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Static structural analysis of spur gear using ANSYS 15.0 and material selection by COPRAS, MOORA techniques

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Abstract

Structural analysis of components is an important task in design phase which ensures the success of the design before stepping for product manufacturing. The material selected for a product to serve a particular function need validation through certain analysis for the application desired. The present work aims to conduct structural analysis of spur gear pair subjected to different torque values such as 132, 190 and 225 Nm. Structural steel, Aluminium Silicon composite, AISI 4140 alloy steel and Ti6242S are the materials considered for static structural analysis to evaluate total deformation, strain energy, equivalent von mises stress and equivalent elastic strain by varying the torque for a spur gear pair. The analysis results are further taken as input for multi criteria decision making to identify the best and worst material options through COPRAS and MOORA. The weights of the individual output responses are evaluated through CRITIC method and utilized for calculating the weighted normalized matrix. COPRAS recommend Ti6242S as the best material and Structural steel as the worst preference. The recommendations of MOORA are in confliction with COPRAS. MOORA recommends Structural steel as the best material and Ti6242S as the worst option. The results are further validated through TOPSIS and it has a good agreement

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Experimental investigation on surface roughness and cutting tool – Workpiece interface temperature for AA6061 using CRITIC and TOPSIS techniques

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Abstract

The measurement of surface roughness after machining a component plays a significant step for ensuring the aesthetic quality of the finished product. The appropriate input parameters selection is highly vital to attain a desired surface finish in any machining process. The present work studies the effect of three different end milling process parameters such as cutting speed, feed and depth of cut to understand their significance over surface roughness and cutting tool – work piece interface temperature. The weight determination for the criteria has been done using CRITIC method and multi objective optimization is carried out using TOPSIS methodology. Taguchi's Signal to Noise ratio method is adopted for identifying the significant parameter for output responses individually. For both the responses depth of cut is the most potential factor through signal to noise ratio method. A1B2C1 is recommended for low surface roughness and A2B2C1 is found to be the combination for low cutting tool - work piece interface temperature. Through TOPSIS methodology the optimized parameter combination for minimization of both the output responses is found to be A3B3C2 and Depth of cut is the potential factor affecting both the output responses. Cutting speed is found to be factor having less significance over both surface roughness and cutting tool – work piece interface temperature.

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A review of optimization techniques in machining of composite materials

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Abstract

In today's fast changing scenario in manufacturing sector it is essential to apply optimization methods in machining process to increase quality of product in market and to stay competitive. This paper discusses on, several methods used for optimization namely Taguchi method, Gravitational Search Algorithms (GSA), Response Surface Methodology (RSM), Analytic Hierarchy Process (AHP), Genetic Algorithm (GA), Artificial Neural Network (ANN), The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) and Fuzzy Logic (FL) in various machining processes such as turning, milling, drilling and Abrasive Water Jet (AWJ) for normal and high speed machining of composite work materials. Optimization of control parameters in machining of composite material for various responses are reviewed and presented for the benefit of selection by research professionals.

Previous Next

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Experimental Investigation on Mechanical behavior and Microstructural Characterization of AA7075 Reinforced with TiB_2 Particles Produced via Stir Casting Process

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ABSTRACT: Aluminium Metal Matrix Composites (AMMC) has been used in fields such as aerospace, automotive, marine and defense owing to its attractive benefits such as high strength to weight ratio, high ductility and corrosion resistance. The present work studies the mechanical and tribological behavior of AMMC specimens prepared adopting stir casting method by varying the weight percentage of titanium diboride (6%, 8%, and 10%) and also conducts microstrutural study. The results indicates that the increase in weight percentage of titanium diboride reinforcement in AMMC increases the mechanical and tribological properties measured such as tensile strength , hardness and wear resistance. Tensile strength increases by 27.63 % and hardness increases by 16.23% for reinforcement with 10% weight comparing to 6% reinforcement weight. The wear rate has got a considerable decrease with increase in weight percentage of reinforcement. The microstructural characterization reveals that uniform mixture is obtained through the stirring process of AMMC manufacturing.

Keywords – AA7075, Friction Stir Casting, SEM Analysis, Titanium Particles

Nomenclature

AMMC – Aluminium Metal Matrix Composite

EDM – Electric Discharge Machining

HMMC – Hybrid Metal Matrix Composite

MMC – Metal Matrix Composites

SiC – Silicon Carbide

TiC – Titanium Carbide

TiB_2 – Titanium Diboride

Al_2O_3 - Aluminium Oxide

B_4C - Boron Carbide

TiO_2 - Titanium Dioide

1. Introduction

Composite materials are the one which has two different materials combined together to act as a single material which has distinct properties than the property exhibited by them individually. Composite materials find applications in numerous fields such as aerospace, automotive, marine, defense and so on. The major advantages of composite materials include high strength to weight ratio, high corrosion and wear resistance, light weight , fatigue strength and more. Composite materials may be

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Synthesis and Optimization of AA 7175 – Zirconium Carbide (ZrC) Composites Machining Parameters

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ABSTRACT

The airline sector mostly preferable material as aluminium and its alloy due to light weight and better resistance combatant for environmental factors. In this work mainly focusing to fabricate the aluminium matrix composites and reducing the surface roughness value of the specimen in the machining process. Initially the AA7175 with reinforcement of zirconium carbide (ZrC) particles are synthesized by the route of stir casting process, the stirring deed improve the material strength. The Design of experiments is involved to optimize the machining (CNC vertical milling) parameters such as Spindle rotational speed (2000 rpm, 2400 rpm and 2800 rpm), Machine feed rate (1000 mm/min, 1400 mm/min and 1800 mm/min) and depth of cut (0.3mm, 0.6 mm and 0.9 mm). The L 27 orthogonal array model is conducted to optimize the factors with the help of Minitab numerical analysis. This approach finds the optimal factors and reduces the surface roughness value, the microstructure examine is carried out and its image is translated to analyze the 3D profilometry technique.

