ICAAMME'24

3rd International Conference on "Advances in Automobile, Manufacturing, and Mechanical Engineering"

5th April 2024

CONFERENCE PROCEEDINGS

AUTONOMOUS

ORGANIZED BY

DEPARTMENT OF AUTOMOBILE ENGINEERING

EASWARI ENGINEERING COLLEGE (AUTONOMOUS)

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MESSAGE FROM DIRECTOR

My heartfelt congratulations to the Automobile Engineering team for their pioneering achievements and their successful implementation of innovative ways in comprehending engineering throughout the academic year.

I am delighted to know that the 2nd International Virtual Conference on "ADVANCES IN AUTOMOBILE, MANUFACTURING AND MECHANICAL ENGINEERING (ICAMME '24)" has turned out as an opportunity for the students to showcase their skills as well as their team's performance. Their logical and analytical way of approaching challenges is an aspect to be highly appreciated. I am positive that the magazine to be released will provide a platform for the students to widen their technical knowledge and sharpen their literary strength.

Further, with a piece of guidance, leading them towards the light as every teacher should, I strongly appeal to the students to be steadfast, creative and devoted to the work they desire to achieve. I extend my best wishes for the success of this endeavor.

Best Wishes!

CHAIRMAN

SRM Ramapuram and Trichy campus Campus

MESSAGE FROM COCHAIRMAN

I extend my warm greetings to you for your outstanding efforts in organizing the 2nd International Virtual Conference on "ADVANCES IN AUTOMOBILE, MANUFACTURING AND MECHANICAL ENGINEERING (ICAMME '24)." Your dedication and meticulous planning have provided a remarkable platform for our students to showcase their skills and contribute to the field of Automobile Engineering.

I am delighted to see the successful implementation of innovative approaches and the logical thinking demonstrated by our students under your guidance. The conference and the forthcoming magazine release will undoubtedly serve as valuable resources for expanding their technical knowledge and honing their literary skills.

As we continue to nurture the next generation of engineers, your leadership and commitment play a crucial role. I commend you for your steadfast dedication and encourage you to keep inspiring our students towards excellence in the field.

With my sincerest appreciation and best wishes for your continued success,

Best Wishes!

CO-CHAIRMAN

SRM Ramapuram and Trichy campus Campus

MESSAGE FROM PRINCIPAL

I extend my heartfelt congratulations to the Automobile Engineering team for their pioneering achievements and successful implementation of innovative approaches throughout the academic year. It brings me great delight to learn about the outcomes of the 2nd International Virtual Conference on "ADVANCES IN AUTOMOBILE, MANUFACTURING AND MECHANICAL ENGINEERING (ICAMME '24)" which provided an excellent platform for our students to showcase their skills and team performance.

I commend the students for their logical and analytical approach to challenges, which is truly admirable. Their participation in the conference and the upcoming release of the magazine will undoubtedly contribute to their technical knowledge and literary prowess. As educators, it is our responsibility to guide and inspire students towards excellence. I urge our students to remain steadfast, creative, and devoted to their endeavors. With dedication and perseverance, they can achieve remarkable success.

I extend my best wishes for the continued success of this endeavor and look forward to witnessing the growth and achievements of our students in the field of Automobile Engineering.

Best Wishes!

PRINCIPAL

Easwari Engineering College

MESSAGE FROM THE CONVENER

Greeting to you all! My warmest congratulations to the students and staff members of our department for successfully administering the 2nd International virtual conference on "ADVANCES IN AUTOMOBILE, MANUFACTURING AND MECHANICAL ENGINEERING (ICAAMME'24)" on the 28th of April 2023.

This international conference is a constructive forum for students to showcase and grow their cognizance in the engineering and industrial sector. Topics such as weight reduction using alternate materials and automation have been undergoing research in the automotive industry. I hope this conference succeeds bringing these subjects to light.

Just as design and research are an important factor in creating automobiles, quality is also an equally important subject to be considered in the production field. As Henry Ford once said, "Quality means doing it right when no one is looking". As an Automobile Engineer quality should become part of department work culture for self-improvement and societal improvement.

Once again I extend my appreciation to all the students and faculty members who have put in their best efforts to make this event a great success. I wish you all the very best.

Dr.S.Sathiyamurthy

Professor & Head

INSTITUTION PROFILE

Easwari Engineering College (EEC), a unit of SRM Group of Educational Institutions is functioning under "Valliammai Society". The society was founded by Dr. T. R. Pachamuthu in the year 1981 in order to promote Quality Education by an Academician and Educationist. EEC was established in the academic year 1996-1997 with the Approval of AICTE, New Delhi. The Institution is affiliated to Anna University, Chennai since 2002. College offers 11 Under Graduate Programmes and 6 Post Graduate Programmes covering Engineering, Technology and Management. The Institution has a strong Industry Interaction with reputed National and International Organizations. The college has obtained ISO 9001:2015 Certification from TUV South Asia. The college is accredited with 'A' Grade by NAAC. Training programmes are given to improve the Theoretical and Practical skills of student's right from their first year of study. Campus recruitments by top companies through continuous Industry Institute Interactions (III Cell). In 2016 – 2017, 1041 placement offers were made and 225 companies visited the campus. In 2017-'18, 695 students were placed and 143 companies visited the campus. Highest placement in leading IT and core companies. 1041 were placed in 2017 with highest salary package of Flipkart – 15.4 lakhs/annum, DBS Bank -15-45 lakhs/ annum.

DEPARTMENT PROFILE

The Department of Automobile Engineering was established in 2014 with a clear vision: to provide top-tier education, instill relevant skills, and cultivate attributes aligned with evolving global standards and the dynamic needs of the automobile industry. Our department boasts state-of-the-art laboratories equipped with industry-sponsored vehicles and engines from esteemed companies like FORD, Hyundai, and BMW India Pvt. Ltd. With a focus on nurturing the next generation, we have a cadre of qualified and dynamic young faculty members who are dedicated to shaping the future

leaders of the industry. Our faculty comprises seasoned experts, 60% of whom hold Ph.D. degrees, with the remaining actively pursuing theirs.

We take pride in our students' achievements, with 14 Anna University Ranks, including a prestigious Gold Medal. Furthermore, we have funding from the Department of Science and Technology (DST), amounting to Rs. 52.8 lakhs, for a significant research project. Collaborations are integral to our ethos, exemplified by our memorandum of understanding (MOU) with Ashok Leyland Limited, Hosur Plant, offering one-year on-the-job training (OJT) opportunities for final-year students as Engineering Interns, with a generous stipend of Rs. 9000 per month.

Our curriculum is constantly updated to include skill-based courses in emerging areas, ensuring our graduates are well-prepared for the job market. Notably, our students actively engage in Karting race competitions, consistently achieving success under our P.R.I.D.E. activities. Our laboratories are equipped with cutting-edge facilities including Automotive Components, Engine Performance and Emission Testing, Vehicle Maintenance, Machine Shop, Automotive Design, Automotive Electrical and Electronics, Automotive Fuel and Lubricants, and Computer-Aided Drafting and Simulation. Our research endeavors focus on crucial areas such as Composite Materials, Welding, Surface Coating, and Micro Machining, aiming to contribute significantly to advancements in the field.

In essence, the Department of Automobile Engineering is committed to excellence in education, research, and industry collaboration, poised to meet the challenges and opportunities of the automotive sector in the 21st century.

VISION

To impart quality education, skills and attributes based on continuously changing global standards and local industrial requirement and hence emerge as centre for advance studies and research.

MISSION

M1 To provide quality education to the students based on the continuously changing global graduate attributes.

M2 To understand the requirement of Automobile Industries of the region and to add value to the students based on their changing needs.

M3 To tie up with industries for mutual benefit like training, internship and partial delivery of courses for the students.

M4 To develop partnership with industries for product development and research.

M5 To offer advance studies courses for becoming centre for excellence in the field of automobile Engineering.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO1 Our graduates will have fundamental technical knowledge and develop core competency in diversified areas of Automobile Engineering with a view to expanding the knowledge horizon and inculcating lifelong learning among students.

PEO2 Our graduates will pursue advanced studies, research and industrial product development in the field of Automobile Engineering by developing partnerships with industrial and research agencies thereby serving the needs of the industry, government, society and scientific community.

PEO3 Our graduates will be capable of building their own careers upon a solid foundation of knowledge to solve automobile problems based on interdisciplinary approach and a strong sense of responsibility to serve their profession and society ethically.

PEO4 Our graduates will have effective communication, leadership, teaming, problem solving and decision making skills by understanding contemporary issues thereby contributing to their overall personality and career development.

ABOUT THE CONFERENCE

The rapid advancements in various scientific disciplines within the developing world have ushered in a new era of possibilities in science and technology. Particularly in the fields of Automobile Engineering, contemporary materials, and Manufacturing, research is progressing at an unprecedented pace. Each year witnesses the exploration and implementation of new materials and manufacturing techniques, continually pushing the boundaries of innovation in Automobile and Mechanical Engineering.

This conference is dedicated to showcasing the latest breakthroughs in materials and manufacturing processes. By bringing together industry professionals and academic researchers, we aim to expedite the transformation of research findings into real-world applications. Our goal is to provide a platform where Researchers, Academicians, Industrial experts, and practicing Engineers can converge to exchange ideas, share knowledge, and discuss the latest developments and trends in the fields of Automobiles, materials, and manufacturing processes.

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PERFORMANCE AND EMISSIONS CHARACTERISTICS OF VARIABLE COMPRESSION RATIO ENGINE USING TOMATO SEED METHYL ESTER BLENDS AND EGR

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Abstract

This study used the Response Surface Methodology (RSM) optimization technique to investigate the effects of load, Tomato Methyl Ester (TME), and Exhaust Gas Recirculation (EGR) enriched diesel on engine performance and exhaust gas emissions. EGR of 10 to 30 percent and TME blend biodiesel 20 to 60 percent were selected to obtain better BTE and reduce BSFC, NOx, CO, smoke, and HC. The engine was run by load (0–100%) utilizing the RSM technique. The findings demonstrated that the engine's load, TME, and EGR concentration all had a significant impact on the response variables. The maximum BTE of 32.4% was obtained by matching the responses to the optimal study factors, which were load 100%, TME Blend 20%, and EGR 10%. Fuel consumption of 0.2 kg/kW.h is decreased at 50% load, 60% TME Blend, and 10% EGR. Emissions of CO and HC increased by 27.5% and 21.7%, while emissions of smoke and NOx decreased by 15.1% and 49.3%.

