuss each of these mechanisms in some detail.



Experimental Analysis of Heat Transfer Rate by Applying Ceramic Coating on Metal Surface

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ABSTRACT

In this project we have study the heat transfer analysis of ceramic coating applied on stainless steel metal surface. The experiment is carried out emissivity test rig. The coating technique is used by Plasma Electrolysis Oxidation (PEO). The result has been compared to the pure stainless steel and ceramic coated stainless steel with reference of the black body.

KEYWORDS: *stainless steel, ceramic coating, Plasma electrolysis oxidations, heat transfer rate, Emissivity.*

1. INTRODUCTION

Energy is a core subject to education in Mechanical Engineering (ME). Among the various issues, technologies for energy recovery and conversion are at the forefront of any mechanical engineering curricula.

Heat

Heat is the amount of energy that flows spontaneously from a warmer object to a cooler one. More generally, heat arises from many microscopic-scale changes to the objects, and can be defined as the amount of transferred energy excluding both macroscopic work and transfer of part of the object itself. The process of heat, also called heating

Heat transfer

Heat transfer is a discipline of thermal engineering that concerns the generation, use conversion, and exchange of thermal energy (heat) between physical systems. Heat transfer is classified into various mechanisms, such as thermal conduction, thermal convection,

thermal radiation, and transfer of energy by phase changes. Engineers also consider the transfer of mass of differing chemical species, either cold or hot, to achieve heat transfer. While these mechanisms have distinct characteristics, they often occur simultaneously in the same system. Heat conduction, also called diffusion, is the direct microscopic exchange of kinetic energy of particles through the boundary between two systems. When an object is at a different temperature from another body or its surroundings, heat flows so that the body and the surroundings reach the same temperature, at which point they are in thermal equilibrium. Such spontaneous heat transfer always occurs from a region of high temperature to another region of lower temperature, as described by the second law of thermodynamics. Heat convection occurs when bulk flow of a fluid (gas or liquid) carries heat along with the flow of matter in the fluid. The flow of fluid

Design and Fabrication of 3D Printer

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ABSTRACT

3D printing is called as desktop fabrication. It is a process of prototyping where by a structure is synthesized from a 3d model. The 3d model is stored in as a STL format and after that forwarded to a 3D printer. It can use a wide range of materials such as ABS, PLA, and composites as well. 3D printing is a rapidly developing and cost optimized form of rapid prototyping. The 3D printer prints the CAD design layer by layer forming a real object. 3D printing process is derived from inkjet desktop printers in which multiple deposit jets and the printing material, layer by layer derived from the CAD 3D data.

3D printing significantly challenges mass production processes in the future. This type of printing is predicted to influence industries, like automotive, research and development team, medical, education, consumer products industries and various businesses.

KEYWORDS: 3D printing, Rapid Prototyping, ABS, PLA

INTRODUCTION

3D-

printing or additive manufacturing is the construction of a three-dimensional object from a CAD model or a digital 3D model. It can be done in a variety of processes in which material is deposited, joined or solidified under computer control, with material being added together (such as plastics, liquids or powder grains being fused), typically layer by layer.

In the 1980s, 3D printing techniques were considered suitable only for the production of functional or aesthetic prototypes, and a more appropriate term for it at the time was rapid prototyping.^[3] As of 2019, the precision, repeatability, and material range of 3D printing have increased to the point that some 3D printing processes are considered viable as an industrial-production technology, whereby the term additive manufacturing can be used synonymously with 3D printing. One of the key advantages of 3D printing is the ability to produce very complex shapes or geometries that would be otherwise impossible to construct by hand, including hollow parts or parts with internal truss structures to reduce weight. Fused deposition modeling (FDM), which uses a continuous filament of a thermoplastic material, is the most common 3D printing process

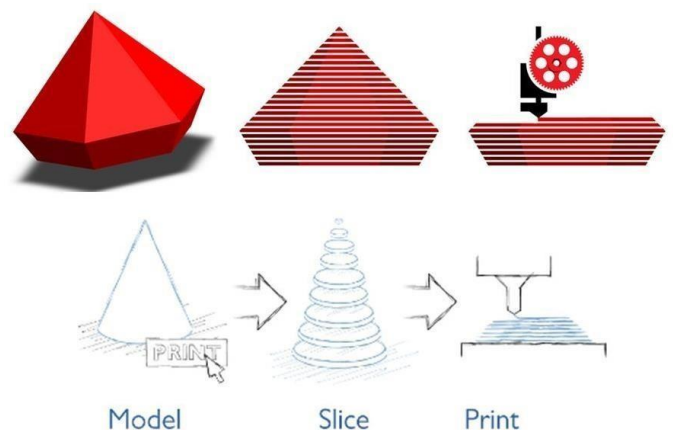


Fig : Process of 3D Printing

EXPERIMENT AND METHODOLOGY:

Our objective is to study, design and fabrication of a 3d printer. We studied the history, different printing methods and overview of the past research in the previous chapter. This chapter includes design and fabrication of the same mentioned earlier. First we ordered the whole tool-kit including all the parts and components those are used to manufacture a 3d printer. It took a while

EVALUATION OF METAL FOAM IN BATTERY THERMAL MANAGEMENT SYSTEM

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ABSTRACT

Batteries, especially lithium-ion ones, are the main energy sources of electric vehicles. In order to remove the generated heat in these batteries, passive cooling systems such as those employing phase change materials (PCMs) can be used, without any energy consumption. The main drawback of conventional PCMs is their low thermal conductivity, which can be solved by adding conductive additives to pure PCM. In this study, nine passive battery thermal management systems (BTMSs) based on paraffin wax as pure PCM, and copper foam as conductive additive, but with nine different amounts (from 1 to 9 volume%), are numerically simulated to reveal the role of additive content. The results show that the addition of metal foam greatly influences the time evolution of PCM liquid fraction. It is turned out that the addition of 6 volume% copper foam can create the best cooling effect and preserves the cell in the desired temperature range. In fact, adding more than this value can significantly reduce the heat absorption capacity of BTMS and makes the BTMS unreliable.

Keywords: Conjugate heat transfer · Porous media · Battery thermal management system (BTMS) · Li-ion battery · Phase change materials (PCMs)

INTRODUCTION

ELECTRIC VEHICLES (EV)

Today, according to the reduction in fossil fuel resources and also dangerous contaminants coming out of conventional vehicles, human is forced to design and utilize different types of electric vehicles (EVs). Lithium-ion (Li-ion) batteries are the main sources of energy in the mentioned vehicles due to their high power and energy density, long lifecycle and low rate of self-discharge. However, the Li-ion batteries suffer from high level of heat generation while they work at high discharge rates. The excess amount of generated heat should be removed from the battery cells, otherwise it may cause thermal runaways and safety concerns. In order to remove excess generated heat, researchers have looked for effective ways to develop battery thermal management systems (BTMSs) with higher performance.