Keywords: *AA7175, zirconium carbide, milling, reinforcement, minitab, CNC, stir casting*
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1. INTRODUCTION

In the space equipments and the airline parts manufacturing industries the material of aluminium alloy occuping a major role for consumption of fabrication parts. These alloys are extensively growth the strength of the assembly with light weight and help to form a rigid structure. Aluminium alloy possess the great mechanical and chemical properties, it proffers the exceptional tribological and corrosion properties. Now its application would be expanded to the home appliances and medical care units, in automobile sectors the aluminium alloy usage is increased twiced. The civil construction field, the structural design and interior decorative the aluminum alloys are substantially occupied due to miniumum cost cinstruction. In all materials, the aluminium alloy has easy to shaping and sizing at any form including without heating. The reinforcement is the key role of increasing the strength and mechanical properties of the materials and also alter the surface structure of the composites. The reinforcement is used to reduce the wear and improve the corrosion resistance and reduce the vibration of the material. The composite preparation is the main foundation of the research work for further conducting experimental work. The stir casting route is the best way of producing any type of composites simply and short period, in this process mainly concentrate to applying proper stirring action with maintain proper time period. Before stir casting process all the materials are cleande properly and the base material is preheated in healthy condition, the reinforced particles are weighted in correct way through digital balance. The strengthening is the one of the process of addition of the hard particles to the base material. The stir casting method preferred to obtain enhanced bonding potency of the materials with adapting of high melting temperature of the materials and applying continues stirring accomplishment.

The milling operation is used for to remove the material with using of multipoint cutter tool. The convex shape can be machined in the stir casted composite samples with influence of different process parametrs. All the above mentioned in the introduction is followed for this investigation such as synthesis and optimization of the vertical milling process parameters. Plan to obtain less surface roughness value of the AA7175 with adding of zirconium carbide particles.

2. EXPERIMENTAL PROCEDURE

2.1 Materials and composition

The AA7175 has great cracking resistance, fracture toughness and stress corrosion; it is effectively applied for aircraft application such as structural components, control valves. The constituent of chemical elements of the aluminium alloy 7175 are presented in the Table 1. The reinforcement particles of the zirconium carbide has a ceramic hard refractory material, it has mainly used to make a tool bits and cutting tools [1]. The zirconium carbide has high melting temperature such as 3500^{0}C.

From the earlier literature study the process factors selected of this experiment as spindle rotational speed, machine feed rate and depth of cut [2]; all the factors and it levels are tabulated in the Table 2.

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Original Article

Nano-alumina reinforcement on AA 8079 acquired from waste aluminium food containers for altering microhardness and wear resistance

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Abstract

The recycling of waste is act of charity as it takes part of maintain environmental clean as well as offer balance in supply to meet the same or alternate use. Thin Aluminium sheets made food packaging items are usually 'use and through' and AA 8079 obtained by recycled them after use by stir-casting process. This research aims to investigate the control over hardness and wear resistant by reinforcing alumina nanoparticles at different wt% in such recovered AA 8079 by Sliding wear test and Vickers micro hardness test to identify the degree of variation in mechanical and tribological aspect of reinforcement effects. The results of wear test reveal that the highly influencing functional parameter is normal pressure or load on

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Effect of ZrB_2 on microstructural, mechanical and corrosion behaviour of aluminium (AA7178) alloy matrix composite prepared by the stir casting route

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Highlights

- Aluminium alloy matrix composites reinforced with zirconium diboride particles were developed by stir casting process.
- Mechanical, corrosion behaviours and microstructure of the composites were studied.

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Influence of EDM parameters on Al_2O_3& Gr reinforced aluminium matrix composites

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Abstract

Electric discharge machining (EDM) routehas capability of machining hard materials. Even intricate shapes can be machined by this process. Traditional machining routes develop machining issues like tool wear and pitiable surface finish. It can be overcome by the EDM process. The objective of this work is to prepare AA6351-10wt%Al_2O_3-5wt%Gr composites through stir casting process. The manufactured composites were machined via EDM route and their machining characteristics material removal rate (MRR) and surface

Study on Various Types of Nose Cone Profiles at Supersonic Speed through Analytical, Experimental and Numerical Simulation Methods

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Abstract

The present article investigates the analytical, experimental and numerical simulation study of different nose profiles having different geometric shapes used in missiles and the one that offers the minimum aerodynamic drag based on the known performance over the existing conventional nose profiles. Bi-cone, Cone, Ogive and spherical Blunt Cone are the selected nose profiles for the evaluation and comparison of aerodynamic parameters such as pressure co-efficient, shock location and shock wave angle over the selected profiles for flow analysis. As the fineness ratio and the Mach number increases, the overall drag increases which is a key point of the project.. All the four models were fabricated and tested by placing them in a wind tunnel at Mach number of 2.5 at a pressure of 12 bar to analyze the aerodynamic characteristics. This proposed method can be used for the design and optimization of nose cone shapes used in missiles and aircrafts at supersonic speeds. The ogive shaped nose cone model is found to have better aerodynamic characteristics than other nose cone shapes considered and spherically blunt cone nose model is found to have poor aerodynamic characteristics.

Index Terms: ANSYS 16.2, CATIAV5R20, Supersonic Speed, Static Pressure

Nomenclature

Mono and Multi Response Optimization of End Milling Parameters for AA6061 by Taguchi Based GRA and TOPSIS Methodology

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Abstract

The main focus of the present study is to conduct machining of aluminium alloy 6061 through end milling process and to measure the cutting forces generated such as tangential force (Fx), radial force (Fy) and axial force (Fz) for the purpose of optimizing the input parameters such as cutting speed, feed and depth of cut. The experimental design plan for conducting the experiments are prepared from Taguchi's L_9 orthogonal array using MINITAB 17.0 and the input parameters are varied in to three levels. The results obtained are further analyzed using Signal to Noise ratio method for mono optimization of input parameters and in regard to multi response optimization GRA (Grey Relational Analysis) and TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) methodologies have been adopted. The weights for the attributes of the output parameters are determined through entropy method and the maximum weightage is obtained for axial force Fz. The research findings have revealed that from both the multi response optimization techniques adopted the significant influencing parameters over the output characteristics is found to be in the order of cutting speed, feed and depth of cut in ascending order in ranking and it has good agreement. Cutting speed has a maximum contribution percentage of 32.78% as per GRA and 25.66% of contribution in case of TOPSIS method than other parameters considered. The optimized parameter setting obtained by TOPSIS method is A3B1C1 (4000 rpm, 20 mm/min, 0.2 mm) and according to GRA method A1B3C3 (1000 rpm, 60 mm/min, 0.6 mm) is the recommended parameter setting for reduced cutting force values.

