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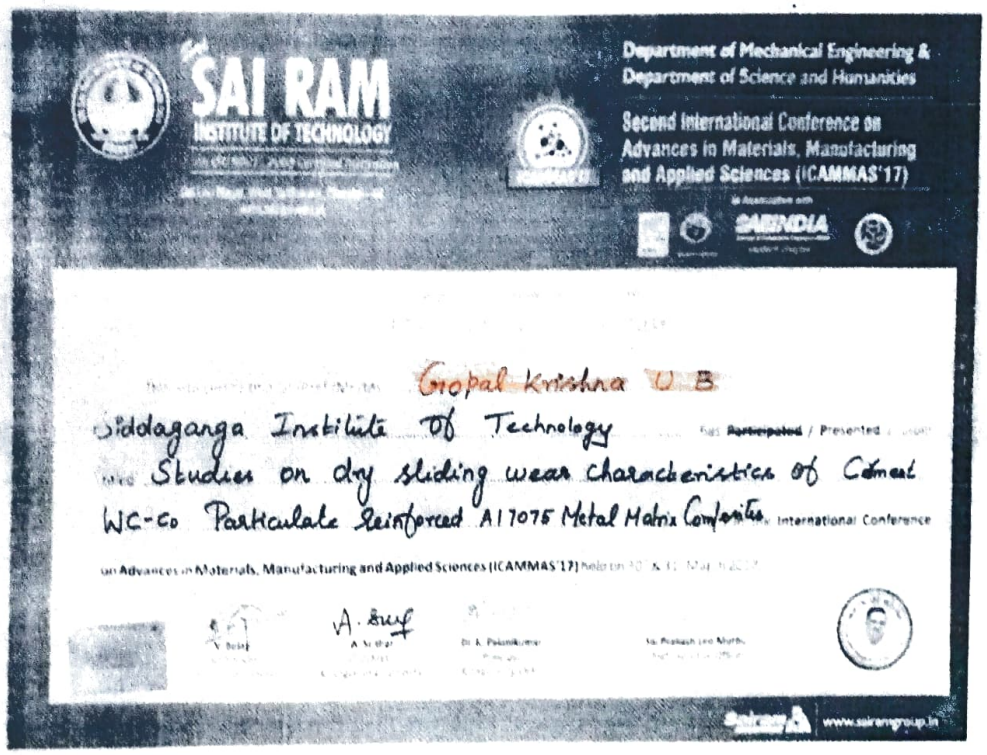

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H03- Study of Vibrational Analysis of Cantilever Beam Made by Natural Hybrid Fibre Composites

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Abstract- The composite materials are well known by their excellent combination of high stiffness and low weight. Their inherent anisotropy allows the designer to tailor the material in order to achieve the desired performance. In the present work, free vibration characteristics of natural hybrid composite beams were investigated. Composite beams were prepared in the compositions of 20:30; 25:25; 30:20 weight % made from banana and sisal reinforced with epoxy resin (50 weight %) with hardener. Compression molding technique was used to fabricate beams. The influence of the fibre composition on the natural frequencies and damping ratios was also investigated. Results were revealed that, composite beams of compositions 20 sisal fibre: 30 banana fibres exhibited least average natural frequency. By increasing the amount of banana in the hybrid composite, natural frequency was reduced with minimum vibration.

Index Terms- Natural hybrid fibre composite, Sisal fibre, banana fibre, vibrational analysis.

I. INTRODUCTION

HYBRID composites are one of the emerging fields in polymer science that are gaining attention for application in various sectors.

Environmental hazards of non-biodegradable products have aroused the need for the researchers to develop new class of environmental friendly fibres. In many applications, natural fibre composites are realistic alternatives to synthetic fibre reinforced composites, since the former fibres possess many comparatively recognitions, such as low density, high specific strength, low cost, biodegradability, renewability, good thermal and acoustic insulating properties [1-5].