Keywords: Exhaust gas recirculation; Emission; Performance; Tomato methyl ester.

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PARAMETRIC STUDY OF U- SHAPED TUBE HEAT EXCHANGER WITH DIFFERENT CROSS- SECTIONS

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Abstract

In the ever-evolving energy sector, renewable sources are gaining increasing importance, with geothermal energy being recognized as a vital contributor. This study focuses on the efficient and economical utilization of low-temperature geothermal energy through Borehole Heat Exchanger (BHE) systems, particularly within Ground Source Heat Pumps (GSHPs). Residential and commercial buildings are identified as prime candidates for GSHP installations. However, it is crucial to understand the impact of soil thermal conductivity and weather conditions on BHE performance, as these factors influence heat extraction efficiency. This research aims to provide insights into optimizing BHE systems for sustainable heat extraction, enhancing the overall efficiency and effectiveness of geothermal energy utilization by using a cross section shape which is optimal for heat transfer with minimal losses. Here in this research, we have compared five different cross sections flat oval, circle, semicircle, pentagon and hexagon.

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EXPERIMENTAL INVESTIGATIONS ON MECHANICAL PROPERTIES OF AL7075-SIC METAL MATRIX COMPOSITES

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Abstract

Aerospace, aviation, marine, automobile, electronics, golf clubs, turbine blades, brake pads, etc. Many manufacturing techniques for aluminium carbide metal matrix composites (Al7075-SiC MMC's) are available. Stir casting route is simple, less costly, and used in mass production among the different methods. Thispaper analysed a 10%, 20%, and 30% reinforced mechanical properties of Silicon carbide aluminium. The composite Al7075-SiC Metal Matrix is made using stir casting technique. Fabricated composites were distinguished by their mechanical properties such as hardness, tensile strength and yield strength.

Keywords: Al7075-SiC MMC's,Metal matrix composites,Stir casting ,Hardness test ,Tensile test

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WEAR BEHAVIOUR OF AL-7075/SIC METAL MATRIX COMPOSITES

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Abstract

Aluminium Al-7075 base composites, reinforced with SiC particles which is fabricated by stir casting method and their wear resistance and coefficient of friction has been investigated in the present study as a function of applied load and weight fraction of SiC varying from 10,20 and 30 %. The dry sliding wear properties of composites were investigated by using Pin-on-disk testing machine at sliding velocity of 2 m/s and 4 m/s and sliding distance of 2000 m over a various loads of 10 N. The result shows that the reinforcement of the metal matrix with SiC particulates up to weight percentage of 30 % reduces the wear rate. The result also show that the wear of the test specimens increases with the increasing load and sliding distance. The coefficient of friction slightly decreases with increasing weight percentage of reinforcements. The wear surfaces are examined by optical microscopy which shows that the large grooved regions and cavities with ceramic particles are found on the worn surface of the composite alloy.

Keywords: Al7075-SiC MMC's,Metal matrix composites,Stir casting ,Pin on Disc,wear test

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TRIBOLOGICAL BEHAVIOUR OF W_2S/CU COATED AA7075 BY ELECTRICAL DISCHARGE COATING PROCESS

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Abstract

Aluminium alloys possess wide potential in the automotive industry, particularly in hot reciprocating applications such as pistons for diesel and petrol engines due to its mechanical and physical properties. Though it has superior properties, it is susceptible to wear and corrosion. To address this issue, surface modification is required for to enhance the wear resistance and reliability of the component. Hence the current study focuses on enhancing the surface properties of aluminium alloys electro discharge coating (EDC) with W_2S/Cu. To access the coating performance, wear test was carried out with pin on disc machine with Taguchi L9 orthogonal array using the variables such as normal load, sliding speed and sliding time to study the effect of response. The results show that there is a strong relationship between wear behaviour and parameters. It was concluded that the wear rate increases with increase of normal load, sliding speed and sliding time. However coefficient of friction increases with increase of normal load and sliding time, decreases with sliding speed.

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MACHINING EFFICIENCY EVALUATION AND COMPARATIVE MACHINING PARAMETERS OF EDM USING ON EN8 & EN 24 STEEL

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Abstract

This experiment aims at achieving an integrated approach to solve the optimization problem of EDM process. At any stage, the dominance factor of the input variables and output variables contained in the constraints and objective functions can be computed. The main objective of this work is aimed at characterize the electric discharge machining of EN8 and EN 24 steels on EDM. Since an electrode with micro features is employed to cut its mirror image in the workpiece, it is necessary to investigate the machining efficiency of the electrodes used. Furthermore, to improve the machining efficiency, it is momentous to consider the effect of various influencing input and output parameters. In this project, a series of experiments to be conducted with the copper electrode as a tool and EN 8 & EN 24 as work piece to machine small depth on the workpiece. The combination of pulse on time pulse off and ampere setting new line is considered for maximum Material Removal Rate (MRR), Surface Roughness (SR), constrained circularity error and overcut. The main aim has to be identify the same parameter and same electrode, which could enhance the production of quality of impression, and to have a significant contribution for modern industrial requirements. The experiments has to be carried out as per L4 orthogonal array with each experiment performed under different conditions of such as Discharge current, Pulse ON Tine, Pulse OFF time while machining

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EXPLORING THE ROLE OF COMPOSITE MATERIALS IN NEXT-GENERATION VEHICLES

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Abstract

Composite materials are increasingly becoming indispensable in the automotive industry, offering a pathway to next-generation vehicles that are lighter, stronger, and more efficient. This paper explores the evolving role of composite materials in shaping the future of automotive design and manufacturing. It delves into the unique properties of composites, such as high strength-to-weight ratio and corrosion resistance, which enable the creation of lightweight vehicle components without compromising on safety or performance. Moreover, the abstract discusses the integration of advanced composite technologies into various vehicle systems, including body structures, chassis components, and interior features, highlighting their potential to enhance fuel efficiency, increase range in electric vehicles, and improve overall sustainability. Furthermore, this paper examines the challenges and opportunities associated with the widespread adoption of composite materials in the automotive sector. It addresses issues such as cost-effectiveness, scalability of production, and recyclability, while also highlighting ongoing research efforts aimed at overcoming these barriers. Additionally, the abstract explores emerging trends in composite manufacturing techniques, such as additive manufacturing and automated fiber placement, which promise to streamline production processes and further optimize the performance of composite-based vehicle components.

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DESIGN AND DEVELOPMENT OF A CAR INTERIOR DOOR TRIM

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Abstract

The automotive industry is continuously evolving to meet consumer demands for comfort, functionality, and aesthetics. One critical aspect of a car's interior that significantly influences these factors is the door trim. The car interior door trim serves multiple functions beyond enhancing the visual appeal of a vehicle. It provides insulation, soundproofing, and structural support to the door, as well as accommodating various components such as handles, switches, and speakers. As a result, the design and development of door trims is a complex and multifaceted process that requires a careful balance between functionality and aesthetics. The first step in the design and development process is understanding the vehicle's target market and identifying the specific requirements for the door trim. This involves research into consumer preferences, material selection, and the integration of cutting-edge technologies. Innovations in materials, such as lightweight composites, sustainable options, and advanced surface treatments, have opened up new possibilities in design and functionality. Car manufacturers are increasingly adopting eco-friendly materials and recycling processes to reduce the environmental footprint of their products. Door trim development also focuses on achieving a balance between aesthetics and sustainability by using recycled or bio-based materials. The integration of technology in car door trims has become a distinguishing feature. Smart door trims now incorporate touchscreens, haptic feedback, and interactive lighting for improved user experience.

Keywords: Door Trim Panel, Tooling axis, Dog House, Push Pins, Heat stakes.

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INTEGRATION OF ARTIFICIAL INTELLIGENCE FOR REAL-TIME TRAFFIC MANAGEMENT IN CONNECTED VEHICLES

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Abstract

The integration of artificial intelligence (AI) for real-time traffic management in connected vehicles represents a significant advancement in transportation systems. This paper investigates the utilization of AI techniques such as machine learning and deep learning algorithms to enhance traffic flow, reduce congestion, and improve overall road safety. By harnessing the power of AI, connected vehicles can collect and analyze vast amounts of data from various sources, including sensors, cameras, and infrastructure, to make informed decisions in real-time. This abstract explores the potential benefits of AI-driven traffic management systems, including optimized route planning, adaptive traffic signal control, and proactive accident detection and mitigation strategies. Furthermore, it evaluates the challenges and opportunities associated with the implementation of AI in connected vehicles for traffic management. These include issues related to data privacy, cybersecurity, interoperability among different vehicle manufacturers, and the need for robust communication infrastructure. Despite these challenges, the integration of AI technologies holds immense promise in revolutionizing traffic management, paving the way for safer, more efficient, and environmentally sustainable transportation networks. This abstract serves as a foundation for further research and development in this rapidly evolving field of automobile engineering.

Keywords: Artificial Intelligence, Real-time Traffic Management, Connected Vehicles, Intelligent Transportation Systems, Traffic Flow Optimization.

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EXPERIMENTAL UNDERSTANDING OF COMPOSITE FIBERS FOR MOTORCYCLE BRAKES

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Abstract

This experimental study delves into the intricate understanding of composite fibers' behavior within motorcycle brake applications. Through a systematic investigation encompassing material characterization, fabrication techniques, and performance evaluations, the study elucidates the intricate interplay between fiber composition, structure, and processing parameters. By employing advanced testing methodologies such as dynamic mechanical analysis and frictional studies, the research delineates the nuanced effects of fiber orientation, reinforcement patterns, and composite matrix selection on crucial brake performance metrics like frictional stability, wear resistance, and thermal conductivity. The findings offer valuable insights into optimizing composite fiber-based motorcycle brake systems, paving the way for enhanced safety, durability, and efficiency in two-wheeled transportation. Furthermore, this research underscores the pivotal role of interdisciplinary collaboration between materials science, mechanical engineering, and automotive technology in advancing the frontier of motorcycle brake design. Through a synergistic approach integrating theoretical modeling, experimental validation, and real-world application, the study elucidates the intricate interactions between composite fiber microstructure, mechanical properties, and braking dynamics.

Keywords: Composite fibers, Motorcycle brakes, wear resistance, Friction, Material characterization.