An electric vehicle (EV) is one that operates on an electric motor, instead of an internal-combustion engine that generates power by burning a mix of fuel and gases. Therefore, such a vehicle is seen as a possible replacement for current-generation automobile, in order to address the issue of rising pollution, global warming, depleting natural resources, etc



Electric Vehicle (EV)

BATTERY THERMAL MANAGEMENT SYSTEM (BTMS)

The Battery Thermal Management System (BTMS) is the device responsible for managing/dissipating the heat generated during the electrochemical processes occurring in cells, allowing the battery to operate safely and efficiently. The BTMS's (Battery Thermal Management System) objective is to prevent accelerated battery deterioration by managing the heat generated by its components so that it operates continuously under optimum temperature conditions. The BTMS is the battery-pack component responsible for ensuring that the cells operate under the optimum temperature conditions specified by the manufacturer.

Experimental Investigation of Phase Change Material on Battery Thermal Management System

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ABSTRACT

Electric vehicles (EV) develop fast and have become popular due to their zero emission and high tank-to-wheels efficiency. However, some factors limit the development of the electric vehicle, especially performance, cost, lifetime and safety of the battery. Therefore, the management of batteries is necessary in order to reach the maximum performance while operating at various conditions. The battery thermal management system (BTMS) plays a vital role in the control of the battery thermal behavior. In this study, the paraffin (PCM) was prepared and characterized. And then the PCM have been applied in the LiCoO₂ battery module for experimental research. Different discharge rate and pulse experiments were carried out at various working conditions, including room temperatures (25C) and high temperature (350c). Testing result indicated that PCM cooling system can control the peak temperature under 40 I. The results exhibit that PCM cooling in battery thermal management has promising advantages over traditional air cooling.

Keywords: Aluminum, Battery Thermal Management System, paraffin, PCM.

INTRODUCTION

As is well known, the electric vehicle is a very important alternative transportation and gains more and more attention due to the shortage of conventional fossil energy. Because of its renewable property, zero pollution, zero emission and high energy utilization, electric vehicle has become a hot research topic in the automotive industry. For that reason, the United States, China, Japan and Europe have proposed their own development plans for renewable energy vehicles. In the United States, Obama firstly proposed a commitment to reach 1 million electric vehicles in 2015 in the state of the Union address in 2011. In 2012, China released the development plan of renewable energy automotive industry and clearly stated that by 2015 and 2020, the total sales volume of all-electric vehicles and plug-in hybrid vehicles should exceed 500,000 and 5,000,000 respectively. In 2010, the Japanese government announced the "new generation of automotive strategy", which planned to by 2020 develop electric vehicles and hybrid electric "new generation vehicle" to the level that total sales accounted for about 50% of its new vehicle sales.

European major automobile country Germany, in its "national electric vehicle development plan", proposed that the total number of electric vehicles in Germany would reach 1 million by 2020. The efforts made by all countries in the world for the development of electric vehicles have led to the continuous progress of electric vehicle technology. Electric cars include three types: plug-in hybrid vehicles, pure electric vehicles, and fuel cell cars. The electric vehicle contains three main technologies: battery and its management system, motor and its controller, vehicle control technology.

The main research of battery technology is concentrated on positive and negative materials, membrane materials, additives in electrolyte, and management system of battery pack. The battery management system also includes electrical management, thermal management and safety management.

To avoid the adverse impacts of high-temperature conditions, battery systems designed for vehicle applications typically employ convective thermal management in the form of air or liquid cooling. Thermal management system designs can vary widely in complexity and in cost.

On the low end of complexity, the management system might use a small fan to circulate ambient air from the environment through the battery chamber. This approach is fairly simple and inexpensive to implement, but it might not manage heat effectively enough to permit high-rate battery use in all conditions or to prevent a sizable temperature



Design and Fabrication of Power Generation Through Smart Speed Breakers

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ABSTRACT

It is very significant to design pollution free energy generation system. Speed breaker Power Generator (SBPG) is the most emerging technique which produces electrical power with minimum input.

- ❖ *An experimental study to generate the electricity by SBPG is described in this paper.*
 - ❖ *In this system, a Rack and pinion mechanism is used for the production of electricity.*
 - ❖ *The rotary motion is transferred to DC generator which generates DC power which is stored in batteries same as in solar technology.*
 - ❖ *The generated power can be used for the domestic purpose or commercially, which are present near the speed breaker.*
- We can tap the energy generated and produce power by using the speed breaker as power generating unit.*

It is observed that the generated voltage is directly proportional to the angular speed of the generator gear. Further, it is found that the total power generated from the rotational induction generators is 691 kW while that from the translational induction generators is 8.2922 kW per day on 12-hour basis.

One such example of producing power in order to provide energy for a smaller area / scale is from speed breakers cheapest and new source of energy is obtained by the conversion of one form of energy into other. The renewable sources of energy become more popular because of nonpolluting and easily available from the nature. The number of vehicles passing over the speed breaker on the road is increasing day by day. Such speed breakers are designed for heavy vehicles, thus increasing input torque and ultimately increasing the power as output. There are many suitable and compact mechanisms to enhance efficiency. The generated power can be used for the lamps near the speed breakers and this will be a great boon for the rural villages too. In this paper it is mainly focused on the working of the newly developed rack and ratchet (pinion) mechanism which is used to develop the power from speed breakers, its practical implementation.

It generates about 43 watts from one push of 65 kg weight. which can convert into electric energy by generator and later stores in batteries. In this particular study gear, rack and pinion were used for fabrication of the experimental setup. Contact stresses of rack and spur gear were analyzed under static loading and finite element analysis

KEYWORDS: Speed Breaker, Kinetic Energy, Rotational induction, Boost converter, renewable energy, Rack and pinion mechanism, Finite element analysis, Generator, Passenger Car.



Design and Fabrication of 360 Degree Flexible Drilling Machine

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Article Info

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ABSTRACT

Drilling is a cutting and material removal process in which holes are made with the help of a drill bit, often multi-point cutting tool. Drilling process involves, the drill bit to rotate at high rpm (revolutions per minute) against the surface of the workpiece. Thus, the unwanted part will be drilled, and the material will be drawn from the hole in the form of chips along the shank. Therefore, Drilling machine is one of the machines which is very important and is the heart of an industry. The purpose of our project is to make the drilling machine to rotate flexibly in 360 degrees to make it more convenient. The machine is compact and by using this machine, total cycle time will be reduced and also, once the workpiece is clamped on the base plate, there is no need to move the workpiece to different locations for the purpose of drilling, it minimizes the number of machines required and human fatigue is also minimized. With the contrast of this machine, we can drill in any direction at any angle with minimized human effort. The machine is mounted on a flat surface which is supported by legs. In this drilling machine we have used rack and pinion mechanism to move the drill in different angles, so the machine can work in less space with efficiency. Multiple operations can be done by changing the tool in the tool holder. This machine can also be used in automation.