The most commonly used plant fibres for polymer reinforcement are sisal, jute, banana, flax, coir, ramie, kenaf, hemp, Palmyra etc.

The main objective of this work is to contribute for a better understanding of the dynamic behavior of components made from natural fibre reinforced composite materials, specifically for the case of composite beams. Using natural fibres with polymer based on renewable resources will allow many environmental issues to be solved. In order to investigate the influence of the stacking sequence on the dynamic behavior of the components, experimental study has been carried out. The results are presented and discussed [2]

II. MATERIALS AND METHODOLOGY

Natural sisal and banana fibre were used. The epoxy (L12) with the hardener (K6) was used as matrix material. The mixing ratio of the resin with the hardener is 10:1 by weight.

a. Methodology

The banana fibres were randomly taken from a bundle. Fibre length, fineness, diameter and weight were measured, respectively. Fibres were cut with 15 mm in length. The linear density value of the fibre was conducted by estimating the mass per unit length. The composite preparation process was performed in the following order using random mixing technique by hand lay-up.

The UTM machine was used for compressing of the mixture. Specimens of suitable dimension of 200mm X 20mm X 3mm were cut using electric saw for dynamic testing. Utmost care was taken to maintain uniformity and homogeneity of the composite Specimens of suitable dimension obtained with different composition. The detailed composition and designation of the composites are mentioned in Table 1.

b. Dynamic analysis test

The dynamic analysis of cantilever beam using virtual instrument is important in which free vibrations are induced and measured in the beam. This vibration data issued to identify the beam's fundamental mode of vibration. Lab VIEW was being used to measure or record the beam vibrations and to analyses the natural frequency graph. Data acquisition (DAQ) card (Deaq-9174) was used to acquire the data and was displayed in the Lab VIEW front panel based on the block diagram. The objective of dynamic analysis is to determine structure response using Lab VIEW and interpret those results to analyses the structure. The Fast Fourier Transform (FFT) and the power spectrum are powerful tools for analyzing and measuring signals from plug-in data acquisition (DAQ) devices. It can measure the frequency components within the signal and original damping ratios can be calculated from the vibration waveform obtained [4]

c. Experiment procedure

1. Cutting of Fibres in To Desired Length

Long fibres of sisal and banana were cut in to smaller length of 15mm. These fibres were weighed in a weighing machine as per the required Wt. % and randomly oriented.

Preparation of laminates (Hand lay-up)

Randomly oriented fibres were mixed thoroughly over a period of 15min and later were mixed with epoxy resin and hardener.

The composite preparation process was performed in the following order using random mixing technique by hand lay-up. First, the Epoxy-L12 resin and the K6 hardener were mixed in the ratio of10:1 by weight as recommended. One half of resin was placed inside the mixing chamber and the fibres

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Effect of Reflow and Isothermal Aging Temperature on Sn-Pb and Pb-free Solder/Substrate Interfacial Regions

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Abstract- In the present work, effect of reflow and isothermal aging temperature on interfacial reactions between Sn–37Pb and Sn–3Ag–0.5Cu solders on copper (Cu) substrates was investigated. Both solders were as-reflowed on Cu substrates at 230°C for 15mins. Further, solder/Cu regions were aged isothermally at 100°C for 24hours. As-reflowed Sn-Pb solder/Cu substrate interfacial region exhibited continuous and layered type of IMC at the interface and this IMC morphology changed to scallop type as isothermally aged. As-reflowed Sn-Ag-Cu solder/Cu samples, showed continuous and needle shaped Cu_6Sn_5 and Ag_3Sn IMCs at the interface. However, in an isothermally aged condition, plate shaped Cu_6Sn_5 and flower shaped Ag_3Sn IMCs were found inside the solder matrix. Scanning electron microscopic study revealed that, thickness of Cu_6Sn_5 IMC was higher in reflowed Sn–Pb /Cu region than Sn–Ag–Cu/Cu region. However, Cu_3Sn IMC was not found at the interface of both solder/Cu systems.