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DEVELOPMENT OF LIGHTWEIGHT MATERIALS FOR AUTOMOTIVE STRUCTURAL APPLICATIONS: A REVIEW

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Abstract

The automotive industry has witnessed a significant paradigm shift towards the integration of lightweight materials in vehicle design to address the ever-growing demands for improved fuel efficiency, reduced emissions, and enhanced safety standards. This review paper provides a comprehensive overview of the recent advancements and challenges in the development of lightweight materials for automotive structural applications. The first section of the review delves into the motivations driving the adoption of lightweight materials in the automotive sector. With stringent regulatory requirements aimed at reducing greenhouse gas emissions and enhancing energy efficiency, automakers are compelled to explore innovative solutions to minimize vehicle weight without compromising structural integrity or performance. Additionally, the growing consumer preference for eco-friendly vehicles further underscores the importance of lightweight material integration. Furthermore, the review highlights recent research efforts and technological advancements aimed at enhancing the performance and manufacturability of lightweight materials. This includes developments in alloy design, processing techniques, joining methods, and surface treatments to overcome inherent challenges such as formability, weldability, and compatibility with existing manufacturing processes.

Keywords: Lightweight materials, Automotive industry, Structural applications, Material development, weldability.

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MODELING AND OPTIMIZATION OF ELECTRIC VEHICLE BATTERY THERMAL MANAGEMENT SYSTEMS FOR ENHANCED PERFORMANCE AND EFFICIENCY

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Abstract

This paper presents a comprehensive modeling and optimization framework for electric vehicle (EV) battery thermal management systems (BTMS) aimed at enhancing the performance and efficiency of EVs. The thermal management of batteries is crucial for maintaining their optimal operating conditions, ensuring safety, and prolonging their lifespan. Utilizing this model, we conduct sensitivity analyses to identify key parameters affecting the thermal behavior of the battery system. Furthermore, an optimization algorithm is employed to design an efficient BTMS architecture by maximizing heat dissipation, minimizing temperature gradients, and optimizing energy consumption. This research contributes to the advancement of EV technology by providing a systematic approach for designing and optimizing battery thermal management systems. By addressing the challenges associated with battery heating and cooling, such as thermal runaway, capacity degradation, and reduced driving range, this study facilitates the widespread adoption of electric vehicles. The developed modeling framework offers insights into the thermal dynamics of EV batteries under various operating conditions, enabling the development of robust BTMS designs tailored to specific vehicle architectures and environmental conditions. Ultimately, the optimized BTMS enhances the reliability, safety, and longevity of electric vehicle batteries, contributing to the sustainability and viability of electric transportation systems.

Keywords: Electric Vehicle (EV), Battery Thermal Management, Modeling, Optimization, Performance Efficiency.

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GENERATION AND UTILIZATION OF ELECTRIC ENERGY FROM HYDRAULIC POWER IN SPECIAL PURPOSE VEHICLES

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Abstract

This work explores the generation and utilization of electric energy from hydraulic power in special purpose vehicles. The integration of hydraulic systems into vehicles presents an innovative approach to enhance energy efficiency and reduce environmental impact. By harnessing the power of hydraulic energy, vehicles can generate electricity through hydraulic pumps connected to hydraulic motors or generators. The generated electricity can be stored in batteries or capacitors for later use or directly utilized to power auxiliary systems onboard special purpose vehicles such as construction equipment, agricultural machinery, or military vehicles. This work discusses the potential benefits, challenges, and applications of this technology, highlighting its role in advancing the sustainability and performance of specialized vehicle operations. Through case studies and analysis, the effectiveness and feasibility of integrating hydraulic power generation into special purpose vehicles are examined, offering insights into the future of energy-efficient transportation solutions.The automotive industry constantly seeks innovative solutions to enhance efficiency and address operational challenges. This work focuses on optimizing the functionality of a chassis cab equipped with a lifting bucket, powered by an engine-driven Power Take-Off (PTO).

Keywords: Hydraulic Power Generation, Special Purpose Vehicles, Electric Energy Utilization, Sustainable Energy Solutions, Mobile Power Generation.

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PROPERTIES AND BEHAVIOUR OF STEEL SLAG REINFORCED AL-SI METAL MATRIX COMPOSITE PREPARED USING STIR CASTING

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Abstract

Metal matrix composites (MMCs) possess significantly improved properties including high specific strength; specific modulus, damping capacity and good wear resistance compared to reinforced alloys. There has been an increasing interest in composites containing low-density and low-cost reinforcements. Among various discontinuous dispersoids used, iron powder is one of the most common and medium-density reinforcements available in large quantities as a solid. Hence, composites with iron as reinforcement are likely to overcome the cost barrier for widespread applications in automotive, aerospace and engine applications. It is therefore expected that the incorporation of iron particles in aluminum will promote properties enhancement at the same time, has the potential for conserving energy-intensive aluminum and thereby, reducing the cost of aluminum products. Nowadays particulate-reinforced aluminum matrix composites are gaining importance because of their low cost with advantages like isotropic properties and the possibility of secondary processing facilitating the fabrication of secondary components. The present investigation has been focused on the utilization of abundantly available industrial iron in a useful manner by dispersing it into aluminum to produce composites by stir casting method.

Keywords: Aluminum-silicon alloys, Metal matrix composite, stir casting, Stirrer speed.

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OPTIMIZATION OF PROCESS PARAMETERS DURING FRICTION STIR WELDING OF AA2014 & AA7075 USING HYBRID GRA-PCA

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Abstract

In this study, multi-objective optimization for Friction stir welding (FSW) of dissimilar AA2014-AA7075 has been presented to provide optimum tensile strength, hardness. The input parameters considered for the analysis are tool rotational speed, feed and tilt angle. Experiments are designed based on the Taguchi L_9 orthogonal array. Investigative analysis on the effect of input parameters on the responses was carried out. The parametric influence on responses was discussed through main effects plot and interaction plot. Further, multi objective optimization was performed with hybrid Grey relational analysis (GRA) and principle component analysis (PCA). Results demonstrated that tool rotational speed is the most significant factor affecting the responses followed by feed and tilt angle. The optimum cutting parameters obtained are tool rotational speed 710 rpm, feed 30 mm/rev, and tilt angle 0^o.

Keywords: Tensile strength, hardness, FSW, orthogonal array, multi objective optimization.

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EXPLORING THE ADVANCEMENTS IN COMPOSITE MATERIALS: A COMPREHENSIVE REVIEW

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Abstract

Composite materials have garnered significant attention in recent years due to their exceptional properties and versatility across various industries. This comprehensive review delves into the latest advancements in composite materials, offering insights into their manufacturing techniques, properties, and applications. Through an extensive analysis of recent research and development efforts, this paper quantifies the progress made in enhancing the mechanical, thermal, and electrical properties of composite materials. Additionally, it explores the incorporation of novel fillers, reinforcements, and matrix materials to achieve superior performance characteristics. Moreover, this review examines the sustainability aspects of composite materials, including recyclability and environmental impact, shedding light on the efforts to make composites more eco-friendly and economically viable. Furthermore, it provides a critical assessment of the challenges and opportunities facing the widespread adoption of composite materials in various sectors, such as aerospace, automotive, construction, and renewable energy.

Keywords: Composite materials, recyclability, environmental, Materials science, Modern technology.

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MACHINE LEARNING APPROACHES FOR PREDICTIVE MAINTENANCE IN CYBER-PHYSICAL SYSTEMS

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Abstract

Predictive maintenance is critical for ensuring the reliability and longevity of equipment in cyber-physical systems (CPS). Traditional maintenance strategies often rely on predetermined schedules or reactive approaches, leading to inefficiencies and unexpected downtime. Machine learning (ML) has emerged as a promising solution for predictive maintenance by leveraging data-driven models to anticipate equipment failures before they occur. This paper presents a comprehensive review of machine learning approaches for predictive maintenance in CPS, focusing on their application in various domains such as manufacturing, transportation, and energy systems. The review covers different ML techniques, including supervised learning, unsupervised learning, and reinforcement learning, highlighting their strengths and limitations in different CPS contexts. Furthermore, the paper discusses challenges such as data quality, scalability, and interpretability, along with potential solutions and future research directions to advance the field of predictive maintenance in CPS.

Keywords: Machine Learning, Predictive Maintenance, Cyber-Physical Systems, Supervised Learning, Unsupervised Learning, Reinforcement Learning.

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DEVELOPMENT OF BIOMIMETIC POMPEII WORM INSPIRED EV THERMAL MANAGEMENT SYSTEMS

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Abstract

This study investigates the enhancement of battery thermal management systems in electric vehicles through design, thermal analysis, and flow characterization of various fin configurations. Using Catia software for design creation, Ansys for thermal analysis, and computational fluid dynamics (CFD) software for flow characterization, the study aims to increase heat release rates from the battery casing by introducing fins.

Numerical analyses conducted with Ansys revealed that the irregular fin configuration exhibited superior heat release and thermal management capabilities compared to other designs. The irregular fin design achieved higher heat flux and temperatures in the fin zone, leading to increased heat release rates from the battery casing. Also confirmed from the obtained numerical results that the irregular fin design significantly increased heat release rates compared to other configurations, indicating improved battery performance and longevity. Comparative analyses against existing and proposed fin designs, including rectangular and rectangular with step fins, reaffirmed the irregular fin as the optimized design for battery thermal management. Overall, this study highlights the effectiveness of fins in enhancing battery thermal management and underscores the importance of selecting appropriate cooling mechanisms for electric vehicle batteries. The findings provide valuable insights for the design and implementation of efficient cooling systems aimed at maximizing battery reliability and performance.