Keywords: AA 6061, ANOVA, End Milling, Grey Relational Analysis, TOPSIS

Notations and Abbreviations

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Pilot Testing of FDM Samples by Taguchi's L_4 Orthogonal Array and Multi Response Optimization using GRA and DEAR Approaches

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Abstract : *The concept of conducting pilot testing or study is like a rehearsal of the main experimental work which will be conducted in later stages. The aim of conducting such a study is to ensure the validity of the proposed experimental setup, research methodology and other related concepts in a research to endup in a successful manner. The conduction of pilot study many not ensure complete success but it increases the likelihood of success of the main research. The present work conducts pilot testing of four different FDM (Fused Deposition Modelling) samples printed using ABS (Acronitrile Butadiene Styrene) material by adopting Taguchi's L_4 Orthogonal Array experimental design matrix prepared by varying the inputs such as layer thickness, infill density and printing speed into two levels. The printing time taken, material consumed by the individual specimen and its compressive strength are evaluated for analysis. The results obtained from the pilot study as per experimental design is further subjected for Mono response optimization through Signal to Noise ratio method and Multi Response Optimization through Grey Relational Analysis (GRA) and Data Envelopment Analysis Based Ranking (DEAR) approaches for comparison. The research findings have shown that from both the Multi Response Optimization methods the optimized parameter setting is found to be A1B2C2* (0.1mm, 80%, 75 mm/s) *and Infill density is the most significant factor followed by layer thickness and printing speed affecting the output characteristics. From mono optimization done through signal to noise ratio method, for both model building time and material consumption the parameter setting A2B1C2 (0.3mm, 40%, 75 mm/s) is recommended and for compression strength A1B2C1*(0.1mm, 80%, 25 mm/s) *is to be followed for maximization. Printing speed is the factor with very low significance over all the output parameters considered in both mono and multi response optimization methods.*

Keywords: Data Envelopment Analysis Based Ranking Method, Grey Relational Analysis, L_4 Orthogonal Array, Pilot Testing

1. INTRODUCTION

Research is an interesting process which involves rigorous activities like data collection, conducting experiments, analysis of the experimental results, deriving conclusions , providing suggestions for future scope of work and recommendations for improvement on the topic which has got analyzed. The researchers of any field have to adopt a suitable research methodology pertinent to their research area in order to end up the research process successfully. Pilot study or pilot run is an important step in a research process which acts like a rehearsal of the main study and also it helps in ensuring the capability and genuineness of the methodology proposed for conducting experiments , analyzing the experimental data and execution of the results. Polit study does not ensure the total success of the research work carried out but it gives a indication over the success of the research. The present work conducts pilot testing of ABS samples prepared using fused deposition modelling process to understand the effect of input variables such as layer thickness, infill density and printing speed over the economical factors such as model building time and material consumption. Compressive strength of the sample is the only technical parameter considered in the present study. For the past two decades numerous research work has been carried out in the field of fused deposition modelling to optimize input process parameters to reduce production time, part weight, surface roughness, dimensional error and to enhance the mechanical properties such as tensile strength, impact strength, compression strength, flexural and fatigue strength etc. Rupinder Singh et.al [1] conducted pilot study for the selection of process variables while making an attempt to reduce the surface roughness of hip implant processed by FDM process and identified that the minimum surface roughness was resulted with low infill density part with zero degree orientation. Kamaljit Singh Boparai et.al [2] adopted pilot study while making an attempt to model and optimize the extrusion process parameters such as composition , mean barrel temperature and die

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Multi Response Optimization of Hard Turning Process Parameters for OHNS Steel by Taguchi Based Grey Relational Analysis and Assignment of Weights Method

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Abstract: *The Scope of the current work is to multi optimize the hard turning parameters for OHNS (Oil Hardened Non Shrinkage) steels through taguchi based Grey Relational Analysis (GRA) and Assignment of weights method and also to identify the significant parameter influencing the output characteristics considerably. The present work considers the hard turning operation parameters such as cutting speed, feed and depth of cut to measure the output characteristics such as cutting force, material removal rate (MRR), surface roughness and tool wear. The results obtained through the experimental design matrix generated by adopting Taguchi's L_9 Orthogonal array has been considered for multi objective optimization. The research findings have shown that through Assignment of weights method the optimized parameter combination is found to be A3B3C3 and the depth of cut is the significant parameter followed by feed and cutting speed. The optimized parameter setting recommended from GRA is found to be A3B1C1 and Cutting speed is found to be the most significant parameter followed by Feed and Depth of Cut. In both the analysis methods Feed takes the second position as dominant or influencing factor out of the three parameters considered.*

Keywords: Assignment of Weights, Grey Relational Analysis, Hard Turning, Multi Response Optimization, OHNS Steels, Taguchi's Orthogonal Array