Index Terms- Solder Joint, Reflow, Micro-structures, IMC layer, Isothermal aging.

I. Introduction

Soldering is a low temperature metallurgical joining method using a filler metal known as solder alloy to hold the parts to be joined together [1]. The reliability of solder joints is greatly influenced by the interfacial reaction between the solder and substrate because, during reflow when liquid solder react with the substrate, the intermetallic compounds (IMCs) grow at the interface between solder/substrate [2]. These IMCs provide a strong bond to the solder joints. The formation of a thin IMC layer is vital for good bond ability, while excessive formation weakens the solder joints [3]. However, in microelectronic industry especially in flip chip packaging process, package undergoes repeated reflow process, due to which intermetallic compounds (IMCs) grows rapidly at the solder/substrate interface. Like reflow, thermal aging of solder joints under service conditions greatly vary the growth of IMCs that can strongly influence the life of the soldered joints [4]. However, Investigations on an effect of effect of reflow and thermal ageing on solder joints are scant. The objectives of present work is to investigate the effect of reflow and isothermal aging temperature on evolution of microstructure between Sn–37Pb and Sn–3Ag–0.5Cu (SAC) solder and copper substrate.

II. Experimental, Results and Discussion

A. Materials used in the experiments

Alloys and substrate material used in the current research are mentioned in Table –1.

TABLE I: Alloys and substrate used

Alloys	Substrate
Sn–37Pb and Sn–3Ag–0.5Cu	Copper (Ø12.5× 8mm)
Reflow temperature and Time	230°C, 15minutes
Aged temperature and Time	100 °C, 1440minutes

Copper substrate was chosen for the following reasons

- Excellent heat conductivity and electrical conductivity
- Good corrosion resistance and biofouling resistance
- High thermal, electrical conductivity and melting point
- Non-magnetic, and corrosion resistant

The procured high purity Cu substrates (99.9%) were polished using emery papers of different grade numbers (P200, P300, P500, P1000 and P2000) to get a mirror finish. The polishing was essential for adhering of solder alloy on Cu substrate.

Spherical solder balls (weighing approximately 0.08gm) were prepared using an electronic solder gun from commercially available Sn–37Pb and Sn–3Ag–0.5Cu solder alloy wires (0.7mm thick).

Spherical balls of both the solder alloys were kept on the Cu substrate (Fig 1a) and the solder/ substrate system was kept inside the oven after coating substrate surface with RMA flux (223, Lot 273-11-1). The chamber was heated to a reflowed temperature (above the liquidus of solder alloy) of 230°C for 15 minutes. The reflowed solder/substrate system was removed from the oven and air cooled. Figure 1b shows SAC solder reflowed on Cu substrate.

Both Pb and Pb free solders reflowed on Cu substrate were further subjected to aging. Samples were aged isothermally at temperature of 100°C for 24hours (1440minutes). Figure 1c shows isothermally aged SAC solder bonded to Cu substrate.

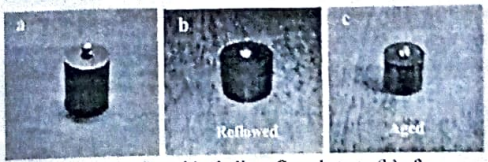

Fig 1: (a) Sn–Ag–Cu solder ball on Cu substrate (b) after reflowed on Cu (c) isothermally aged sample.