Keywords : Biomimetic, Battery, Electric vehicle, Battery Thermal management system

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IMPROVEMENT OF SURFACE FINISH IN THE INNER PART OF THE SAND CORE MAKING

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Abstract

This study delves into the enhancement of surface finish within core making processes, crucial for ensuring the quality of casted products across industries. Surface finish profoundly impacts product aesthetics, functionality, and performance, driving the need for continuous improvement in core making operations. By scrutinizing current challenges and leveraging innovative methodologies, this research explores advancements in material selection, molding techniques, surface treatments, and equipment optimization. Through comprehensive analysis and experimentation, valuable insights are gained into elevating surface finish quality. The abstract highlights the significance of surface finish in core making, outlines the objectives of the study, and provides a glimpse into the methodologies employed. It emphasizes the practical implications of the research findings, offering actionable recommendations for industry practitioners to enhance surface finish and overall product quality. Ultimately, this study contributes to the ongoing evolution of core making technologies, underscoring the importance of achieving superior surface finish to meet industry standards and exceed customer expectations

.**Keywords:** Surface finish, Sand core making, Material properties, Molding parameters, Surface treatment, Shot blasting, Synergistic effects

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EXPERIMENTAL INVESTIGATION ON ALUMINIUM ALLOY AA7075 USING ABRASIVE WATER JET CUTTING

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Abstract

In today's context manufacturing industries primary target is to produce the product with high quality. The important properties for the products producing high hardness, wear resistance, toughness is in high demand for various applications say marine, aeronautical or nuclear industries. The quality of making products using conventional process is quite complicated. Abrasive water jet machining is used most widely in the present development because of its machining accuracy. Due to the particles of abrasive grains, the materials get fractured in the targeted area with the much loss of kinetic energy. This cutting operation is fast and simple to remove the portion of materials more effectively. Due to the tremendous features in water jet machining technique, many researchers attention is focused towards this process by studying the varying input parameters, different abrasive mesh sizes for improvement of better machining conditions without any additional cost. In this present work, machining operational parameters are to be optimized on abrasive water jet machining of AA7075 to achieve minimal surface roughness, maximum material removal rate and hardness. Cutting parameters such as abrasive feed, stand-off distance and nozzle speed are considered to optimize the AA7075 cutting through Response Surface Methodology.

Keywords: AA7075, Abrasive water jet cutting, Material Removal Rate, Surface Roughness, Hardness.

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EXPERIMENTAL STUDY ON MECHANICAL PROPERTY VARIATION OF PLA FILAMENTS REINFORCED WITH RECYCLED MONO CERAMIC AND BI-CERAMIC FILLERS: INCORPORATING EGGSHELL AND SEA SHELL POWDERS

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Abstract

This project addresses the surging demand & innovation in 3D printing technology, which is currently experiencing unprecedented growth and anticipated to expand rapidly. The exponential increase in 3D printing usage, however, raises critical concerns about the environmental impact and escalating costs associated with the production of raw materials for 3D printable filaments. To confront these challenges, the project proposes a novel material by integrating recycled ceramic materials such as eggshell and sea shell powder with polylactic acid PLA for making 3D printable filaments. By incorporating recycled materials, the project aims to not only curb manufacturing costs but also alleviate the environmental toll through the sustainable repurposing of waste materials. This project also compares the mechanical properties of the composite PLA from adding mono-ceramic filler and bi-ceramic fillers of similar ratios. The utilization of recycled materials in conjunction with polylactic acid (PLA) for 3D printable filaments not only reduces the ecological footprint but also capitalizes on the unique ceramic properties of these natural waste materials. In essence, this project endeavors to establish a sustainable and cost-effective model for additive manufacturing by demonstrating the viability of recycled materials in meeting the demands of a burgeoning 3D printing industry.

Keywords: Polylactic acid (PLA), Composite materials , composite 3d printing filaments, recycled fillers for 3d printing, Egg shell powder, Sea shell powder, bi-ceramic filler composites, extrusion printing.

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EFFECT OF PRINTING PATTERN ON 3D PRINTING OF PLA-MARBLE DUST FILAMENT: A CHARACTERISATION STUDY

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Abstract

3D printing, as opposed to conventional manufacturing methods, is an additive process increasingly favored for engineering component production. Its attributes, including minimal material waste, streamlined manufacturing, reduced human involvement, limited post-processing, and energy efficiency, position it as a sustainable solution for industrial needs. This research delves into the effects of different printing patterns on both the manufacturing process and final properties of objects made from PLA-Marble dust filament composites. Through comprehensive assessment encompassing structural integrity, surface quality, and mechanical properties, the study evaluates parameters like thermal conductivity, flammability, microstructure, compression strength, and tensile strength. Results highlight the significant impact of printing patterns on the performance of PLA-Marble dust composites, with each pattern presenting distinct strengths and limitations. These insights offer valuable guidance for optimizing printing parameters and selecting appropriate patterns to enhance the quality and functionality of 3D printed objects utilizing PLA-Marble dust filaments.

Keywords: 3D printing, PLA-Marble dust filament, energy efficiency, sustainable, thermal conductivity.

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EFFECTS OF DUAL FUEL REACTIVITY CONTROLLED COMPRESSION IGNITION COMBUSTION OF N-BUTANOL WITH DIESEL AND HEMP OIL BIODIESEL IN DIESEL ENGINE

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Abstract

The experimental work was carried out in the single cylinder diesel engine at dual fuel Reactivity Controlled Compression Ignition (RCCI) mode for n-butanol with diesel and hemp oil biodiesel. Due to the depletion of the petroleum products and total emissions from tail pipe of diesel engine has become need to seek for the alternative of petroleum products for term use. These particles present on the experimental investigation on the performance and emission characteristics of RCCI combustion. In this process the intake manifold injection of n-butanol combined with direct injection of diesel and hemp oil ethyl ester (HOME) are used in single cylinder diesel engines at different load conditions. Low reactivity n-butanol can be injected inside the intake manifold whereas high reactivity fuel (Diesel and HOME) was directly injected into the cylinder. In dual fuel mode the net heat release rate is high due to pre-mixture of n-butanol with fresh air charge in the intake manifold. The specific fuel consumption is low in dual fuel mode; in connection with efficiency characteristics get high fuel efficiency. High amount of NOx is reduced in dual fuel operating condition.

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PRODUCTION OF OIL FROM PLASTIC WASTE THROUGH THERMAL DEGRADATION PROCESS

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The production of bio-oil from plastic waste through the thermal degradation process is a sustainable and innovative approach that addresses both environmental and waste management challenges. The term "thermal degradation" refers to a chemical process that occurs when a material is subjected to heat. The physical and chemical characteristics of the material can change as a result of this decomposition, frequently leading to a loss of integrity or usefulness. Temperature, exposure time, the presence of additional materials, and the basic characteristics of the material itself all affect the degree and kind of thermal degradation. Pyrolysis is one of the thermal degradation processes that involve heating organic materials in the absence of oxygen, leading to the decomposition of complex organic compounds into simpler products, including bio-oil. In this study, healthcare waste, which typically consists of various organic materials such as medical plastics, syringes, bandages, and medical glucose bottles among other disposable items, is considered. Among these, medical glucose bottles are chosen as feedstock for pyrolysis due to their significant contribution to daily waste in the medical field and their negligible environmental and human health concerns. The pyrolysis process involves heating the medical glucose bottles to high temperatures between 400 and 500 °C in a controlled environment. This conversion process results in the production of bio-oil, char, and gases from the medical glucose bottles. The maximum yield rate of medical glucose bottle waste (MGBW) oil at 450°C of heating temperature will be solid (21%), liquid (27%), and gas (43%), with a calorific value of 42.5 MJ/kg, which is comparable to diesel. The bio-oil obtained from this process has several potential applications, such as in furnaces, and it can also be suitable for CI engines as an alternative fuel. KEYWORDS: Thermal Degradation Process, Pyrolysis, Medical Plastic Wastes, Bio-Oil, Medical Glucose Bottles.

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OPTIMIZATION OF MACHINING PARAMETERS OF ABRASIVE JET WATER CUTTING ON AA6082 ALUMINIUM ALLOY THROUGH RESPONSE SURFACE METHODOLOGY

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Abstract

The primary goal is to manufacture the output of good quality in the present sense of the manufacturing industries. In the maritime, the aeronautical or atomic industries, the main characteristics for the products that yield high hardness, wear-resistance and strength are strongly demanded.Product quality using conventional processes is quite complicated. Because of its handling precision, abrasive water jet handling is most often used in modern architecture. The surfaces get fragmented in the intended region with a great loss of kinetic energy because of the fragments of abrasive grains. This cutting method is quick and easy to more easily extract the part of the materials. The effort to the enormous features of water jet cutting, many scientists concentrate on this method by researching various input parameters, abrasive mesh sizes to improve improved processing conditions without the expense.In this phase work on abrasive water jet processing must be designed to ensure minimum surface roughness and optimum substrate removal and toughness in operating parameters. The AA6082 cutting through response surface methodology is considered as optimizing parameters for cutting such as abrasive feed, stand-off distance and nozzle rate.

Keywords:AA6082,Abrasive water jet cutting, Material Removal Rate, Surface Roughness, Hardness.

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IMPROVED LITHIUM SULFUR BATTERY PERFORMANCE BY APPLYING THE SOLID ELECTROLYTE INTERFACE METHOD

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These days the lithium particle battery is utilized in all kind of contraptions , electric vehicles etc. In lithium sulfur battery which have the gigantic sum of vitality thickness over lithium particle battery.But in lithium-sulfur (Li-S) batteries did not perform well since sulfur species (polysulfides) broken down into the electrolyte, causing its erosion. By utilizing the method of solid electrolyte interface(SEI) to extend the execution of the lithium-sulfur battery. Since the Li-S batteries offer a number of focal points in comparison to current battery innovation counting an moving forward the gravimetric vitality thickness, a all together diminished crude materials taken a toll, made strides security characteristics and a diminished natural burden related with the cell materials. The theoretical starts by emphasizing the critical require for efficient and feasible vitality capacity arrangements, particularly within the context of renewable vitality integration and electric vehicles. It at that point traces the elemental chemistry of Li-S batteries, emphasizing the tall hypothetical vitality thickness of sulfur as a cathode fabric and the arrangement of lithium polysulfides amid cycling.Lithium–sulfur (Li–S) batteries are considered as promising candidates for next-generation imperativeness capacity contraptions due to their ultrahigh hypothetical gravimetric essentialness thickness, cost-effectiveness, and characteristic neighborliness. In this consider, the commonplace applications of computational chemistry in Li–S battery considers, relating to characterization methodologies, such as X-ray diffraction, infra-red spectra, X-ray support spectroscopy, conclusive imperativeness, and atomic appealing resonation, are checked on. In specific, high-accuracy calculations and large-scale models, materials genome, and machine learning approaches are anticipated to assist progress computational orchestrate for the progression of Li–S batteries and related areas. Keywords: Lithium sulfur batteries ,Polysulfide shuttle, Li-metal anode, Battery modelling, Solid electrolyte interface.