INTRODUCTION

360-degree flexible drilling machine is a type of drilling machine which can drill in 360-degree angle with accuracy and precision in circular cross-section. We have chosen this project as the drilling machine is the heart of any industry. It is very essential and plays a crucial role in an industry. Drilling is a cutting process in which it uses a drill bit usually multi point cutting tool to cut a hole of circular cross-section in solid materials. The drill bit cuts a hole with its sharp cutting edges and rotary motion and as the drill bit fed into the surface of the workpiece, hole will be cut. The drill bit

head makes the drill bit to rotate at hundreds to thousands of rotations per minute (revolutions per minute) which makes cutting edges of the drill bit to remove the unwanted material from the workpiece along the shank. With these high-speed revolutions of the drill bit, it can cut almost any material with accuracy and precision except for rocks. In rock drilling even these high speeds and sharp cutting edges cannot make a hole just with the drill bit and the speed. Therefore, we use a hammer, the hole usually made in rock drilling by hammering the drill bit into the hole by quick short movements and the hammering action can be

Design of Water Heater cum Water Cooler Using Refrigeration System

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ABSTRACT

The purpose of this study is to use water cooler and water heater to improve the convenience of the user so that they can use the water cooler and mobile water heater properly and comfortably. This study focuses on how refrigeration and water heaters use thermoelectric pads as a cooling and heating medium. Peltier works when the voltage is flowing from the power bank. The temperature difference on the surface of the processor allows the heat to occur at a fast rate. Arduinouno is used as a voltage regulator and temperature sensor to improve product performance. concept designs are designed, created and evaluated. The final prototype will include some markers that will be used as temperature readings by cooling and heating. Based on the results shown, the prototype can achieve the desired result with optimized energy consumption. When the temperature supplier produces a good temperature, the amount of water temperature will rise and the heat in the water will reach thermal equilibrium until the cold and hot temperatures reach a better minimum. Therefore, the temperatures in the cold and hot areas are more efficient in achieving thermal equilibrium in rising water.

I. INTRODUCTION

REFRIGERATION SYSTEM

The mechanism used for lowering or producing low temp. in a body or a space, whose temp is already below the temp. Of its surrounding, is called the refrigeration system. Here the heat is being generally pumped from low level to the higher one & is rejected at high temperature.

Refrigeration

The term refrigeration may be defined as the process of removing heat from a substance under controlled conditions. It also includes the process of reducing heat & maintaining the temp. of a body below the general temp. of its

surroundings. In other words, the refrigeration means a continued extraction of heat from a body whose temp is already below the temp of its surroundings.

Refrigerator & Refrigerant

A refrigerator is a reversed heat engine or a heat pump which takes out heat from a cold body & delivers it to a hot body. The refrigerant is a heat carrying medium which during their cycle in a refrigeration system absorbs heat from a low temp. system & delivers it to a higher temp system.

Refrigeration Cycle

In refrigeration system the heat is being generally pumped from low level to higher one & rejected at that temp. This rejection of heat from low level to higher level of temp can only be performed with the help of external work according to second law of thermodynamics. The total amounts of heat being rejected to the outside body consist of two parts:

- The heat extracted from the body to be cooled.
- The heat equivalent to the mechanical work required for extracting it.

A refrigerator is a reverse heat engine run in the reverse direction by means of external aid.

Every type of refrigeration system used for producing cold must have the following four basic units:

- Low temp thermal sink to which the heat is rejected for cooling the space.
- Means of extracting the heat energy from the sink, raising its level of temp before delivering it to heat receiver.
- A receiver is a storage to which the heat is transferred from the high temp., high pressure refrigerant.
- Means of reducing the pressure & temp of the refrigerant before it returns to the sink.

The processes of the cycle are evaporation, compression, condensation & expansion.

By reversing the heat engine cycle completely & by changing the working agent, a refrigeration cycle is

DESIGN AND THERMAL ANALYSIS OF THERMOELECTRIC BATTERY FOR ENERGY PRODUCTION

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ABSTRACT

Currently humans are facing delicate issues, similar as adding power costs, environmental pollution and global warming. In order to reduce their consequences, scientists are concentrating on perfecting power creators concentrated on energy harvesting. Creators (TEGs) have demonstrated their capacity to transfigure thermal energy directly into electric power through the Seebeck effect. In this paper considered different types of shapes similar as blockish- leg, trapezoidal-leg, Y- leg, I- leg and X-leg, for P- N- Module all grounded on their separate shape structures along different top and nethermost contact as magnesium alloy, copper alloy, aluminum alloy all grounded on their separate thermal parcels to Optimizing the module with respect to input parameters for maximum affair parameters like current viscosity, voltage flux, temperature distribution, and remaining affair parameters using Ansys- 21 software

Keywords: Different shaped legs, different top and bottom contact plate materials like magnesium, copper and aluminium alloy, Ansys-21.

I. INTRODUCTION

The concept of thermo electricity can be classified into 2 parts. Thermo electric Coolers (TEC) and Thermo electric Generators (TEG). In order to run a TEC, a certain amount of current has to be input along with maintaining a temperature difference which gives a cooling power and the coefficient of performance of the device can then be measured. However, in a TEG, a load resistance is input along with maintaining a temperature difference and electricity is thus generated from these conditions.

THE SEEBECK EFFECT

when there is a temperature difference in a thermo electric material, an electric current is created due to movement of holes and electrons in the semiconductor materials the effect that causes this behavior is called the seebeck effect.

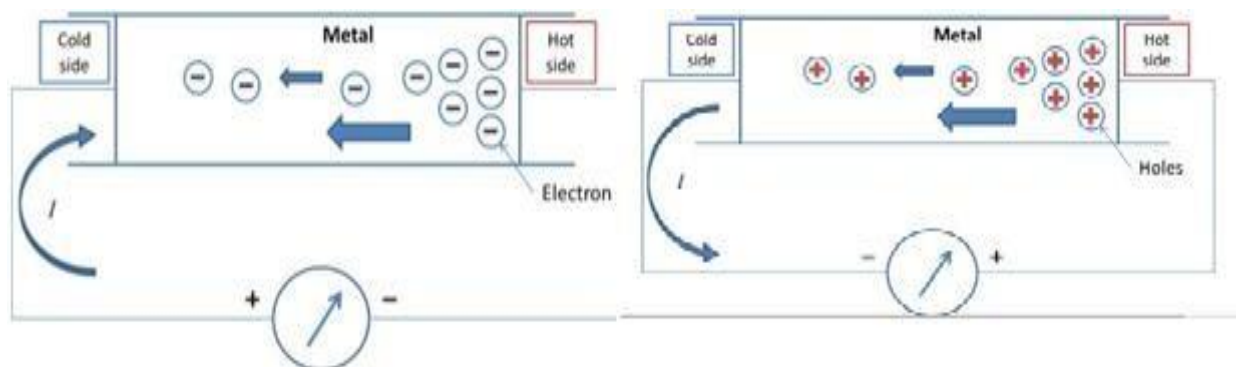


Figure1.1.The movement of (a) holes (b)electrons in the Seebeck Effect

Mathematical relation

$$V = \alpha \Delta T$$

1.1

Application Design of an Integrated Outdoor Air Quality Monitoring Device Based on Solar Power