B. Interfacial study

For solder/substrate interfacial study, solder drops bonded to the substrate after reflow and aged were sectioned (as shown in Fig 2) along the axis using low speed precision cutter (Isomet low speed saw) and polished using SiC papers of different grit sizes. The final polishing was carried out on rotating velvet disc in which aluminium chloride powder was sprinkled with small amount of water and then etched with 5% Nital

H02- Study of Thermal Resistance on Interface Materials

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Abstract— Thermal Interface Materials (TIMs) play a key role in the thermal management of microelectronics devices by providing a path of low thermal impedance between heat generating devices. TIMs provide mechanical coupling between the silicon device and the heat spreader sink. During device operation, the adhesive joint between the heat generating device and heat spreader sink is subjected to thermal mechanical stresses due to differences in the thermal expansion coefficients of the silicone device and the heat spreader material. The adhesive joint can consequently de laminate from the mating surfaces causing a significant increase in thermal impedance across the thermal interface material. TIMs offers improved thermal performance as well as enhanced reliability. In this present work experimentation carried out for different thickness of brass plates with constant loading conditions to determine the thermal resistance. Thermal resistances obtained from the experimentations concluding that the resistance for lower thickness at loading conditions are less.

Keywords—TIM, Thermal resistances, heat transfer, Thermocouples, surface topography

I. INTRODUCTION

The efficiency of heat transfer from heat source to the heat sprader becomes a true challenge which novel electronics technology needs to manage. Generally commercial electronic devices can generate a large amount of heat. Thus, it means that the heat dissipation technology becomes more and more significant to ensure proper operating of electronic devices. The operation of integrated circuits (IC) at elevated temperature is a major cause of failures in electronic devices and a critical problem in developing more advanced electronic packages [1]. According to Moore's law, the number of transistors that can be placed inexpensively on integrated circuits doubles approximately every two years. The thermal management in such systems is therefore an important area of research [2]. The thermal management can use convection, conduction and radiation to keep devices operating temperature in proper ranges, which ensure high reliability and proper operating parameters.

The thermal interface materials are commonly one of the best choices to meet the thermal issue requirements. The thermal interface materials basic function is to fill micro-sized surface irregularities (i.e. gaps, holes, etc) between two solid materials to improve the conduction of the heat from one material to another by reducing the thermal contact resistance between them. Thermal interface materials include thermal fluids, thermal greases (pastes), resilient thermal conductors, solders (applied in the molten state), and phase change materials (PCMs, which change to the liquid state from the solid state while they are in service) [3].The major challenge in TIM testing is caused by the fact that there is a significant difference between standardized lab test data and application-specific (or in-situ) test results in a given set of application conditions [4-5]. Standardized test methodologies are mandatory because the user has the right to a fair comparison between various TIMs from various vendors

II. WORKING METHODOLOGY

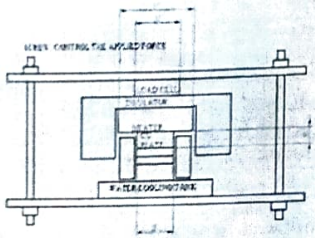

Fig 1. Experimental Setup

The apparatus comprise of three slabs of different materials of same thickness clamped on both sides using bolts and nuts. On one side of the composite wall a heater is fitted as shown in Figure 1.

Thermocouples are fitted at the interface of the plates at different points as to obtain average temperature for each surface. Heat conducted through the composite wall is taken away by circulating water on the outside of the wall whose rate of flow and an increase in temperature can be recorded.

First start the main switch, then by adjusting the dimmer knob give heat input to heater. Take the readings of all thermocouples after attaining the steady state. Make the dimmer knob to 'zero' position and then the main switch off. Repeat the procedure for different heat input.

III. RESULTS AND DISCUSSION

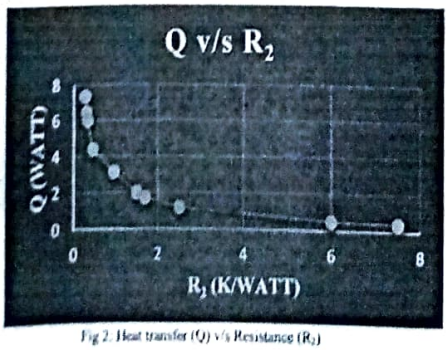

Fig 2. Heat transfer (Q) v/s Resistance (R_2)