1. INTRODUCTION

Manufacturing process of any method (Additive, Formative, and Subtractive) consists of crucial factors which has a severe impact or influence over the output characteristics of the end product. The improper selection of the manufacturing parameters results with a component or part with poor characteristics which may further lead to the rejection of the manufactured part in quality assessment. The general output characteristics associated with any subtractive manufacturing processes are high surface finish, high material removal rate, reduced tool wear, enhanced dimensional accuracy, low machining time and setup time. The above mentioned output characteristics can be achieved through proper selection of cutting parameters through the optimization of process parameters either as a single objective or multi objective manner . The optimized parameter combination obtained for one output characteristic may not provide accurate results in case of other output characteristics associated with the problem. Problems with multiple objectives prevails everywhere and techniques or methods such as Grey Relational Analysis, Desirability Function analysis, TOPSIS (Technique of Order Preference Similarity to the Ideal Solution) and many other methods have been developed in the recent decades to solve the multi objective problem in an effective manner. Raneen Abd Ali et.al[1] conducted multi response optimization study of face milling process parameters for AL-2024 alloys using grey relational analysis by varying the parameters such as cutting speed , feed , depth of cut and tool path strategy and adopted Taguchi L_{27} Orthogonal array for conducting experimental trials and found that the cutting speed has the maximum contribution with 74.72% towards the output responses and tool path strategy is found to have a significant influence over the surface roughness and topography. Rafał Swiercz et.al [2] investigated the Electric Discharge machining parameters such as Discharge current, pulse time and time interval for tool steel 55NiCrMoV7 by adopting desirability function approach for three different cases namely finishing, semi finishing and roughing operation. The authors have concluded that the factors discharge current and pulse time have significant effect over the surface roughness and white layer thickness , but the factor time interval has significant effect only over the process stability. S.Muniraj et.al [3] analysed the effect of turning parameters for micro alloyed steel by considering cutting speed, feed and depth of cut by adopting Taguchi based Grey Relational Analysis coupled with principal component analysis. Nikolaos Fountas et.al [4] studied the effect of cutting parameters while turning brass alloy by adopting taguchi based experimental design and grey wolf algorithm by considering the three major parameters cutting speed, feed and depth of cut. Doreswamy Deepak and Rajendra Beedu [5] reported about the effective parameters in turning of Al-6061 alloy by using Taguchi based Grey analysis method and

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Comparative Study on Effective Turbulence Model for NACA0012 Airfoil using Spalart – Allmaras as a Benchmark

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ABSTRACT

The present work is dedicated to conduct a comparative study on identifying the effective turbulence model in terms of flow outlet velocity, error percentage, number of iterations and time coefficient using NACA0012 airfoil by considering Spalart – Allmaras as a reference model. The current study considers 12 different turbulence models including Spalart – Allmaras for obtaining the output characteristics individually. The turbulence models in existence such as Standard K-epsilon, RNG K-epsilon, Realizable variant of K-epsilon, Standard K-Omega, SST K-Omega, BSL K-Omega, Transition K-KL Omega, Transition SST, Reynolds Stress (Linear Pressure Strain), Reynolds Stress (Quadratic Pressure Strain), Reynolds stress (Stress Omega) have been utilized for the evaluation and comparison. The NACA0012 airfoil is modelled using CATIA and the meshed model of the airfoil is analyzed using ANSYS FLUENT under standard boundary conditions. The results obtained have shown that the Standard K – epsilon model is found to have less error percentage in comparison to other turbulence models. The count over the number of iterations taken reveals that the models such as Standard K-omega, SST K-omega and BSL K-omega has shown the least number of iterations compared to rest of the turbulence models for completing the analysis. The time coefficient calculation shows that Standard K-omega and SST K-omega ranks top by showing less time for conducting the analysis with 77.92 seconds and the maximum time was shown by the Reynolds's stress models considered in the study.

KEYWORDS: CFD, NACA0012 Airfoil, Spalart – Allmaras, Time Coefficient, Turbulence Models

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1. INTRODUCTION

Computational Fluid Dynamics (CFD) has become a field with higher utilization in many engineering disciplines due to its flexibility and capability to handle and solve complex engineering problems. The domain comes under the branch of physics which involves the flow analysis of fluids and gasses with different boundary conditions. Computational Fluid Dynamics (CFD) is the combination of various fields such as physics, flow technology, computing power, mathematics and fluid mechanics. It is a group of techniques combined together in solving the Navier-Stokes equations or strictly, RANS equations (Reynolds-Averaged Navier-Stokes) by satisfying the conservation of mass, momentum and energy to predict the behavior of fluidic systems. The numerical methods such as Finite Volume method, Finite Difference method and Finite Element method are involved in solving complex engineering problems and Finite Volume methods is the most preferred solver in case of CFD analysis [1].

The most promising nature of the CFD domain in providing space for the analysis of complex situations prevailing the product design and development of fields like Electronics, Power, Turbo machinery, Construction, Hydraulics, Biomedical, Sports, Medicine and Space studies. CFD is an inevitable method of understanding the flow and avoiding failure of the product or process in place where which may result in huge loss in terms of time, money and energy. Software's such as ANSYS FLUENT, OPENFOAM has the capability to conduct the flow analysis with varying boundary conditions. CFD has specific applications in aerospace industry such as aerodynamic design of vehicles, combustion modelling, performance of aircraft components such as turbochargers, propellers and cooling fans etc.

Nicolas Pellerin et.al [2] investigated the turbulent flow over NACA0012 airfoil with Reynold's number 5×10^6 by using LBM method with multi - domain grid refinement, cascaded collision operator and considered Spalart – Allmaras model to compare the results in terms of force coefficients, pressure profiles, and velocity profiles. Olubunmi Popoola et.al [3] has investigated the accuracy of the turbulence models such as Standard, RNG, Realizable k-ε Models, Standard and SST k-ω Models, Transition k-*kL*-ω Model and the Transition SST Model for the simulation of higher heat

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RESEARCH ARTICLE OPEN ACCESS

Experimental Investigation on Mechanical Behavior of Banana, Coconut and Glass Fibre Reinforced Composites

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Abstract

The present work aims to experimentally investigate the mechanical behavior of composite specimens made using natural and synthetic fibres. The prepared composite specimens using banana, coconut and glass fibre reinforcements are further tested for its mechanical properties such as tensile, bending and impact strength per ASTM standards. The specimens made out of Glass fibre is found to have superior mechanical properties than natural fibres in all the three different mechanical properties at a higher percentage. The coconut fibre has less strength than banana fibre in case of bending strength and higher strength in tensile property consideration.

Keywords: ASTM Standards, Banana Fibre, Coconut Fibre, Glass Fibre .