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Abstract

Pollution has rocked the world with skyrocketing pollution levels. Though the long-term solution to the pollution problem lies in finding and minimizing pollution sources, we need to bring the current pollution levels under control by the time. The best way of controlling pollution is by using air purifiers. But regular indoor air purifiers are small low power devices that don't possess enough purifying capability needed for outdoor spaces. Along with this there is also an issue of power supply in outdoor machines.

So here we design a heavy-duty outdoor air purifier that is made for outdoor purification along and powered by solar panels so it is energy independent. Our solar air purifier consists of a heavy-duty suction fan that pulls air from the bottom of the purifier through a layer of HEPA and Carbon filters for elimination of PM 10 PM 2.5 pollutants as well as gases.

Keywords: OUTDOOR SOLAR AIR PURIFIER, HEPA AIR FILTER, SOLAR PANEL.

1. Introduction

As we know that air pollution level in cities is very high. Most of pollution comes as by-product from vehicle and construction of buildings; these are in form of particulate matter which are like methane, carbon dioxide, dust particulate etc. These create a lot of health problems like respiratory illness, decreased lung functions, development of diseases like asthma etc. Larger dust particles are major particulate among these and if its air quality value is down to minimum then air has very improved quality in which all type of living things can breathe easily. Although there are many types of air purifier that are available in market but none of them are sufficient enough to deliver its working efficiency in public places like bus stand, near hospitals, traffic signals etc. Many institutes are also not able to afford these because of high cost and installation cost. Government organizations have very low budget for air purifier like extra expenditure. So, it is advisable to develop such air purifier which can cost less and are highly efficient. So, we are making solar powered air purifier, which runs on solar energy without use of filters and also works for longer duration than others. It uses component like solar panel, fan, converter, pump, etc.

-Design and Fabrication of Emergency Braking System

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ABSTRACT

The general public, policymakers and the automobile industry have developed a growing amount of interest in automotive safety. It is more than explained by the figures on road collisions, where around 1 a year. Thanks to road traffic collisions 2 million people die. This paper introduces a cost-effective crash warning system concept for low-budget cars. Rear-end crashes are typical crash situations, and driver fatigue is a major cause of such incidents and therefore does not respond on time. No security program is a substitution for the most critical safety device of any driver's car. Many vehicles manufacture now use revolutionary technology for a day to help warn drivers to stop crashes and reduce possible impact speed when a collision cannot be stopped. Another such feature is Collision Warning with Automatic Braking where the area in front of the car is constantly tracked with the aid of the long-range sensor and driver is alert in the case of a collision and with the brake assist for collisions with other cars, both driving and stationary. Additionally, if the driver fails to respond given the warning and the potential collision is considered inevitable; brakes are automatically applied to stop the vehicle. This helps to reduce the level of effect and therefore the chance of repercussions. Finally, it was discussed how, using traffic incident data, the utility of these programs can be measured from the real- life safety viewpoint.

Keywords: Crash, Arduino Ultrasonic System, Automatic Braking system

INTRODUCTION

The Automatic Braking Collision Warning system is a mix of many innovations. Over the years, vehicle safety has acquired a growing attention from the general public, governments and the automobile industry. Increasing demand from the general population, governments and the automotive market. An effective means of making ongoing progress in the development of safety is a working cycle focused on real-world scenarios and input on the production of this knowledge. This working approach was found to be very successful for the production of passive protection. This research extends this cycle of working towards the production of modern active protection systems. Strong safety programs require a broader field of research and success targets, thereby extending to incident of injuries next to injury defence and adversary vehicle next to host car. The aim of this paper is to address some of the latest innovations in active protection and put them in perspective. Using blinking LED and LCD monitor, the identification of collisions is achieved by using the Ultrasonic sensor and the Stop signal. Braking is achieved by means of a servo motor attached to a parking brake lever to ensure maximum braking power and minimum braking time. Electromechanical actuation by means of mechanical actuator which makes the action extremely fast, thus ensuring safety braking. Prime mover control is cutoff by means of a relay switch to reduce power wastage and split wear. All these devices are operated using Arduino Super 2560 which is a programmed microcontroller to perform the specified function.

Overall efficiency in the improvement of an industrial boiler using COAL ACTIVATOR

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Abstract

The main objective of this project is to find out the boiler capacity and its development. The thermal industry is considered to be the major source of conventional energy in India. The chemical energy of coal is converted into electricity in a thermal power plant. It is now the most in demand industry due to high energy demand. The boiler is a very important part of the power plant. Running the plant with maximum result we need high boiler efficiency. Calculating boiler efficiency as one of the most important types of performance measurement in any power plant. For calculation of Boiler efficiency basically we use Direct and Indirect method. It is a measure of how effectively chemical energy in fuel is converted into heat energy in steam going to the turbine. We also improve boiler efficiency by using coal activator.

The art of converting plastics into useful fuels was scaled up a few decades ago, but this side is far less likely. Plastic contains most of the organic polymers made up of carbon and other elements. Various processes such as gasification and pyrolysis are used to convert plastics into smaller hydrocarbon units such as naphtha. This is named as a "COAL ACTIVATOR". This paper aims to provide the best options that will help reduce fuel (Coal) prices in the future.

Keywords: Boiler, Boiler Efficiency, Boiler Losses, Performance, Coal Activator, Direct Method and Indirect Method.

Introduction

Saving energy may be the one of most interested themes and then one of the most important subjects for boiler. According to bureau of energy efficiency "thermal efficiency of boiler is defined as the percentage of heat input that is effectively utilized to generate steam." It is also defined as "Boiler efficiency is a ratio between the energy supplied to the boiler capacity and the energy received from the boiler." It is expressed in percentage. And the boiler fuel (coal) is mixed with coal activator to improve the efficiency.