Professional Ethics in Students through Yoga

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ABSTRACT

Every individual in the world are born with certain personal ethics and inherit professional ethics from the outside world. But it is up to every human being as to how they inculcate the knowledge and learn from the experiences in their lifespan. Apart from personal ethics, Professional ethics are equally important as far as todays social life is concerned. It was disappointing to realize that many people lack good professional ethics and there have been attempts made to eliminate the indiscipline that results from it. Hence, we have tried to use one of the many theoretically successful methods to curb this problem. As professional ethics can only be inculcated through practice, starting at an early stage would help inculcate more professional ethics in an individual. Since engineering is one of the professional courses, beginning at the college level would result in a well defined individual by the time he/she graduates.

This study basically concentrates on the use of Yoga and meditation that will help an individual clear his mind and understand the various principles they ought to follow in their professional life. Since this is a study on whether yoga would help develop professional ethics, we have used simple meditation techniques which include breathing exercises and postures(asanas) for relieving the agitated minds of entry level engineers.

Keywords: *yoga, professional ethics.*

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INTRODUCTION

As observed in everyday life,[3] a person's character and mindset is always judged based on the moral, humanitarian and personal ethics he/she follows. Moreover, if the person is subject to being educated or working in a professional institution, he/she is also judged based on the professional ethics of that person. Not moving away from the subject, professional ethics of a student is bound to be set right if the student is to live a life without the regret of not following self-conscience.

It is also noticed that students in today's world are greatly affected by the mixed cultures and practices followed by their colleagues and friends. And this involvement has equal number of drawbacks as the benefits of national and international integration.

REASONS FOR LACK OF ETHICS

The reasons for lack of or weak ethics with respect to education can be various aspects that drive the persons mind to execute unacceptable actions.

Few of them are ambiguous situations where a student is forced to go against self-conscience in order to avoid possibilities of failure.

Another reason can be the student's personal background which makes them habitual to maintaining and practicing bad ethics.

Sometimes a student loses track due to improper or insufficient value education and ends up following bad ethics due to curiosity of knowing the result. Students also follow bad professional ethics such as cheating,[1] lying, and seeking shortcuts in obtaining their professional goals.

Not realizing that doing so makes them a prey to insufficient qualities such as loyalty, confidentiality, honesty, fairness and clear judgment.

SOLUTION TO THE PROBLEM

In order to overcome this common indiscipline in the society, many ways have been experimented and practiced that ultimately holds the goal of developing good professional ethics in an individual[2].

The study done here is based on the implementation of yoga for attempting to redirect the mindset of individuals with

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DEVELOPMENT OF ELECTROMAGNETIC ENGINE FOR FUTURE TRANSPORT APPLICATIONS

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ABSTRACT

Trade Has Been Seeing To End Its Dependency On Oil. Moreover Currently The Need For Fuel Has Amplified And In The Near Future, Scarcity Of Fossil Fuels Is Being Expected Due To Their Endlessly Growing Consumption. The Present Work Focusses On The Development Of Electromagnetic Engines As An Alternate For The Existing Fuel Combustion Engines. Various Probabilities Were Carried Out In Developing An Electromagnetic Engine And The Magnetic Flux Produced By The Electromagnet To Give Required Force To The Piston And Power Output Produced By Engine Were Calculated.

KEYWORDS: *Electromagnetic Engine, Magnetic Flux & Existing Fuel*

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Original Article

INTRODUCTION

Since ages the human mankind has invented many new technologies which will help to reduce his effort for his daily needs. One such kind of invention is an "engine". The internal combustion engine is an engine in which the combustion of a fuel occurs with an oxidizer in a combustion chamber that is an integral part of the engine. The main problem with the conventional IC engine is that they need fuel for combustion and when these fuels are burnt there is liberation of large amount of pollutants. Another concern is that people tend to use gasoline propelled vehicles even for short distance travel, although electric vehicles are available in the market for some time but are not that very popular because of high cost and less durability. The growing demand for fuel and the depletion of fuel reserves have made it the need of the hour to use alternate engine system [1].