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REVOLUTIONIZING LAST-MILE LOGISTICS: A COMPREHENSIVE ANALYSIS OF DELIVERY ROBOTS IN URBAN ENVIRONMENTS

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Abstract

This paper presents the design and implementation of a multi-step drop-off delivery robot (MSDDR) capable of completing multiple deliveries in a single trip. MSDDRs offer significant potential to increase delivery efficiency and reduce operational costs compared to traditional single-drop-off robots. The paper first outlines the motivation and challenges associated with multi-step delivery. It then describes the proposed MSDDR design, including its hardware, software, and control algorithms. The paper further details the implementation of the MSDDR, and performance evaluation. Results could demonstrate the robot's ability to effectively navigate complex environments and deliver packages accurately in a multi-step manner. The paper concludes by discussing the potential benefits of MSDDRs for various delivery applications and highlighting future research directions.

Keywords Last mile delivery, drop-off, SADR, RADR.

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THE EFFECT OF MICROSTRUCTURE AND SURFACE ROUGHNESS CHARACTERISTICS IMPROVEMENT OF NIMONIC 90 UNDER DIFFERENT ENVIRONMENTAL CONDITIONS BY USING CRYOGENIC

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Abstract

This project delves into the turning performance of Nimonic 90, a Nickel-based superalloy renowned. The investigation employs an innovatively developed cryogenic assisted turning (CAT) process to find out sustainability of material structure in various conditions. Experiments are meticulously conducted under different environmental conditions like dry, oil, ionic liquid and cryogenic conditions within a minimum quantity lubricant environment. Ionic liquids (ILs) serve the dual purpose of lubrication and cooling in the cutting fluid, liquid nitrogen (LN2) is the cryogenic cooling medium. Utilizing a CNC turning machine, various cutting condition are systematically measured. The proposed work emphasizes key output parameters such as surface roughness (Ra) and microstructure. This machining endeavour involves applying cutting fluids, specifically canola oil and ionic liquids, with a keen interest in undering their influence on the microstructure and machined surface of the material. The research to analysing Nimonic 90 characteristics under different testing environments.

Keywords: Surface roughness, Microstructure, MQL, Cryogenic, Ionic Liquid

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CHARACTERIZATION OF NANOPARTICLE ADDED POLYMER MATRIX COMPOSITE IN WEATHERING CONDITIONS

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Abstract

Polymer matrix composites, or PMCs, are lightweight materials with qualities that may be tailored, which has attracted a lot of interest in engineering applications. Adding nanoparticles to polymer matrices has shown to be a viable way to improve these composites' mechanical properties even more. This work provides a thorough mechanical testing assessment of PMCs enhanced with nanoparticles. The study focuses on how the kind, concentration, and dispersion of nanoparticles affect the mechanical characteristics of composite materials. Graphene oxide, silica, and carbon nanotubes are among the several nanoparticles that are disseminated throughout the polymer matrix by a variety of processes, such as solution mixing and melt blending. A series of mechanical tests, including tensile, compressive, flexural, and impact tests, are performed on the resultant composites.

Keywords: mechanical tests, including tensile, compressive, flexural, and impact tests

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EXPERIMENT INVESTIGATION AND MACHINING CHARACTERISTIC OPTIMIZATION ON SS316 &MONEL K 500 BY USING WEDM PROCESS

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Abstrac:

A non-conventional machining technique called electro-discharge machining employs brief electrical discharges to machine any electrically conductive material, regardless of its hardness or strength. The experiment yielded minimal gap voltage, minimum level of pulse on, minimum level of pulse off, and minimum surface finish for both materials. Through the use of minimum pulse on time during the electric wire cutting operation, exact kerf width and diameter of SS316 and MONEL K 500 were produced. Microcracks and microvoids in the white layer were confirmed, certain faults were found, and a microstructure analysis was conducted to determine the minimum and maximum surface roughness average specimen. Monel discovered a higher corrosion rate in comparison to stainless steel from the analysis of salt spray.

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AN ANSYS SIMULATION STUDY ON INTERLAMINAR FRACTURE TOUGHNESS AND DISPLACEMENT ANALYSIS IN CARBON AND GLASS FIBER REINFORCED HYBRID COMPOSITES WITH NANOCLAY/TIO_2 MODIFIED EPOXY MATRICES

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Abstract

This research focuses on the comprehensive analysis of interlaminar fracture toughness and displacement behaviour in hybrid composites comprising carbon and glass fibres, utilizing epoxy matrices modified with Nanoclay and TiO2. The study employs ANSYS simulation techniques to model and assess the impact of three different combinations of composite materials on both fracture toughness and displacement characteristics. By varying the fibre compositions and nano-modifier ratios, the simulation aims to provide a detailed understanding of the mechanical performance of the hybrid composites. The investigation explores how these variations influence not only the interlaminar fracture toughness but also the displacement patterns within the composite structures. The findings contribute valuable insights into the optimization of composite designs, enabling the development of advanced materials with enhanced fracture resistance and controlled displacement behaviour for diverse engineering applications.

Keywords: Hybrid composites, ANSYS simulation, Fracture toughness, Displacement, Nanoclay and TiO2

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MECHANICAL PROPERTIES OF JUTE, BAMBOO PULP, KENAF FIBER REINFORCED EPOXY RESIN HYBRID COMPOSITE PLATE WITH SILICON CARBIDE

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Abstract

The improved mechanical qualities and environmental sustainability, composite materials are essential to many engineering applications. The mechanical characteristics of a unique hybrid composite plate made of kenaf, bamboo pulp, and jute fibres embedded in an epoxy resin matrix with silicon carbide particles added are examined in this work. The hand lay-up method is used in the fabrication process, and compression moulding comes next. Tensile, flexural, and impact tests are used in mechanical characterisation to assess the strength, stiffness, and capacity for energy absorption of the composite. The findings show that the hybrid composite has better mechanical qualities than any of its component parts, highlighting the synergistic advantages of silicon carbide reinforcement and natural fibres together. By providing insights into the design and optimisation of hybrid composites for improved mechanical performance, this work advances the development of sustainable composite materials for structural applications.

Keywords*:* composite material, kenaf, bamboo pulp, jute fibres, epoxy resin matrix.

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LIFI-BASED HILLS COMMUNICATION

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Abstract

Comparing wireless data transmission in water to other mode communication in air presents a number of different issues. In order to achieve the desired data transfer speeds for wireless communication Hills, sophisticated equipment components are required. In comparison to other conventional communication technologies, the water medium has a few unique properties that make it challenging to communicate data via. The main objective of this work is to develop an hills Li-Fi system, which optimize transmission range and adaptability to environmental changes. This work is to evaluate data transfer speeds and reliability Hills.

Keywords: Hills Communications, Wireless Sensor Network (WSN), Li-FI, IoT, Sensors.

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SYNERGISTIC ENHANCEMENT OF MECHANICAL PROPERTIES IN COMPOSITES REINFORCED WITH SILICON NITRADE, BORON CARBIDE, AND COBALT

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Abstract

This study investigates the mechanical properties of a Magnesium, Aluminium, Copper composite reinforced with silicon nitride (Si3N4), boron carbide (B4C), and cobalt (Co) nanoparticles. In this work, the mechanical behaviour of AI(7075), Copper(C26800), Mg(AZ91) composite layers fabricated using the power material like Silicon Nitrade, Copper carbide and cobalt using nano particles it can be improving the strength and hardness wear resistance and thermal strength . The composite layers are produced by incorporating reinforcing particles into the AI(7075), Copper(C26800), Mg(AZ91) matrix. The Optical microstructure, Scanning Electron Microscope (SEM), Impact test, hardness are rate ot the composite layers are evaluated and compared with those of the base material of Magnesium, Aluminium, Copper. An important method for examining materials microstructural characteristics at a high resolution. SEM analysis was used in this work to comprehend the Magnesium, Aluminium, Copper surface and structural features. Grain boundaries, porosity, and topographical features were among the fine surface details that the SEM images of the material showed. The fundamentals, benefits, and drawbacks of each technique are covered, along with current technological developments. Optical microscopy is a crucial tool in deepening our understanding of the microscopic world, from identifying nanomaterials to deciphering the intricate workings of cellular processes. Highlighted are also developing trends and future prospects in optical microscopy, suggesting that this dynamic area will continue to foster interdisciplinary collaboration and innovation. When assessing how materials behave under dynamic stresses like collisions, impacts, or explosions, impact testing is essential. This explores the significance of impact testing in various industries, including automotive, aerospace, construction, and sports equipment. Additionally, the abstract delves into the parameters affecting material response to impact, such as strain rate, temperature, and specimen geometry. Understanding material behaviour under dynamic loading conditions is essential for ensuring product safety, performance optimization, and material selection. Additionally, it will discuss the significance of hardness testing in quality control, material selection, and assessing mechanical properties. The results show that the presence of reinforcing particles and the improved microstructure produced by FSP have improved the mechanical characteristics. This research contributes to a deeper understanding of the mechanical behaviour of aluminium alloys, Magnesium, Copper composite layers produced by FSP, offering insights for potential applications in industries requiring high-performance aluminium alloys, Magnesium, Copper.

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TENSILE IMPACT PROPERTIES OF SS316L3DPRINTED COMPONENT BY DED PROCESS

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Abstract

This study investigates the tensile impact properties of stainless steel 316L(SS316L) components fabricated using the Directed Energy Deposition (DED) additive manufacturing process. SS316L is a commonly used material in various industries due to its excellent corrosion resistance and mechanical properties. Additive manufacturing techniques offer unique advantages in producing complex geometries with reduced material waste, but the mechanical performance of 3D printed components can vary based on process parameters. In this research, SS316L specimens were fabricated using a DED system, and their tensile impact properties were evaluated. The effects of process parameters such as laser power, scanning speed, and powder feed rate on the mechanical performance were systematically studied. Microstructural analysis was conducted to understand the correlation between the observed mechanical behavior and the material's micro structure. The results indicate that the tensile impact properties of SS316L components are influenced by the DED process parameters. Optimal combinations of these parameters were identified to achieve improved mechanical properties, balancing strength and ductility. Additionally, microstructural characterization revealed insights into the deformation mechanisms and failure modes observed during tensile testing

Keyword : Additive manufacturing, DED process, SS316L, Tensile, impact properties

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BIOMASS CONVERSION TO BIOFUEL AND BIOCHAR

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Abstract

This project explores the conversion of biomass, a renewable resource, into valuable products: biofuel and biochar. Biofuel provides a clean-burning alternative to fossil fuels, reducing dependence on unsustainable resources and greenhouse gas emissions. Biochar, a charcoal-like material, serves as a soil amendment, enhancing fertility and sequestering carbon. The project will investigate various conversion methods, such as thermochemical and biological processes. Thermochemical conversion, like pyrolysis, utilizes heat in a controlled oxygen environment to produce biofuel and biochar simultaneously. Biological conversion employs microorganisms to break down biomass into biofuels like biogas and ethanol. By optimizing these processes, the project aims to maximize biofuel production for transportation and industrial uses. Additionally, the project will explore the agricultural benefits of biochar, including improved soil health, water retention, and crop yields. This integrated approach offers a sustainable solution for energy needs while promoting soil health and carbon sequestration.