Companies around the world and people started producing fuel from waste plastic. Only 8% of waste plastic is recycled in the U.S., in 15% Western Europe, and very few in developing countries, this recycling of plastic keeps it vast the amount of plastic from landfills and from the oceans. Over 500 billion pounds of new plastic made every year and almost 33% of it is single use and thrown. Since less plastic is recycled, we need it reframe plastic waste versus landfill as a less used resource destination. According to the United Nations Environment Program, global plastic consumption has gone up from 5.5 Million tons in the 1950s and 110 million tons in 2009. Due to technical limitations or inconvenience of recycling, only a portion of that material will reappear in the new plastic products. This leads to extra-normal amounts dumped in landfills for thousands of years. Pacific ocean is the largest landfall in the world: The Great Pacific Garbage Patch.

Department of Plastics The American Chemical Council asked the Earth Institute Earth Engineering Center to explore recovery paths the energy inherent in non-recycled plastics. As a

AA7xxx alloy in order to reduce the grain size of with addition of AA7xxx+0.5% SC; Study their Microstructure, Mechanical properties, Thermal properties and Stress Corrosion cracking behaviour

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Abstract

Purpose- In order to reduce the grain size with addition AA-7xxx+Sc alloy, study their mechanical properties, microstructure and corrosion behaviour of AA-7xxx with AA-7xxx + wt% (0.5Sc) alloys. Precipitation hardening of above conditions was investigated.

Design/methodology/approach- Precipitates at different age-hardening conditions were measured of nano scale precipitates MgZn₂, Al₂Cu and Al₃Sc. The precipitation hardening behaviour of AA-7xxx+0.5 wt.% Sc alloys are studied on the basis of optical microscopy, electron microscopy (SEM & TEM), XRD observations, mechanical properties and electrochemical analysis.

Findings- AA 7xxx and AA-7xxx+0.5 wt.% Sc alloys were developed casting method and comparing mechanical properties, microstructure and stress corrosion cracking behaviour of using 3% NaCl solution medium to understand the corrosion behaviour of alloy such as AA 7xxx and AA-7xxx+0.5 wt.% Sc alloy, AA-7xxx+0.5 wt.% Sc precipitation hardened (T6) alloy.

Originality/value- Hardness, mechanical properties and Stress corrosion cracking behaviour of AA-7xxx with AA-7xxx + wt% (0.5Sc) alloys and understand the corrosion behaviour of alloy such as AA 7xxx and AA-7xxx+0.5 wt.% Sc alloy, AA-7xxx+0.5 wt.% Sc precipitation hardened (T6) alloy and potentiodynamic polarization (PDP) curves.

Keywords: AA7xxx alloys, Stress corrosion cracking, Precipitation hardening, Transmission electron microscopy (TEM), AA-7XXX+0.5%Sc.

Introduction

Aluminium alloys are prominent materials like aerospace, marine, naval and auto mobile applications. Ultra-fine grained (UFG) materials possess superior mechanical properties which have attracted the scientific community in the past few decades. These structured materials offer a significant improvement in strength without compromising ductility and toughness. In specific, AA7xxx series alloys are most recommended light weight aluminium alloy for aerospace applications due to their high specific strength, resistance to various corrosive media, etc. Proper selection of alloying additions and thermo-mechanical processing will be considered as key strengthening factors which facilitate the formation of the desirable compounds and refining

Evaluation of Thermal Properties of a Plastic Gears Composed of Sugar Bagasse Reinforced with Polyester/ Graphene Blends

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Abstract

Currently, bagasse sugarcane, a waste product of the sugar industry, is mainly burned as fuel in sugar mill boilers. The low cost, low density and acceptable mechanical properties of bagasse fibre make it an ideal candidate to be considered for value-added applications such as reinforcement in plastic composites. In this by varying the composition of bagasse sugarcane with graphene as the filler material five specimens are prepared. The Structural deformation, bending stress and strain of gears with different materials are analyzed through ANSYS software. The heat flow rate on the surface of the gear tooth is analyzed with the help of CFD software under dry and wet run condition. The performance of the gears under various speeds and torques are observed in this work.

Keywords: Sugarcane bagasse, Graphene, Ansys, CFD, Heat flow rate, tooth Surface.

1. Introduction

Now-a-days natural fibers such as banana, pineapple, and flax fiber composite materials are replacing the glass and carbon fibers owing to their easy availability and cost. Natural fibers may play an important role in developing biodegradable composites to resolve the current ecological and environmental problems. Natural fibers are lighter and cheaper, but they have low mechanical properties than glass fibers. By use of hybrid fibers may solve this issue. Most of the studies on natural fibers are concerned with single reinforcement. The addition of natural fibers to the glass fiber can make the composite hybrid which is comparatively cheaper and easy to use. Natural fibers are chosen as reinforcement because they can reduce the tool wear when processing, Respiratory irritation and serves as alternatives for artificial fiber composites in the increasing global energy crisis and ecological risks. A fiber reinforced polymer is a composite material consisting of a polymer matrix embedded with high strength fibers, such as glass, aramid and carbon. The major advantages of composite materials are that they have a high ratio of stiffness to weight and strength to weight. A principal advantage of composite materials lies in the ability of the designer to tailor the material properties to the application.

2. Literature Review

Barnasree, Kumar, and Bhowmik et. al. [1] were studied wood dust particle reinforced in epoxy based composite for analysis of mechanical behavior. The sundy wood dust particle used as reinforcement and LY 556 epoxy for resin. The six different percentage of filler particle used in study. Tensile and flexural test were carried out using UTM and sample size based on ASTM Standard. The different design parameters like as filler content and speed for loading with tensile and flexural strength using GRA were optimized. Optimization by GRA has the advantage of selecting best and worst options. GRG shows that test run number 13 is the best suited and test run number 3 is the least important. Epoxy composite with 10 filler contents (wt%) at corresponding speed of 1 mm/min shows best performance and on the other hand with 0 filler content (wt%) at the speed of 3 mm/min shows the worst performance.

Dry sliding wear behaviour of WC-Co coating on Ti6Al4V using Thermal Spray coating technique

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Abstract

The titanium alloys are extensively using in defence, aerospace, automobile, chemical plants and biomedical applications due to their very high strength and lightweight properties. The most commonly used titanium alloy is the two phase Ti6Al4V. But, it has poor wear and corrosion resistance when exposed to different environment conditions. In this work, surface coatings were applied on Ti6Al4V substrate using high velocity oxy fuel (HVOF) to improve wear characteristics. The ceramic coating (WC-Co) were deposited on Ti6Al4V substrate with different thicknesses 300µm, 400µm and 500µm.

In the present investigation, hardness of both coated specimens and substrate were found by conducting Vickers hardness test. The cross sectional and surface morphology of substrate and coated system with varying thickness were made using SEM.

Pin-on-disc tests are performed for evaluating sliding wear behaviour of substrate and coated system where the counter disc was made of chrome steel. Wear test was carried out at different sliding distances of 1000m, 2000m, 3000m and 4000m at a constant load of 50N and the disc speed was recorded as 600rpm. The mass loss of substrate material and coated system was measured for all the test conditions to demonstrate the wear behaviour. SEM analysis showed the wear behaviour of coated and uncoated samples. The mass loss of the above test conditions expressed that the coating system found to be better improvement in wear resistance of substrate. However, the thicker coat samples (500µm) shows maximum hardness and highest wear resistance.