A need for unique form engine was required, to increase the travel at very cost effective way. Therefore there was urgent requirement to come up with a substitute form of an engine which is completely eco-friendly and easy to maintain. The electromagnetic engine can substitute as an alternative engine. It works completely on battery current, thus controlling the pollution to very large extent. It can be considered as a completely green technology [2,3].

Atul Kumar et.al have described that the electromagnetic engine uses electric power to run which is cleaner and cheaper than fossil fuels. The paper makes use of solenoids which act as magnet when electricity is supplied to them [4].

Vishal AbasahebMasilet. al have described about the working principle of an electromagnetic engine which is different from motor. An engine was constructed using electromagnet and permanent magnet itself asa piston of the engine [5].

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Information and Communication Technology and its Brunt on Learning Objectives

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Abstract: This paper displays a concise synopsis of steps required in appropriation of information and correspondence innovation in instructive associations and its effect on both the instructors and understudies. The components impacting instructors to deject and acknowledge ICT are likewise talked about. The contextual investigations for the usage of ICT and reviews after the execution on the results as far as achieving instructive objectives are likewise highlighted.

***Key words:* Approaches to change, Areas of change, Assessment, Curriculum, Facilities, ICT adoption, ICT integration**

I. INTRODUCTION

Information and communications Technology (ICT) is a thorough expression which stresses on the part of coordinated correspondences [1] and the mix of media communications, PCs and vital undertaking programming, middleware, stockpiling, and varying media frameworks, which encourage clients to passage, store, import, and control data. The fast development in ICT have gotten noteworthy changes the twenty-first century, and also influenced the requests of present day social orders. ICT is ending up plainly continuously more vital in our everyday lives and furthermore in our instructive frameworks. Subsequently, there is a rising interest on instructive establishments to utilize ICT to educate the abilities and learning understudies requirement for the 21st century

Numerous techniques can be taken after for the utilization of ICT in advanced education however every one of these strategies are extraordinary as they are circumstance based and are specifically for that organization. A sorted out structure can be created to permit organizations to think about themselves their improvement in different zones. A foundation may get itself more in one region of the network while being less required in different zones [2]. This rebuilding procedure requires successful reception of advances into existing condition keeping in mind the end goal to furnish learners with information of particular branches of knowledge, to elevate significant learning and to upgrade proficient efficiency [3]. The methodologies are sorted beginning from "rising" approach as the dispatch of selection till the "changing" approach as an objective without bounds of training.

Overall interest in ICT to give schools ICT foundation and offices has been begun by numerous administrations. The insights of ventures by different governments are especially disturbing. For instance in United Kingdom, the administration spending on Teachers' creative utilization of PC in 2008–09 in the UK was £2.5billion, in United States, the consumption on K-12 schools and advanced education organizations was $6 billion and $4.7 billion separately in 2009 and in New Zealand, the legislature spends over $ 410 million consistently on schools ICT foundation .In Ghana, the legislature has contributed a large number of dollars to outfit optional schools with ICT offices. An enormous measure of cash has been spent on equipment, programming, and framework, for example, PC labs, web, and science asset focuses furnished with current ICT offices to bolster educating and learning in science [4].

II. METHODOLOGY

2.1. Nascent Approach

The toddler phases of the ICT can be straightforwardly joined to this approach where in the instructive association starts the procure of electronic gadgets and the related software's. In this stage, the instructors and more elevated amount directors start to survey the potential outcomes and results of including ICT for establishment administration and the educational modules.

In any case, the customary practices took after by the organization, for example, chalkboard educating, giving oral notes to the understudies and the assessment of the specific substance still continues as before. Foundation association gives discrete eras to each subject. Learner's entrance to innovation is through individual teachers. An educational program that expands the fundamental abilities and attention to the employments of ICT helps development to the following methodology.