1. Introduction

The use of renewable materials as reinforcement in composites is growing steadily. In particular, advantages such as accessibility, low cost, non-hazardous nature and positive impact on environment have attracted attention of the researchers towards natural fibres. The replacement of synthetic fibres with natural ones does not occur in high loading application. Nevertheless, medium load application, especially in the automotive sector, can accommodate natural fibre reinforced composites more easily based on decreased fuel consumption. The composites are developed using various natural fibres such as banana, coconut, bamboo, flax, hemp, sisal, jute and coir. The development of composites with natural fibres expresses a lot of challenges. The natural fibres have wide range of physical and mechanical properties that is related to the original sources such as diameter, length, specific gravity, methods of processing treatment etc. governing its wider

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Experimental Investigation on Effect of FSW Parameters on Hardness and Microstructure of AA 6061 and AA 5083

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Abstract: **The current investigation aims in assessment of the hardness and microstructural evolution of friction stir welded dissimilar metal alloy joints. The present work considers the aluminium alloys AA 6061 and AA 5083 in the form of sheets of 6mm thickness for the fabrication in the form of butt joint through friction stir welding using H13 tool steel FSW tool. Dissimilar friction stir welded joints were fabricated by varying the process parameters like rotational speed, traverse speed and axial force. The selected parameters are varied with three levels and three different specimens have been welded and the properties like hardness, microstructure is evaluated in this process. The selected factors have shown considerable effect over the hardness at the stir zone. The microstrutural examination has revealed that eutectic particles of Al-Mg-Si in matrix of AL solid solution present in all the three specimens.**

Keywords: **AA 5083, AA 6061, Friction Stir Welding, Hardness, Micro Structure.**

1. Introduction

Aluminium and it's alloys has received a great attention in usage to act as a potential material for making products in many industries such as aerospace, automobile, construction, marine and so on. Aluminium is available in numerous series which can be treated further for making suitable for a particular application. The properties of the aluminium alloys can be varied by subjecting them to a suitable treatment before and after the manufacturing process Alloy systems are classified by a number system or by names indicating their main alloying constituents. Selecting the right alloy for a given application entails considerations of its tensile strength, density, ductility, formability, workability, weldability, and corrosion resistance, to name a few. Aluminium alloys are used extensively in aircraft due to their high strength-to-weight ratio. On the other hand, pure aluminium metal is much too soft for such uses, and it does not have the high tensile strength that is needed for airplanes and helicopters. With the growth of Aluminium within the welding fabrication industry, and its acceptance as an excellent alternative to steel for many applications, the welding of aluminium alloys by different processes and the effect of process parameters over the mechanical properties, metallurgical characteristics, temperature distribution, and residual stresses at the joint has become a field of interest in research [1]. The traditional joining process adopted to join similar and dissimilar aluminium alloys in the past has shown considerable defects at the joint and it has shown a direction to find an alternate solution for overcoming this problem. Many Researchers have suggested that Friction Stir Welding has evolved as a potential solution for producing welds on aluminum and magnesium alloys [2].

2. Literature Survey

J. Stephen Leon and V. Jayakumar [3] has investigated the mechanical properties of AA6061 alloy plates welded by FSW process and made a comparison with parent metal. The authors have selected a plate of dimension 300mm x150mm x 6mm for welding the plates by varying the parameters such as tool rotational speed and welding speed. The area of the weld nugget zone size slightly decreased as the welding speed increased. Comparing with other welding speeds, the lowest speed 16mm/min results better mechanical properties and increase in the area of the weld nugget. The authors have reported that the weld joint made by means of FSW have shown a superior tensile properties and impact strength than the parent metal due to higher hardness and fine microstructure. The most significant parameter which affects the mechanical properties is found to be the welding speed selected.

Ramaraju Ramgopal Varma, Abdullah Bin Ibrahim, Mohammed, Arifpin Bin Mansor [4] have reported about the effect of FSW input parameters such as rotational speed, traverse speed and axial load over the joint created by using dissimilar metal combinations. The authors have considered AL 5083 in the advancing side and AL 6061 in the retreating side. The authors have considered taguchi's L8 Orthogonal array for creating the experimental design matrix which consists a total of 8 experimental runs. The authors have evaluated the mechanical properties such as yield strength, elongation, tensile

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Investigation On Drag Force Reduction by Aerospikes Using CFD

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***Abstract*: Drag force reduction over missiles has become a common problem of study in the present scenario. The presence of spikes in forward facing missile has shown a remarkable influence in reducing the drag force created with the base cone blunt shape. The present work considers the brahmos missile model for analyzing the presence of spikes in hemispherical and triangular form in reducing the drag through ANSYS CFD module by considering a free flow stream with a mach number of 2.75 at zero-degree angle of attack over the missile. The results obtained have shown that the hemispherical model has reduced the drag by 4% than the triangular spike model. The variation of spike geometry and dimensions may be considered for further study.**

***Keywords*: Aerospikes, Brahmos Missile, CFD, Drag reduction, Hemispehrical Spike, Triangular Spike.**

1. Introduction

The study of a moving body in the presence of air and its related response over the flow is an interesting and essential area of aeronautical and automobile engineers as the study has more valuable contribution towards the design of aircrafts, missiles and rockets. The aircraft and missiles are bodies that are heavier than air and so can support their weights only if they produce a force to counter it. This force can be either lift force generated by the flow of air over the wings and body or generated by means of an engine in the form of thrust. A moving body in the presence of air experiences an opposing force in motion called as drag which has to be generally countered by engine's thrust. The drag force created has depends upon fineness or bluntness and size of the body. To minimize the drag force one has to choose the aerodynamic shape without compromising the essential and desired functional requirements. Aerodynamic characteristics of various external components and their configuration aid their selection towards an optimum missile performance with respect to its lift and drag characteristics, aerodynamic stability, maneuverability, etc. Comprehensive and accurate data to enable a missile technologist to zero-in on a particular configuration is not readily available since much of the essential data is classified. The fundamentals of many technically specialized areas such as aerodynamics, thermodynamics (mainly heat transfer), kinematics, propulsion, structural design-are a necessity though it makes the task of the aeronautical design engineer rather complex. The body of the missile may be divided into three major sections the - fore body or the nose, the mid-section and the aft or boat-tail section. The Fig. 1 shows the schematic diagram of missiles.