Keywords: Ti6Al4V, HVOF, WC-Co, wear, hardness.

1.Introduction

Thermal sprayed coatings are used in a wide range of other applications such as the gas turbine, petroleum, chemical, paper/pulp, automotive and manufacturing industries. Metals, carbides and cermets are the most widely used coating materials. The most familiar thermal spray techniques such as high velocity oxy fuel (HVOF) process and detonation spray (DS) or detonation gun (D-gun) spraying system. Selection of coating material, coating technique and the process parameters is an important factor, which influence the tribological performance.

2.Literature Review

Tungsten Carbide with different compositions of Cobalt such as WC-12%Co, WC-20%Co and WC-6%Co coatings were deposited on steel MoCN315M by Y. Wang [1] using D-gun spray and plasma-spray.

Surface coating technology can efficiently and economically improve the properties of metals such as wear resistance, corrosion resistance and high temperature oxidation resistance, etc. [2,3]

M. Magnani et al. [4] fabricated WC-Co coatings on an AA 7050 aluminium alloy using HVOF technology to improve wear resistance. H. Zhang et al. [5] deposited WC-24% Cr₃C₂-6%Ni coatings by HVOF. They reported that the thermal spray cermet coatings improved wear resistance compared to the substrate material.

ENHANCEMENT OF DESIGN AND FABRICATION OF A COMPOSITE AUTOMOBILE BODY BASED ON INTEGRATED STRUCTURE AND ANALYSIS OF GASES USING GAS ANALYSER

*A Project Report submitted in partial fulfillment of the requirements for the award
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JUNE,2022





**A PROJECT REPORT
ON
OPTIMIZATION AND EVALUATION OF MOTOR-BIKE
RIDER HELMET USING COMPOSITE MATERIALS**

Submitted to “JNTUK-KAKINADA” for fulfillment of requirements for
award of degree of

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IN
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IMPACT TEST CONDUCTED ON COMPOSITE HELMET



Fig 4.8 Impact Test is Conducted on the Composite Helmet

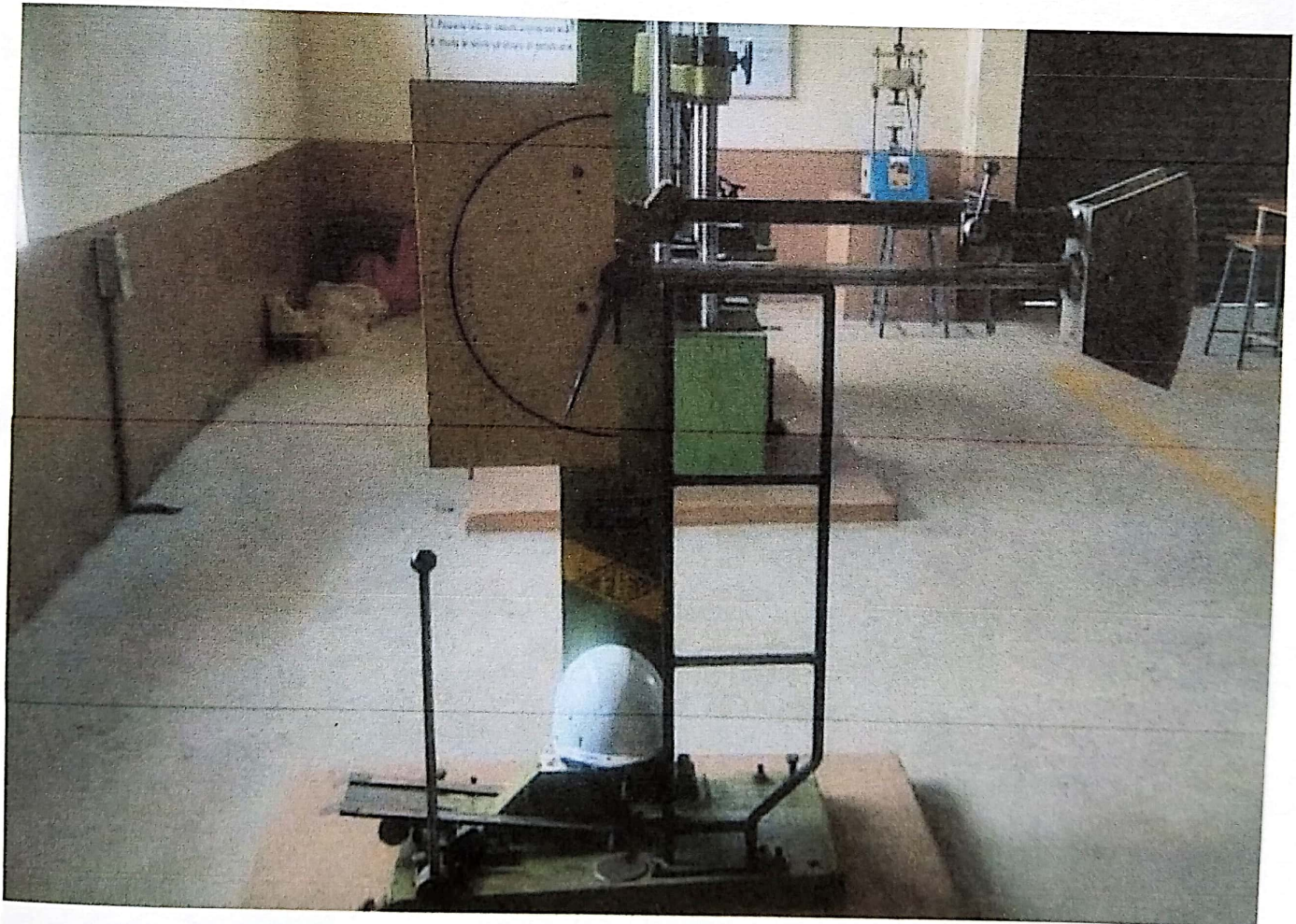


Fig 4.9 Composite Helmet before Impact

**DESIGN AND POWER GENERATION OF ELECTRICAL SPEED
BRAKER**

*A Project Report Submitted In Partial Fulfillment Of The Requirement For
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**BACHELOR OF TECHNOLOGY
IN
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JUNE 2022





EXPERIMENTAL ANALYSIS OF HEAT TRANSFER OF A FIN BY USING COMPRESSED GRAPHITE SHEET

*A Project Report Submitted In Partial Fulfillment Of The Requirement
For The Award Of*