2.2 Applying

This approach is connected with an establishment in which new comprehension of the commitment of ICT to learning has created. In this stage heads and instruction staff utilize ICT for administration and in the educational programs. Instructors to a great extent command the learning condition. For instance, educator addresses might be supplemented with ICT, for example, Power Point presentations' and word-handled hand-

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Research Paper

PERFORMANCE CHARACTERISTICS OF HONGE OIL, SADINEFISH OIL BLEND WITH DIESEL

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Energy conservation is important for most of the developing countries, including rest of the world. The rapid depletion in world petroleum reserves and uncertainty in petroleum supply due to political and economic reasons, as well as the sharp escalations in the petroleum prices have stimulated the search for alternatives to petroleum fuels. The situation is very grave in developing countries like India which imports 70% of the required fuel, spending 30% of her total foreign exchange earnings on oil imports. Petroleum fuels are being consumed by agriculture and transport sector for which diesel engine happens to be the prime mover. For the developing countries of the world, fuels of bio-origin can provide a feasible solution of the crises. The fuels of bio-origin may be alcohol, vegetable oils, biomass and biogas. Some of these fuels can be used directly while others need to be formulated to bring the relevant properties close to conventional fuels. The power used in the agricultural and transportation sector is essentially based on diesel fuels and it is therefore, essential that alternatives to diesel fuels be developed. Non-edible oils have capability to solve this problem because they are renewable and lead to reduction in environmental pollution. The direct use of non-edible oils as a diesel engine fuel is possible but not preferable because of their extremely higher viscosity. Transesterified non-edible oils are promising alternative fuel for diesel engines. Studies have been carried out on the performance and emission characteristics of Honge oil Methyl Ester and its blends with diesel oil are analyzed in a direct injection CI Engine. The properties of Honge oil Methyl Ester thus obtained are comparable with ASTM bio diesel standards.

Keywords: Biodiesel, Non-edible oils, Transestrification, Honge Oil Methyl Ester (HOME), Sardine fish oil

INTRODUCTION

Diesel engine is a popular prime mover for transportation, agricultural machinery and industries. Diesel fuel islargely consumed by the transportation and agricultural sectors. Import of petroleum products is a major drain on our foreign exchange sources and with growing demand in future

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Design and development of Hybrid seed dryer with airflow inversion and recirculation

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Abstract:

Sun drying is still the most common method used to preserve agricultural products in most tropical and subtropical countries. Some of the problems associated with open-air sun drying can be solved through the use of a solar dryer who comprises of collector, a drying chamber and sometimes a chimney.

Dryers have been developed and used to dry agricultural products in order to improve shelf life. Most of these either use an expensive source of energy such as electricity or a combination of solar energy and some other form of energy. There is spoilage of fruits and other fresh foods that could be preserved using drying techniques in India and other developing countries.

Keywords Hotair, Moisture content, Seed germination, Regeneration.

1. Introduction

Drying of seeds and vegetables is one of the oldest forms of food protection methods known to man and is the most important process for preserving food since it has a great effect on the quality of the dried products. The major goal in drying agricultural products is the reduction of the moisture content to a level which allows safe storage over an extended period. Drying of agricultural products is an energy intensive operation. Solar energy is one of the most promising renewable sources of energy which is freely available in most of the developing countries including India and is considered as an immaculate source of energy. Solar air heaters have been extensively used for meeting low temperature energy requirement such as drying of agricultural produce, space heating and air conditioning and for meeting industrial process heat requirement. Solar dryers are now being increasingly used since they are a better and more energy efficient option available today. Seed with lower moisture content and higher germination rate fetch higher market price. To achieve low moisture content, normally seed are dried at 55–60 °C air temperature; but at these temperatures seed germination level falls. A number of studies have report that the drying air temperature should not be above 40 °C for good seed germination.