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MECHANICAL PROPERTIES OF JUTE, BANANA, COCONUT FIBER REINFORCED EPOXY RESIN COMPOSITE

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Abstract

Now-a-days, the natural fibers and fillers from renewable natural resources offer the potential to act as a reinforcing material for polymer composite material alternative to the use of natural fibers and other man-made fibers. Among various natural fibers and fillers like jute fiber, wheat straw, rice husk, wood powder, coconut coir ash, jute, hemp etc. are the most widely used natural fibers and fillers due to its advantages like easy availability, low density, low production cost and reasonable physical and mechanical properties. This research work presents the effects of natural fillers, hybrid composite structure is formed. The result of test depicted that hybrid composite has far better properties than single fiber glass reinforced composite under impact and flexural loads. However it is found that the hybrid composite have better strength as compared to single glass fiber composites.

Keywords— Photovoltaic, LUO Converter's, Fly back converter, Electrical Vehicle (EV)

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EXPERIMENTAL EXPLORATION OF ABRASIVE AQUA JET MACHINING FOR INCONEL X-750 AEROSPACE ALLOY

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Inconel X-750 stands as a prominent high-strength space alloy, pivotal in aerospace applications and environments demanding corrosion resistance. However, machining this material to meet quality standards poses a challenge due to its mechanical properties. Among unconventional machining techniques, abrasive aqua jet machining exhibits promise in cutting hard and brittle materials. This study aims to ascertain optimal process parameter values to attain superior machining quality on Inconel X-750 alloy via abrasive aqua jet optimization. Parameters such as abrasive jet pressure (A_P), gap distance (G_d), traverse speed (T_{sd}), and abrasive flow rate (A_{fr}) were investigated. Results indicate that increasing A_P, T_{sd}, G_d, and A_{fr} correlates with enhanced material removal rate (M_{RR}). ANOVA analysis underscores the significant influence of A_P on M_{RR}. Leveraging the desirability method, this research offers insights into optimizing abrasive water jet machining parameters for superior performance.

Keywords: abrasive jet pressure, gap distance, traverse speed, abrasive flow rate, ANOVA, Desirability

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TRIBOLOGICAL BEHAVIOUR OF WS_2/CU COATED AA7075 BY ELECTRICAL DISCHARGE COATING PROCESS

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Abstract

Aluminium alloys possess wide potential in the automotive industry, particularly in hot reciprocating applications such as pistons for diesel and petrol engines due to its mechanical and physical properties. Though it has superior properties, it is susceptible to wear and corrosion. To address this issue, surface modification is required for to enhance the wear resistance and reliability of the component. Hence the current study focuses on enhancing the surface properties of aluminium alloys electro discharge coating (EDC) with WS_2/Cu. To access the coating performance, wear test was carried out with pin on disc machine with Taguchi L9 orthogonal array using the variables such as normal load, sliding speed and sliding time to study the effect of response. The results show that there is a strong relationship between wear behaviour and parameters. It was concluded that the wear rate increases with increase of normal load, sliding speed and sliding time. However coefficient of friction increases with increase of normal load and sliding time, decreases with sliding speed.

Keyword: Electrical discharge coating, wear rate, COF.

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INVESTIGATIONS ON DENTAL SOLUTIONS USING ADVANCED ADDITIVE MANUFACTURING AND SURGICAL SIMULATION TECHNIQUES

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Abstract

Additive manufacturing is the process of converting three-dimensional computer aided models into a physical object. The application of 3D Printing is widely used in dental solutions. Bio additive manufacturing is the combination of additive manufacturing and tissue engineering, which are generally deals with biocompatible material fabrication and its significant properties. In this paper the author propose a method to solve the dental problems and provide a high accuracy with the help of surgical planning software. 3D (three dimensional) model is generated from the CT (Computed Tomography) scan data of the patient. The virtual planning and surgical simulations are done by using MIMICS software. The damaged, needed parts of the bone tissue and soft tissue are segmented. The required part called RoI (Region of Interest) are made into 3D models using FDM process. Surgical plates and surgical guides are designed based on final simulation to get the dimensionally fit model. Final model of the case is fabricated by using Fortus 250 MC FDM .The prototype of the patient is then investigated by the surgeons and then undergo pre-processing. This process of printing will help the surgeons to undergo virtual operation. This paper proven that, 3D Printing and surgical planning will be the great help for the surgeons and thereby it reduces operational time and increases success rate.

Keywords: Additive Manufacturing, Bio additive manufacturing, Computed aided Design, Fused Deposition Modelling (FDM).

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AN EXPERIMENTAL COMPARATIVE STUDY ON THE SOLAR DRYER WITH SERPENTINE PROFILE ON ABSORBER PLATE AND PEBBLES STONE WITH OPEN SUN DRYING METHOD

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Abstract

In this paper, a serpentine profile was created in absorber plate filled with pebbles stone on the heat waves flow passage. The reduction in the moisture content of the samples in the serpentine profile forced convection based solar dryer was experimentally investigated. In order to investigate, the wet paddy moisture content was considered for this purpose. To compare the effect of serpentine slope solar dryer on drying wet paddy, the same sample of wet paddy was also dried adjacent to the system by open sun drying process. Experiments were carried out from time interval of 11.40 am to 2.25 pm to measure the dryer air temperature, surface temperatures, and the percentages of the wet basis moisture content are measured at regular intervals of every 15 min. In the experiments, it was found that the developed serpentine with pebbles solar dryer removed the maximum wet basis moisture content than the open sun drying method. Also, at the end of the experiments (2.25 pm), the weight reduction achieved in open sun drying (175 grams) was achieved in the solar dryer by half an hours prior to that. Thus, the rate of drying in solar dryer is more with tailored absorber plate compare to the open sun drying. Thus, the developed solar dryer system can be effectively used for the purpose of drying the agricultural products.

Keywords: Solar Energy; Absorber plate; Serpentine profile; Renewable Energy harvesting.

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PRODUCTION OF OIL FROM PLASTIC WASTE THROUGH THERMAL DEGRADATION PROCESS

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Abstract

The production of bio-oil from plastic waste through the thermal degradation process is a sustainable and innovative approach that addresses both environmental and waste management challenges. The term "thermal degradation" refers to a chemical process that occurs when a material is subjected to heat. The physical and chemical characteristics of the material can change as a result of this decomposition, frequently leading to a loss of integrity or usefulness. Temperature, exposure time, the presence of additional materials, and the basic characteristics of the material itself all affect the degree and kind of thermal degradation. Pyrolysis is one of the thermal degradation processes that involve heating organic materials in the absence of oxygen, leading to the decomposition of complex organic compounds into simpler products, including bio-oil. In this study, healthcare waste, which typically consists of various organic materials such as medical plastics, syringes, bandages, and medical glucose bottles among other disposable items, is considered. Among these, medical glucose bottles are chosen as feedstock for pyrolysis due to their significant contribution to daily waste in the medical field and their negligible environmental and human health concerns. The pyrolysis process involves heating the medical glucose bottles to high temperatures between 400 and 500 °C in a controlled environment. This conversion process results in the production of bio-oil, char, and gases from the medical glucose bottles. The maximum yield rate of medical glucose bottle waste (MGBW) oil at 450°C of heating temperature will be solid (21%), liquid (27%), and gas (43%), with a calorific value of 42.5 MJ/kg, which is comparable to diesel. The bio-oil obtained from this process has several potential applications, such as in furnaces, and it can also be suitable for CI engines as an alternative fuel.

KEYWORDS: Thermal Degradation Process, Pyrolysis, Medical Plastic Wastes, Bio-Oil, Medical Glucose Bottle.

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CATALYST-BASED EXTRACTION OF PYROLYSIS OIL FROM ACACIA ARABICA SEED

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Abstract

The materials used by human beings for their life and the disposal of used materials or residues from waste cause pollution to the environment. Pollution or contamination of these wastes is making problems for living and nonliving organisms in the ecosystem. The types of waste are solid, liquid, and gaseous. Waste management is carried out to dispose of the materials. Waste management involves the process of collection, transport, processing, recycling, and disposal. The disposal of solid wastes particularly by preparing landfill, incineration, pumping into deep wells, and burning does not solve the problem. Changing the solid waste into some useful form like alternative fuel will help to address the energy crises. This project work focuses on extracting oil from various biomasses at yield temperature. The catalysts like KOH, $CaCO_3$, and NaCl are selected according to their oxidation characteristics and are added with acacia arabica. Then pyrolysis process is carried out at a temperature of 620 -700˚C. As a result of adding the catalyst, there is an increase in the extraction of oil. The increase in extraction of an oil product quantity is compensated mainly by a decrease in the gas product. The objective of the work is to determine the effect of reaction, temperature, and time on the optimization of pyrolysis to produce renewable bio-oil. Of the three catalysts, NaCl alone has the greatest power in the extraction of oil from biomass. The optimum oil product yield of 20% is achieved at 620˚C by using NaCl.

Keywords: Pyrolysis. Acacia arabica, Sodium chloride (NaCl) Potassium hydroxide (KOH), Calcium carbonates ($CaCO_3$)

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ADVANCEMENTS IN REGENERATIVE ENERGY WITH ELECTRIC VEHICLE (EV) ENGINES

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Abstract

The main obstacle in the transition from petrol/diesel vehicles to Electric vehicles is the low efficiency, battery life. One of the key features enhancing the efficiency and sustainability of EVs is regenerative energy technology. This abstract explores the integration of regenerative energy systems with EV engines to optimize energy usage and mitigate environmental impact. Regenerative braking, a prominent feature in EVs, converts kinetic energy into electrical energy during deceleration, thereby increasing overall efficiency and extending driving range. Additionally, advancements in regenerative energy technologies, Furthermore, bidirectional charging capabilities enable EVs to serve as mobile energy storage units, allowing them to feed surplus energy back into the grid during peak demand periods or power outages.