1) Nose Section

Forebodies may have many varieties of shapes, most common of which are conical, ogival, power series or hemispherical. These shapes are used primarily on the missiles of supersonic speeds and are generally selected on the basis of combined aerodynamic, guidance and structural considerations. A hemispherical nose has very high drag from the aerodynamic drag or performance standpoint, but it is excellent from the standpoint of structural integrity, resistance to aerodynamic heating and amenability to certain types of guidance like infrared guidance. Since the pressure or wave drag may be several times that due to friction at supersonic speeds, careful selection of the nose shape needs attention to assure satisfactory performance of the overall system.

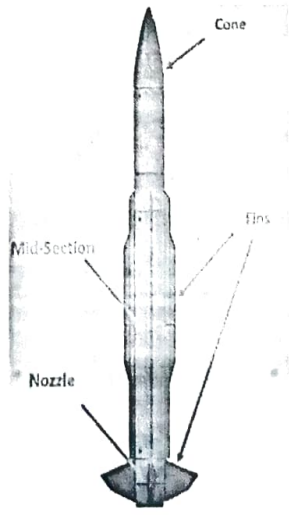

Fig. 1. Schematic diagram of missiles

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Experimental Investigation of Gyroscopic Couple by Response Surface Methodology

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***Abstract*: The investigation about the influence of input parameters over the output parameters through designed experiments has become a growing trend in understanding the relationship between them. It is highly essential to ascertain the effect of one over the another to avoid undesired results. The major objective of this experimental investigation is to conduct designed experiment to evaluate gyroscopic couple through Response Surface Methodology (RSM). It has been adopted for creating the full factorial experimental design using Design Expert 11.0 software to study the effect of Speed and Load which are varied with three levels. The output values of gyroscopic couple are further analyzed to identify the significant parameter influencing the gyroscopic couple using ANOVA technique. Load is found to be more significant than speed over both the measured responses angle turned, time taken and the calculated response gyroscopic couple The predicted equation for gyroscopic couple may be used for further processing.**

***Keywords*: ANOVA, Central composite design, Gyroscopic couple, Response surface methodology.**

1. Introduction

The field of optimization has been considered by most of the authors and researchers in order to achieve their desired outputs. Optimization is actually adopted to identify the best parameter combination and also the significant parameter which influences the output parameter. Response Surface Methodology is a type of experimental design used for creating the experimental plan or layout by using different parameters associated with a process. It finds application in many areas of mechanical engineering in optimization of process parameters such as traditional machining, welding, engine performance improvement, tool wear reduction, enhancement of material removal rate and so on. Avinash A. Thakre et. al [1] has described that Response surface methodology is a powerful statistical tool for mathematical modeling of engineering systems and for optimization of the process parameters. The steps of this process start with the identification of the control parameters and their domain under consideration. The next step is to select the orthogonal design and to conduct the experiments based on this design. Then the empirical models are developed between the response and the process variables. Ashvin J et. al. [2] has investigated the influence of turning process parameters such as Cutting speed (v), Feed rate (f), Depth of cut (d) and Nose radius (r) over the output parameter surface roughness for AISI 410 Steel through RSM technique by conducting 81 experiments in total and reported parameter feed rate has the highest influence over surface roughness Pardeep Sharma [3] has reported about the dry sliding wear of aluminium metal matrix composites through by applying RSM technique for Parameter optimization and found that Sliding distance is the most influential factor on wear rate of composites than load, speed and percentage reinforcement. E.O. Ajala et. al [4] has adopted response surface methodology for optimizing the two stage process of biodiesel production from shea butter. The authors had selected four different operating conditions to conduct investigation and to reduce the free fatty acid content present in shea butter and to increase the percentage yield of shea biodiesel. Sarehati Umar [5] has utilized response surface methodology for the damage detection using frequency and mode shape.Sourab Sinha [6] has investigated the effect of input parameters such as current, voltage and pulse on-time which influences the two major response characteristics namely material removal rate (MRR) and tool wear rate (TWR) and found that current is the most significant factor for the material Incoloy 800HT machined using EDM technique. Ajitanshu Vedrtnam [7] has done optimization of submerged arc welding process parameters through response surface methodology, regression analysis and genetic algorithm. The authors have considered the input parameters such as arc voltage, welding current, nozzle to plate distance and welding speed for understanding their effect over the weld quality of stainless steel material.

2. Gyroscope

A gyroscope is a device used for measuring or maintaining orientation and angular velocity. It consists a spinning wheel or disc in which the axis of rotation (spin axis) is free to assume any orientation by itself. When rotating, the orientation of this axis is unaffected by tilting or rotation of the mounting, according to the momentum. Gyroscopes based on other

Application Of Taguchi's Experimental Design And Range Analysis In Optimization Of FDM Printing Parameters For PET-G, PLA And HIPS

N. Mohammed Raffic, Dr.K.Ganesh Babu P.Madhan

Abstract: The present work aims to conduct optimization of Fused Deposition Modeling printing parameters for three different materials namely PET-G, PLA and HIPS which has less consideration than the conventionally adopted material ABS by various authors in the area of research in past decades for the assessment of specimen weight and fatigue strength. The FDM printing parameters such as Slice Height, Infill Density, Shell Thickness and Raster Angle are varied with three levels (3^4) to create the experimental design matrix as per Taguchi's experimental design.Taguchi's S/N ratio method and Range Analysis are the analysis tools considered for obtaining the optimum parameter combination and significant factor over the output responses measured. From both the above mentioned methods it is observed that Infill density is the most significant factor which affects the specimen weight by contributing 92.14% , 88.86% , 63.52% and fatigue strength by 60.18% , 50.86% , 53.90% for PET-G,PLA and HIPS. PET-G is found to have more fatigue strength than PLA and HIPS. The specimens made out of HIPS are found to weigh less than other materials considered. The optimum parameter combination for both the responses are found to have good agreement in all the three materials considered. Inclusion of other input printing parameters associated with the process and adoption of various DOE methods and optimization techniques are suggested as further research directions from the present work to have a deep insight of the study concerned respectively

Index Terms: ANOVA, Fatigue Strength ,FDM , Range Analysis, Signal to Noise Ratio,Taguchi's Orthogonal Array.