To avoid dehumidified air loss to the environment during forced circulation air drying, closed circulation dryers have also been reported developing a dryer for thin-layer drying of long-grain rice and medium-grain rice from initial moisture content of 19.6 % and 17.5 % respectively.

The most important advantage of the solar dryers is that they work on renewable energy and are pollution free. Also, solar dryers can be easily constructed from local materials. It is successfully proved how solar dryer technology is key element to climatic and environmental protection as well as sustainable development.

2. Solar and Electrical Drying

The principle that lies between the design of solar and electrical dryer is that in drying relative and absolute humidity are of great importance. Air can take up moisture, but only up to a limit. This limit is absolute (maximum) humidity, and it is temperature dependent. When air passes over a moist food it will take up moisture until it is virtually fully saturated, that is until absolute humidity has been reached. But, the capacity of the air for taking up the moisture is dependent on its temperature. Higher the temperature, higher will be the absolute humidity and hence larger uptake of moisture. If air is warmed, the amount of moisture in it remains the same, but the relative humidity falls and the air is therefore enabled to take up more moisture from its surrounding. To produce a high-quality product economically, it must be dried fast, but without using excessive heat, which could cause product degradation. Drying time can be shortened by two main procedures. One is to raise the product temperature so that the moisture can be readily vaporized, while at the same time the humid air is constantly being removed. The second is to treat the product to be dried so that the moisture barriers, such as

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Microstructure and mechanical properties of Inconel-625 welded joint developed through microwave hybrid heating

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Abstract

Application of microwave energy for processing of bulk metals is effectively utilized to join Inconel-625 plates through hybrid heating technique using Inconel-625 powder as an interface filler material. Post welding characterization of microwave developed joints through X-ray diffraction shows the development of carbides of niobium and chromium as well as intermetallic phases along with the primary γ-phase face-centered cubic matrix. Microstructural examination reveals the formation of Laves phase along the grain boundaries in the fusion zone. Microwave-induced joints exhibit average microhardness of 245 ± 20 HV and 0.7% porosity in the fusion zone. Average ultimate tensile strength and flexural strength of the developed joints were estimated at 375 and 377 MPa respectively. Average impact toughness of microwave-induced joints is observed to be 18 J.

Keywords

Microwave, Inconel-625, susceptor, tensile strength, impact toughness, flexural test

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Introduction

Inconel-625 is a solid solution nickel-based super alloy strengthened by the addition of chromium, molybdenum, niobium and carbon. Because of its superior properties it plays a crucial role in development of strategic industries where the use of super alloys is obligatory. The alloy finds wide applications in gas turbines, aircraft engines, marine industries and chemical power plants due to its superior properties in terms of strength, corrosion resistance and creep resistance at high temperatures.[1] The alloy is also prominently known for its unique combination of yield strength, tensile strength, fatigue strength, creep strength and excellent weldability.[2]

Fabrication of nickel-based super alloy components generally involves two approaches: first, they can be made as an integrated casting, and second, the parts can be joined to form the final assembly. Components made from nickel-based super alloy when exposed to harsh operating environments such as high temperature, oxidizing and reducing conditions for longer periods give rise to cracks that propagate through the surface irregularities and cause failure of the parts. Consequently, as nickel-based super alloy is very costly, it is often advantageous to repair the damaged parts rather than to replace them with a new one.[3]

Joining of nickel-based super alloys over the years is primarily being carried out by means of gas tungsten arc welding, electron beam welding, laser beam welding, explosion welding, plasma arc welding and friction stir welding.[1,4,5] Conventional fusion welding processes are easily available and more flexible among the existing welding techniques for joining nickel-based alloys. Although these processes are popular, the extreme heat generated through these processes, formation of hot cracks, segregation of Nb and Mo rich phase result in formation of Laves phase and significant change in microstructures of both heat-affected zone and weld zone that lead to inferior mechanical properties and

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