These innovations leads us towards a more sustainable and interconnected energy ecosystem, where EVs play a vital role not only in transportation but also in energy storage and distribution. Through continued research and development, the integration of regenerative energy systems with EV engines holds immense potential to further reduce carbon emissions and elevation of clean transportation technologies.

Keywords: Electric vehicle, Regenerative energy, Hybrid vehicle

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AUTOMATED DEVICE PROTOTYPE FOR USING ANN FOR THE TRANSESTERIFICATION OF BIO DIESEL

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Abstract

This technique has become increasingly popular recently to convert dietary lipids into compounds with technically more acceptable energy characteristics. It is possible to lower the viscosity of vegetable oils used as feedstock such that they more closely resemble traditional fossil fuels in terms of quality. Triglycerides, an ester composed of three fatty acids and glycerol, are converted into biodiesel by the process of transesterification. In order to forecast biodiesel yield, an artificial neural network (ANN) model was developed using the experimental data. The findings demonstrated that ANN was a potent tool for estimating biodiesel yield, as demonstrated by high R and low mean squared error (MSE) values. This technique has frequently been used to lower high viscosity vegetable oils and triglycerides. There are numerous techniques to produce biodiesel by transesterification, including supercritical, ultra, and high-shear in-line reactors and batch reactors. The setup will include a cylindrical tank, dish, tank cover, heating coil, motor, and rotor with fins. Because it is a renewable source of energy, biodiesel has been viewed as a very good alternative to traditional energy options given the present global energy and environmental problems. Solidworks is used to design the setup for the transesterification process, creating the component parts before assembling them.

Keywords: Transesterification, Biodiesel, Triglycerides, Catalyst, Fatty acids, Glycerol, Vegetable oil.

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VIBRATION AND FATIGUE ANALYSIS OF FRICTION STIR WELDING ROBOT USING ADAMS SIMULATION

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Abstract

The abstract of the study "Vibration and fatigue Analysis of friction stir welding robot using ADAMS Simulation" describes the use of the ADAMS software to analyze the vibration and fatigue of a friction stir welding robot. The study aimed to investigate the performance of the robot in terms of structural and dynamic stability during the welding process. The ADAMS simulation was used to model the welding robot and analyze its response to various welding conditions. The vibration analysis is performed using a modal analysis technique, and the fatigue analysis is carried out using the S-N curve approach. The results of this study show that the FSW robot experiences significant vibration during the welding process, which can lead to fatigue failure of the components. We recommend that to measures such as damping and vibration isolation be implemented to reduce the vibration and improve the fatigue life of the FSW robot. Overall, this study provides useful insights into the dynamics of FSW robotic systems and highlights the importance of considering vibration and fatigue in the design and operation of such systems.

Key words: Friction Welding Robot, vibrations, Adams, Fatigue.

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INVESTIGATION OF MECHANICAL PROPERTIES ON PLASMA SPRAY COATED LASER BEAM WELDED SUPER AUSTENITE STAINLESS STEEL

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ABSTRACT

This paper discusses the mechanical properties of Plasma Spray FeCr18Ni10Mo3 filler powder coating (PSC) of Super Austenitic Stainless Steel (SASS) for butt joint configuration of 2 mm thickness sheets using laser beam welding process. The microstructure studies showed that more amounts of austenite elements were observed in the parent metal. Low heat input was applied in the laser welding process and double side welding method was implemented. Welding parameters such as laser beam power of 800 W, welding speed of 350 mm/min and welding focus distance of 10 mm were used in the laser beam welding. The microstructure studies conducted at the fusion zone and heat affected zone revealed that the austenite boundaries were transformed into coarse grain boundaries and α' martensite structures. All the tensile samples failures had occurred at the fusion zone of as-welded, and PS coated samples. High heat inputs of PS coating process implemented at the fusion zone and heat affected zone transformed α'-martensite structure into β'+β martensite and Cr+Ni grain boundaries. The average hardness of fusion zone of PS coated weldments and as weldments gives 340 HV and 280 HV. Compressive residual stress of XRD test was conducted in fusion zone of as-weldments, and PS coated weldments. The present studies conducted at the fusion zone showed the increase in the corrosion resistance and improved the tensile and bending properties.

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SYNTHESIS AND CHARACTERIZATION OF COMPOSITE NANOMATERIALS FOR BATTLE TANK

Abstract

The purpose of this research is to simulate and test nanomaterial reinforced composites for potential applications in Army vehicles, especially for improved ballistic and blast protection. The resultant simulation and design system can address major concerns in functional requirements of nanomaterials in Armys ground vehicles such as strength, durability, ballistic and blast impact resistance. An important part of this research is to develop a comprehensive modeling tool to predict nano-composite behaviors. Based on a unit cell model developed for nanoclay-epoxy composites, the effect of nanomaterial distribution on the maximum stress developed in an epoxy resin was investigated by including modeling of the nanoclay-polymer interface. Tests were conducted on composite laminate armor coupons that were reinforced by nanocomposites, including quasi-static mechanical tests, drop tower tests, shock tube tests, and ballistic tests. The ballistic tests indicate that armor with nanoclay insertion can survive more rounds of projectile impact. Shock tube tests showed that the damage in the laminate is less severe for samples with nanoclay reinforced epoxy resin than for those without nanoclay reinforcement.

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PERFORMANCE ANALYSIS OF NATURAL CONVERSION SOLAR DESALINATION SYSTEMS EMPLOYING ACRYLIC PLASTIC AS CONDENSER MATERIAL

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Abstract

This study examines the performance of natural conversion solar desalination systems utilizing acrylic plastic as a condenser material. While acrylic plastic offers potential advantages such as reduced weight and cost-effectiveness compared to traditional glass materials, concerns regarding its suitability for desalination applications have been raised due to its relatively low plasticity point. Through comprehensive performance analysis and experimentation, we assess the effectiveness of acrylic plastic in solar desalination systems under varying environmental conditions. Key parameters including freshwater production rate, thermal efficiency, and durability are evaluated and compared with systems employing glass condensers. The results of our study indicate that acrylic plastic may not be suitable for desalination applications due to its plasticity point, which typically ranges between 80-100°C. The relatively low thermal stability of acrylic plastic limits its effectiveness in handling the high temperatures required for efficient desalination processes. Based on our findings, it is concluded that while acrylic plastic offers certain advantages, its limitations in terms of thermal stability render it unsuitable for use as a condenser material in solar desalination systems. This research underscores the importance of selecting appropriate materials for desalination applications to ensure optimal performance and efficiency.

Key Words: Natural conversion solar desalination, acrylic plastic, condenser material, Plasticity.

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INTELLIGENT LOAD ADAPTIVE BRAKING SYSTEM

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Abstract

This Intelligent Load Adaptive Braking System is all about enhancing motorcycle safety through smart braking systems. Motorcycles Manufacturers are designed with braking systems that work well under maximum load conditions, like when there's a rider and a passenger. However, these systems can become less effective and even risky when the motorcycle is under a lighter load, such as when the rider is alone. That causes skidding and increases stopping distance of the motorcycle. To address this issue, we are create a system that adjusts brake pressure based on the actual load on the motorcycle at any given time. This is achieved by installing a load sensor under the motorcycle seat. This sensor detects how much weight the motorcycle is carrying, whether it's just the rider or the rider with a passenger. We're also incorporating a motor-controlled pressure regulator valve in the brake fluid line. This valve is connected to the load sensor and the Arduino Uno microcontroller. The microcontroller processes the data from the load sensor and determines the optimal brake fluid pressure needed to ensure safe and effective braking without skidding or excessive force. key advantage of this system is its adaptability to different load scenarios. For instance, when the motorcycle is ridden by the rider alone, the system calculates and adjusts the brake pressure to prevent skidding during sudden or hard braking, improving safety in emergency situations. On the other hand, when the motorcycle is carrying a passenger, the system optimizes brake force by fully opening the valve during hard braking it reducing the stopping distance and improve the safety.

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ENHANCING VEHICLE HANDLING USING STEER BY WIRE SYSTEM WITH VARIABLE STEERING RATIO

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Abstract

Drive-by-wire is a recently developed technology in the automotive industry. The vehicle equipped with this kind of technology basically runs on electronics which controls various range of operations including braking, throttle, steering and acceleration. Conventional steering systems might be powerful but, in the end, are not very efficient as they wear and tear over the years but, "Steer-by-Wire (SbW)" technology gives the designer more space due to the replacement of mechanical linkages. An electric actuator turns wheels based on ECU commands, often via a motor linked to the steering mechanism. Data fusion enhances decision-making, while Variable Steering Ratio (VSR) adjusts steering ratio electronically. This innovation enhances safety, swiftly adapting to external factors for improved stability and accident prevention, promising transformative advancements in automotive controls. A small-scale model of the system has been prototyped. To determine the steering wheel's degree of turn, we employed a potentiometer. The microprocessor receives this data and uses it to turn the stepper motor. And also made the provision to alter the steering ratio with three distinct speed ranges by utilizing an additional potentiometer to accelerate the car. In conclusion, SbW with VSR is a transformative advancement in automotive controls. It promises to elevate safety, driving performance and overall driving experience.

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READY TO START SYSTEM FOR ELECTRIC VEHICLES USING RELAYS AND TIMER

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Abstract

The "Ready to Start" system, is designed to enhance energy efficiency and safety during vehicle activation. By initiating the EV only when brakes are engaged and the vehicle is in neutral, this system reduces standby power consumption and prevents unintended movement. Integration of this system promises extended battery life, reduced charging needs, and improved driving experiences across various EV types. Widespread adoption requires collaboration among stakeholders, leading to a future where EVs dominate sustainable transportation with efficient innovations. The "Ready to Start" system distinguishes itself with its simplicity and cost-effectiveness. Unlike complex electronic systems, it employs basic relays and timers, readily available and inexpensive components. This design choice not only lowers manufacturing costs but also enhances reliability and maintenance ease. Moreover, the system's straightforward architecture facilitates seamless integration into existing EV platforms, minimizing retrofitting requirements and streamlining production processes. When the ignition switch is activated and the vehicle is in neutral, the driver must press the brake pedal and the vehicle start button to initiate the vehicle. Upon meeting these conditions, the latching relay receives the signal, activating the contactor for a one-time switch action, while the timer relay controls the vehicle's active time, adjustable as needed. Additionally, this model integrates a Tractive System Active Light (TSAL) lamp, indication lamps, and a buzzer to indicate whether the vehicle is turned on or off.