I. INTRODUCTION

The continuous growth and long time success of any industry in the market has a linear relationship with customer satisfaction it attains through its products and best services it provides. Optimization is a procedure adopted by engineers and scientists in order to reduce the variation occurring in a product by controlling the parameters and characteristics pertinent to product design and development. The input process parameters selected will have a serious effect over the final performance of a product or system with no doubt. Many methods like Taguchi's Orthogonal Array, Response Surface Methodology are generally adopted by authors to create the experimental plan and the experimental data is further analyzed to obtain the optimum parameter combination and also the significant parameter which has the maximum effect over the final response under study. Samir Kumar Panda [1] et.al has conducted studies to optimize the FDM input parameters such as layer thickness, build orientation, raster width, air gap and raster angle for ABS – P400. The authors have experimentally identified the various mechanical properties like mechanical, flexural and impact strength of FDM samples through the experimental plan devoloped by Central composite design. The experimental results obtained are further analysed using bacterial foraging technique for identifying the optimum parameter combination.

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The authors have advised to avoid small raster angle which may result in stress accumulation in the direction of deposition and higher raster width may improve strong bond formation between the rasters. Vishwas M [2] et.al has optimized the FDM process parameters for materials such as ABS and Nylon by considering the input parameters model orientation, shell thickness and layer thickness. The taguchi's L9 orthogonal array experimental plan has been devised for conducting the experiments for identifying the ultimate strength and dimensional accuracy of the parts prepared by both ABS and Nylon using FDM Pramaan Mini machine. The results observed are further analysed through Signal to noise ratio method and it has been identified that both shell thickness and orientation angle are most impacted process parameters over the mechanical properties of both the materials. The optimum parameter combination has also been communicated for good achievement of dimensional accuracy of parts printed. John Ryan C. Dizon [3] et.al has made a detailed review on various additive manufacturing techniques commercially available in the market such as Fused Deposition Modeling, Stereo lithography, Digital Light Processing, Selective Laser Sintering, Polyjet Printing and Laminated Object Manufacturing their capabilities, advantages and applications in various sectors. The authors have finally made a conclusion by developing various reasonable questions by having deep insight into the technological capabilities, testing standards, open source software used and mechanical properties arrived through various research methods and the standards followed in conducting the mechanical tests for the evaluation of Tensile, Compressive , fatigue and impact. Anoop Kumar Sood [4] et.al has made a study to improve the dimensional accuracy of FDM processed parts using grey taguchi method by considering layer thickness, raster width , air gap and orientation. J.Santhakumar [5] et.al has made an attempt to enhance the impact strength of polycarbonate material processed by FDM by considering the four input parameters such as layer thickness, build orientation , raster angle and raster width through taguchi's experimental design . Imthiyaz Khan and Dr.A.A.Shaikh [6] has reported a review on FDM based parts to act as rapid tooling and discussed about stair case effect

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Experimental Investigation on Mechanical behavior and Microstructural Characterization of AA7075 Reinforced with TiB_2 Particles Produced via Stir Casting Process

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ABSTRACT: Aluminium Metal Matrix Composites (AMMC) has been used in fields such as aerospace, automotive, marine and defense owing to its attractive benefits such as high strength to weight ratio, high ductility and corrosion resistance. The present work studies the mechanical and tribological behavior of AMMC specimens prepared adopting stir casting method by varying the weight percentage of titanium diboride (6%, 8%, and 10%) and also conducts microstrutural study. The results indicates that the increase in weight percentage of titanium diboride reinforcement in AMMC increases the mechanical and tribological properties measured such as tensile strength , hardness and wear resistance. Tensile strength increases by 27.63 % and hardness increases by 16.23% for reinforcement with 10% weight comparing to 6% reinforcement weight. The wear rate has got a considerable decrease with increase in weight percentage of reinforcement. The microstructural characterization reveals that uniform mixture is obtained through the stirring process of AMMC manufacturing.

Keywords – AA7075, Friction Stir Casting, SEM Analysis, Titanium Particles

Nomenclature

AMMC – Aluminium Metal Matrix Composite

EDM – Electric Discharge Machining

HMMC – Hybrid Metal Matrix Composite

MMC – Metal Matrix Composites

SiC – Silicon Carbide

TiC – Titanium Carbide

TiB_2 – Titanium Diboride

Al_2O_3 - Aluminium Oxide

B_4C - Boron Carbide

TiO_2 - Titanium Dioide

1. Introduction

Composite materials are the one which has two different materials combined together to act as a single material which has distinct properties than the property exhibited by them individually. Composite materials find applications in numerous fields such as aerospace, automotive, marine, defense and so on. The major advantages of composite materials include high strength to weight ratio, high corrosion and wear resistance, light weight , fatigue strength and more. Composite materials may be

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Optimization and thermal analysis of friction stir welding of AA 6061-AA 8011 joints

Navaneethan Sabarirajan and Abdullah Naveen Sait

From the journal Materials Testing
https://doi.org/10.3139/120.111473

Abstract

In the present work, joining of dissimilar aluminum alloys AA6061 and AA8011 was carried out by FSW butt joint. The Taguchi L_9 orthogonal array design of experiments was adopted for the experiments to estimate

from pin and work piece interaction of each position during welding. In this investigation the transient temperature levels of the weld zone during welding and after welding were investigated. Likewise the curves of transient temperatures were plotted with the aid of Origin Pro 2018.

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Prof. Dr. Abdullah Naveen Sait, born in 1976, obtained his Ph.D in 2008, his Master's in 2001 and Bachelor's in 1998. Dr. A. Naveen Sait is conducting research in the field of Materials. Presently, he is serving as Principal and Professor at M.I.E.T. Engineering College, Trichy, Tamil Nadu, India.