**Bachelor of Technology
in
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June, 2022

INSTITUTE OF TECHNOLOGY DEPARTMENT OF MECHANICAL ENGINEERING HEAT TRANSFER LABORATORY GENERAL INSTRUCTIONS TO STUDENTS

- STUDENT MUST WEAR PROPER EYEWEAR AND MUST CARRY RECORD AND OBSERVATION.
- STUDENT SHOULD SIGNATURE IN THE LOG IN REGISTER WITHOUT FAIL.
- STUDENTS SHOULD COME TO THE LAB WITH THOUGH THEORETICAL KNOWLEDGE.
- STUDENT SHOULD SIGNATURE IN THE LOG IN REGISTER AFTER COMPLETION OF OBSERVATION AND RECORD.
- ALL STUDENTS ARE LIABLE FOR ANY DAMAGE IN THE LAB DUE TO THEIR OWN NEGLIGENCE.
- PLEASE CONSULT THE TECHNICIAN IF YOU ARE NOT AWARE OF HOW TO OPERATE OR USE THE EQUIPMENT.
- DON'T WRITE ANYTHING ON THE TABLES AND CHAIRS.
- DON'T REMOVE OR DISMOUNT ANY PARTS.
- STUDENTS ARE STRICTLY PROHIBITED FROM TAKING OUT ANY STAMP FROM THE LAB OR FROM THE LAB PERMISSION OF LABORATORY INCH.
- NO SMOKING OR DRINKING IN THE LABORATORY.
- NO USE OF MOBILE PHONES IN THE LABORATORY.
- STRICTLY PROHIBITED.

INSTITUTE OF TECHNOLOGY DEPARTMENT OF MECHANICAL ENGINEERING HEAT TRANSFER LABORATORY

DO'S:

- KEEP THE VARIATION TO ZERO VOLTAGE POSITION BEFORE STARTING THE EXPERIMENT.
- INCREASE VOLTAGE SLOWLY.
- KEEP ALL THE ASSEMBLY UNDISTURBED.
- OPERATE SLOWLY WITH HIGH TEMPERATURE INDICATOR SLOWLY.
- OPERATE ALL THE SWITCHES AND CONTROLS GENTLY.
- ALWAYS ENSURE THAT THE TOP OF THE CYLINDER IS PROPERLY COVERED WITH INSULATION BEFORE STARTING THE EXPERIMENT.
- ENSURE STEADY STATE HEAT TRANSFER BEFORE NOTING DOWN THE READINGS.
- REGULAR MAINTENANCE OF MACHINERY IN THE LABORATORY.
- SWITCH OFF THE MACHINERY WHEN NOT IN USE.

DON'T'S:

- DON'T WEAR OPEN TOED SHOES AND SLIPPERS IN THE LAB.
- DON'T INCREASE VOLTAGE ABOVE 10V.
- DON'T MOVE ANY COMPONENTS OR ASSEMBLY UNLESS TRAINED AND APPROVED BY A SENIOR MEMBER OF THE LAB.
- DON'T EAT OR DRINK IN THE LABORATORY.
- DON'T USE MOBILE PHONES FOR SOCIAL MEDIA OR WORK RELATED.
- NEVER WORK IN THE LABORATORY ALONE, ALWAYS HAVE ANOTHER PERSON WITH YOU IN THE LAB.