Keywords: Ready to Start, electric vehicle, latching relay, Tractive System Active light

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EXPERIMENTAL INVESTIGATION AND OPTIMIZATION OF MACHINING PARAMETERS FOR EDM USING COPPER ELECTROD ON EN24 STEEL

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Abstract

Metal removal mechanism in Electrical Discharge Machining (EDM) is mainly a thermal phenomenon where thermal energy is produced in plasma channel, and is dissipated though work piece, tool and dielectric. The process is mostly used in situations where machining of very hard materials, intricate parts, complex shapes. The aim of this work is to pursue the influence of three design factors current (I), pulse (V), pulse on (Ton), and pulse off (Toff) which are the most connected parameters to be controlled by the EDM process over OHNS machining specifications such as material removal rate (MRR) and characteristics of surface integrity such as average surface roughness (Ra) quantify them. The experiments were carried out as per L9 orthogonal array. Each experiment was performed under different conditions such as Ampere rating, pulse on time and pulse off time. The optimal factor for Surface Roughness, Machining timing and Material removal rate were found with taguchi design and annova calculations were calculated each output response. The major Contribution of Surface Roughness influenced with pulse on time -45% of the OHNS material. Keywords: EDM, surface roughness (Ra); material removal rate (MRR); current (I); voltage (V); pulse on (Ton).

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CRASHWORTHINESS INVESTIGATION AND OPTIMIZATION OF ADDITIVELY MANUFACTURED BIOMIMETIC HEXAGONAL POLYMER COMPOSITE STRUCTURES FOR ENHANCED IMPACT RESISTANCE

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Abstract

Biomimetic structures are employed in crashworthiness applications owing to their ability to resist and effectively mitigate impact forces has made them indispensable in enhancing safety, minimizing damage, and improving overall efficiency. In recent years, researchers and engineers have increasingly turned their attention toward nature's ingenious designs for inspiration in creating novel structures capable of absorbing and dissipating energy. In this experimental investigation, the prospect of a new class of honeycombs inspired by nature was extensively studied. Comprehensive experimental studies were performed on additively manufactured biomimetic hexagonal structures under quasi-static loading to study their energy absorption and crushing properties. The proposed hexagonal structures were additively manufactured using Fused Deposition Modelling technology using PLA/CF (70% of PLA and 30% of short-chopped Carbon Fibre), PETG/CF (70% of PETG and 30% of short-chopped Carbon Fibre) and PLA/GF (70% of PLA and 30% of Glass Fibre). This research investigation uses multi-objective optimization techniques such as COPRAS, TOPSIS and EDAS to determine the most efficient structure among the proposed designs. The study reveals that the biomimetic structures that were inspired by spiderwebs showed very impressive crashworthiness and energy-absorbing characteristics when compared with other structures. It is to be noted that the suggested hexagonal structure has great potential for the replacement of traditional energy-absorbing structures in aeronautical, automobile and defence applications respectively.

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MECHANICAL PROPERTIES FREE VIBRATION AND DAMPING CHARACTERISTICS OF NATURAL FIBER REINFORCED POLYESTER COMPOSITE MATERIALS.

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Abstract

This study aims to evaluate the result of experimental investigation carried out on Mechanical Properties, free vibration characteristics and damping factors of short Natural fiber polyester composite. Composites specimen is fabricated in random fiber orientation using to hand lay-up method by Influence of fiber length (10mm) and weight percentage (5, 10, 15, 20 wt. %) . Studies revealed that increase in the fiber content will in-crease the Mechanical Properties like Tensile strength, flexural strength, Impact strength and Hardness and Natural frequency (Hz) also Increasing at the time of Damping factor is decrease the given by the composites having a fiber loading of 20 wt. % ranges. The properties were compared with neat polyester Composite Material. In this work increasing fiber content increases the Mechanical Properties, Natural frequency (Hz) and decrease the Damping factors of the composite.

Keywords: Natural fiber (Jute, Kenaf & Flax), Polyester resin, Mechanical Properties, Free vibration testing (FVT), Damping factors.

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DYNAMIC MECHANICAL ANALYSIS (DMA) AND SCANNING ELECTRON MICROSCOPE (SEM) ANALYSIS OF NATURAL FIBRE (JUTE, KENAF & FLAX) FIBER REINFORCED POLYESTER COMPOSITE MATERIAL.

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Abstract

The primary aim of this study is to evaluate the damping characteristics and Scanning Electron Microscope (SEM) analysis of polyester fiber composites containing short Jute, Kenaf & Flax fibers through dynamic analysis across different temperatures and frequencies and Physio-chemical properties on adhesion phenomena (PH, Roughness, Topography, Temperature, etc). An examination is conducted on how temperature impacts the storage modulus (E'), loss factor or damping efficiency (tan δ), and loss modulus (E"). The fabrication of the composite specimen involves a manual layup procedure with a non-directional fiber arrangement, a fiber length of 10 mm, and varying weight proportions of Jute, Kenaf & Flax (5, 10, 15, 20 wt. %). The outcomes of the conducted experiments demonstrated that augmenting the fiber concentration leads to a rise in the storage modulus, whereby the most significant enhancement is observed in composites incorporating 15% Jute, Kenaf & Flax fibers, respectively, across various temperature ranges. Concurrently, the presence of fibers results in a reduction in the peak values of the loss modulus and damping curves (tan d). This particular characteristic is analogous to that of pristine polyester. Through this empirical inquiry, it was observed that the progressive increment in fiber content is directly proportional to the natural frequency and storage modulus of the composite material.

Keywords: Natural fiber (Jute, Kenaf & Flax), Polyester resin, Dynamic mechanical analysis (DMA), Scanning Electron Microscope (SEM).

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COMPOSITE CREATIONS: INNOVATIONS IN MATERIAL ENGINEERING

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Abstract

Composite materials have emerged as a cornerstone of modern material engineering, offering a unique blend of properties that surpass those of traditional materials. This abstract explores recent innovations in composite materials and their applications across various industries. Advancements in material science have led to the development of composites that exhibit superior strength-to-weight ratios, exceptional durability, and enhanced flexibility. By combining different materials at the micro- and nano-scale, engineers have unlocked new possibilities for creating tailored composites with precise properties to meet specific needs. One area of innovation lies in aerospace engineering, where lightweight yet robust composite materials are revolutionizing aircraft design, leading to increased fuel efficiency and improved performance. Similarly, in the automotive industry, composites are playing a pivotal role in manufacturing lighter vehicles without compromising safety or structural integrity. Moreover, composites are making significant strides in renewable energy technologies, with applications in wind turbine blades, solar panels, and energy storage systems. These materials enable the development of more efficient and sustainable energy solutions, contributing to the global transition towards cleaner energy sources.

Keywords: Composite materials, Material engineering, Innovation, Aerospace, Sustainability

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REINVENTING MATERIALS: THE EVOLUTION OF COMPOSITES

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Abstract

The evolution of composite materials represents a paradigm shift in material science, reshaping industries and driving innovation across various sectors. This abstract explores the historical trajectory, current advancements, and future prospects of composite materials, highlighting their transformative impact on engineering, manufacturing, and design. Composite materials, composed of two or more constituent materials with distinct properties, have been utilized since ancient times, albeit in rudimentary forms. However, it wasn't until the 20th century that significant strides were made in composite manufacturing processes and material formulations, paving the way for their widespread adoption in diverse applications. In aerospace, composites have enabled the construction of lightweight yet durable components, contributing to fuel efficiency, reduced emissions, and enhanced aircraft performance. Similarly, in the automotive sector, composite materials are increasingly employed to manufacture lighter vehicles, improving fuel economy and safety without compromising structural integrity.

Keywords: Structural integrity, lightweight, light weight, safety.

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THE COMPOSITE REVOLUTION: REDEFINING MATERIAL PERFORMANCE

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Abstract

In today's dynamic technological landscape, the quest for materials that exhibit superior performance characteristics is incessant. This paper delves into the realm of composite materials, heralding a paradigm shift in material science. Composites, amalgamations of distinct materials, offer a synergistic blend of properties not achievable by any individual constituent alone. This paper explores the multifaceted aspects of composite materials, encompassing their fabrication, properties, and diverse applications across industries. By dissecting the structural and functional attributes of composites, this study elucidates their transformative impact on various sectors, including aerospace, automotive, construction, and biomedical engineering. Moreover, it scrutinizes the intricate interplay between composite composition, microstructure, and performance, illuminating avenues for tailored material design and optimization. Through comprehensive analysis and case studies, this paper underscores the pivotal role of composites in driving innovation and fostering sustainable development. As the Composite Revolution unfolds, it reshapes conventional notions of material performance, propelling us towards a future where the boundaries of possibility are continuously redefined.

Keywords: Composite materials, Performance, Fabrication, Applications

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STUDY OF MECHANICAL BEHAVIOUR & MICROSTRUCTURAL PROPERTIES ON FRICTION STIR WELDED ALUMINIUM ALLOYS 6082 - T6&8011

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Abstract

In this study 6082 T6 aluminum alloys and 8011 aluminum alloys of 5mm Thickness by using a friction stir welding procedure, plates were connected. weldments are carried out by varying various parameters such as Tool rotational rates vary from(600 rpm,800 rpm, and 1000 rpm), Traverse speed varies from(10 mm/min,20 mm/min,30mm/ min) Axial Forces are varies from (4 kn,6 kn,8 kn) and Tilt angle maintains 10.This process is performed by non-consumable tool as Hexagonal, cylindrical and square pin profiles to generate a heat energy and plastic atomic diffusions are made in the weldments. The fractography microstructure of tensile specimen shows minimum failure when the tool rotational speed is 800rpm, traverse speed at 20 mm/min and axial force 8 kN.

Keywords: Aluminium, alloys, traverse speed, axial force.

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