DEPARTMENT OF MECHANICAL ENGINEERING HEAT TRANSFER

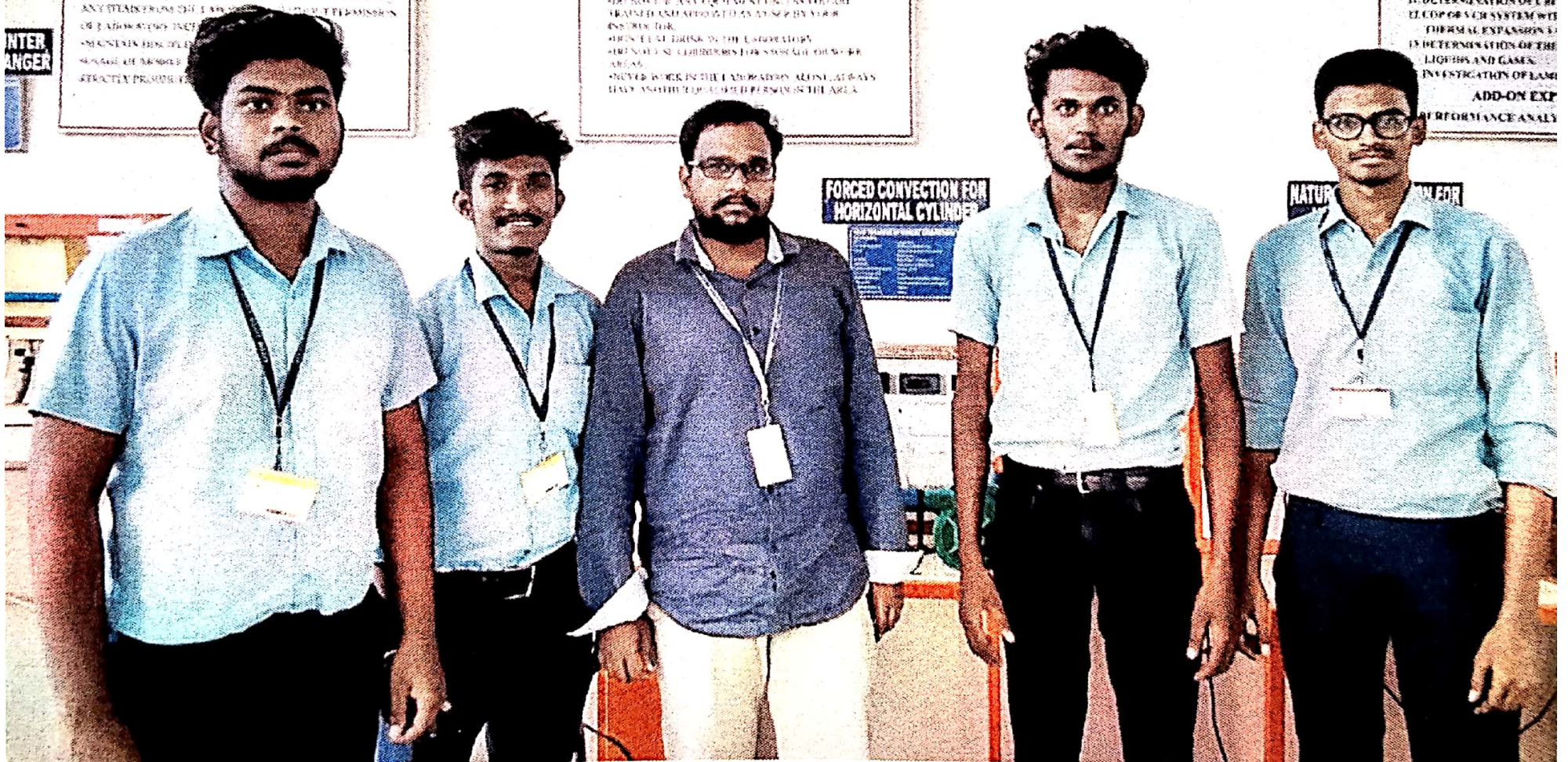
LIST OF EXPERIMENTS

1. DETERMINATION OF COEFFICIENT OF HEAT TRANSFER OF A FLUID THROUGH A LAGGED PIPE.
2. DETERMINATION OF HEAT TRANSFER COEFFICIENT THROUGH A FLUID EXPOSED TO A JET OF AIR.
3. DETERMINATION OF THE HEAT TRANSFER COEFFICIENT OF A METAL ROD.
4. DETERMINATION OF THE HEAT TRANSFER COEFFICIENT OF A FLUID THROUGH A LAGGED PIPE.
5. DETERMINATION OF THE HEAT TRANSFER COEFFICIENT OF A FLUID THROUGH A LAGGED PIPE.
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13. DETERMINATION OF THE HEAT TRANSFER COEFFICIENT OF A FLUID THROUGH A LAGGED PIPE.
14. DETERMINATION OF THE HEAT TRANSFER COEFFICIENT OF A FLUID THROUGH A LAGGED PIPE.
15. DETERMINATION OF THE HEAT TRANSFER COEFFICIENT OF A FLUID THROUGH A LAGGED PIPE.

ADD-ON EXPERIMENTS PERFORMANCE ANALYSIS

FORCED CONVECTION FOR HORIZONTAL CYLINDER

NATURAL CONVECTION FOR HORIZONTAL CYLINDER



**DESIGN AND FABRICATION OF MULTIDIRECTIONAL
ROTATIONAL TROLLEY**

*A Project Report Submitted In Partial Fulfillment Of The Requirement For
The Award Of*

**BACHELOR OF TECHNOLOGY
IN
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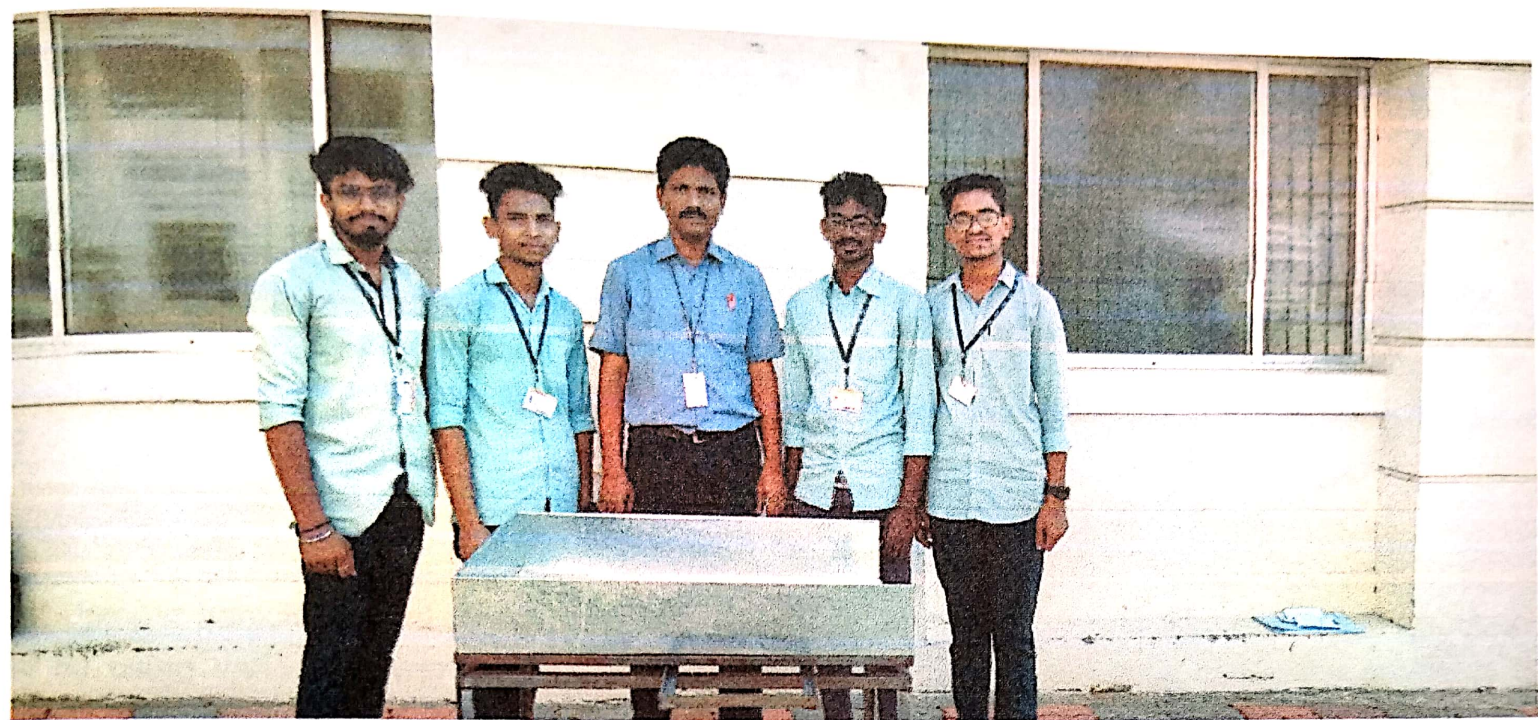
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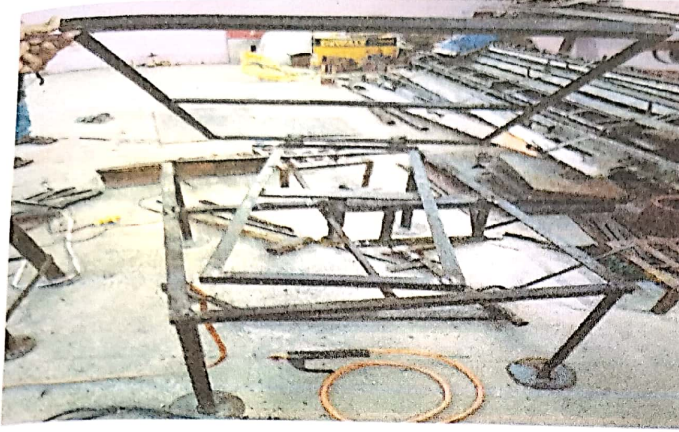


Fig. 4.1(a): Fabrication work of Trolley



Fig 4.1(b): Fabrication collant

FABRICATION AND PERFORMANCE OF THERMO-ELECTRIC REFRIGERATOR

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