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ScienceDirect

Materials Today: Proceedings
Volume 33, Part 7, 2020, Pages 2521-2523

A novel technique to design and production of coil spring in centre lathe

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https://doi.org/10.1016/j.matpr.2019.12.015

Abstract

In this investigation is mainly focused on to design and production of a coil spring in a center lathe machine. The lathe machine is simply operated by a simple electric power; it has different operating speeds to form a coil spring with using of tumbler gear mechanism. The tumbler gear mechanism used for to make different diameter of the spring with different pitch. In this research the different diameter of shaft held in the chuck to produce different diameter of spring. The main purpose of the shaft to act as a guide for producing a spring under the various dimensions. The wire guider unit is used to guide the raw material as a spring wire, the wire guider unit is fixed in the tool post and also it moves on the lathe bed freely by moving of carriage unit along on the bed. The lead screw rotation and automatic movement of carriage are achieved by the tumbler gear mechanism. Variety of size also can be produced easily with short period.

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Machining parameters optimization of Aluminium Alloy 6063 with reinforcement of SiC composites

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Outline | Share Cite

https://doi.org/10.1016/j.matpr.2019.12.085

Abstract

The aim of this investigation is to optimize the effects of machining parameters of CNC milling machine for the Aluminium Alloy AA6063 + SiC with response of surface roughness by employing Taguchi tool. The machining parameters of this investigation are Cutting Speed, Feed rate, and Depth of cut. Taguchi tool as L9 orthogonal array and three levels of machining parameters are used to estimate the output such as surface roughness. The nine specimens of experiments are used to calculate the surface roughness. The ANOVA is mainly support to intimate which parameter is more influence for this investigation. Among three parameters, feed as more significant factor to response value followed as depth of cut and cutting speed.

Previous Next

Keywords

Taguchi tool; Surface roughness; ANOVA; AA6063; Reinforcement

ScienceDirect

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Analysis and design of smart paper punching machine for spiral binding

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https://doi.org/10.1016/j.matpr.2019.12.105

Abstract

In this study mainly concentrated on the automation method to produce new equipment. The Paper punching machine is one of the important equipment for to make holes for spiral binding process. The existing mechanism is a difficult one to form a hole based on the increasing of paper count, much more human effort is also needed. This study and design is to improve the equipment in the sense of automation, the automation help to improve spiral binding works with produce bulky spiral binding in the short period and also reduce the human effort. In this study replacing of pedal operated mechanism and introduces electric motor with drive mechanism, reduction gear box and cam mechanism.

Previous Next

Keywords

Spiral; Automation; Punching; Gear box; Hole

ScienceDirect

Materials Today: Proceedings
Volume 37, Part 2, 2021, Pages 1690-1692

Experimental study on whirling speed of least dimensional mild steel shaft for toy cars

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Abstract

This experimental study deals about the whirling speed impact based on the influence of speed for the same material with same dimensions. In this investigation deals about mild steel material whirling speed which is used to maintain the design of the particular material-based usage in small level motor shaft application like toys, small equipments, moving machineries parts. In this place minimum shaft size such as 5 mm used for investigation. The corresponding deflection plays the main role on whirling speed which is measured with the help of non-contact sensors connected on the experimental setup.

Previous Next

Keywords

Shaft; Whirling speed; Mild steel; Deflection; Frequency

MICROSTRUCTURAL AND TRIBOLOGICAL CHARACTERIZATION OF Al/EGG SHELL ASH COMPOSITES PREPARED BY LIQUID METALLURGY PROCESS

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ABSTRACT

The objective of this present research study is to evaluate the mechanical characterization of composite materials, which were synthesized by a stir casting technique. AA6082 is chosen as matrix material and egg shell ash (ESA) particles as reinforcement. The base alloy and proposed composite specimens were subjected to hardness, tensile and wear test. Metallurgical characterization and worn surface of parent material and synthesized material were investigated by a scanning electron microscope (SEM). Mechanical properties like micro-hardness (HV) and ultimate tensile strength (UTS) of the developed composite materials were improved after the addition of reinforcement content. The microstructural changes in composites before and after inclusion of reinforcement is detailed in this article. Tribological behaviour of the composites was investigated by pin-on-

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Materials Today: Proceedings
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Prediction of surface roughness and tool wear in milling process on brass (C26130) alloy by Taguchi technique

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https://doi.org/10.1016/j.matpr.2019.04.219

Abstract

The machining parameters is optimized during CNC end milling process of brass C26130 alloy using Taguchi technique. The experimental results shows that the combination of 750 rpm spindle speed, 20 mm/rev feed rate and 1 mm depth of cut was identified as the optimum level for minimum surface roughness (SR) and the combination of 750 rpm spindle speed, 60 mm/rev feed rate and 0.75 mm depth of cut was identified as the optimum level for minimum tool wear (TW). ANOVA results revealed that the spindle speed and feed rate was identified as the highest influencing parameters on SR and TW.

Previous Next

Keywords

Brass (C26130) alloy; End milling; Surface roughness; Tool wear; Taguchi technique; ANOVA

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Materials Today: Proceedings
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Effect of EDM process parameters on material removal rate and surface roughness of metal matrix composites: A review

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Outline | Share Cite

https://doi.org/10.1016/j.matpr.2019.06.725

Abstract

Electric erosion process is generally used for processing the metal matrix composites which have more applications in aerospace, aircraft and automobile sectors. Metal Matrix composites have attractive physical and mechanical properties like light weight, high specific modulus, highest strength and thermal stability. The present review is discussed about Electric erosion process and its input and output parameters such as Pulse on time, Pulse off time, Current, etc. on the material removal rate and surface roughness of the composites. This review paper also address the principle of electric erosion process and the impact of the surface properties of the processed composites.

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Materials Today: Proceedings
Volume 27, Part 2, 2020, Pages 1152-1156

Processing and properties of carbon nanotube reinforced composites: A review

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Outline | Share Cite

https://doi.org/10.1016/j.matpr.2020.02.006

Abstract

In the 21st century, the application of carbon nanotubes reinforced composite develop and offer the high specific stiffness and strength. In exacting, the outstanding properties of Carbon Nanotube have low density, elevated elastic modulus, excellent electrical and thermal properties suggest the progress of CNTs reinforced composites. The fabrication of CNTs reinforced composites based on interfacial relationships between carbon nanotubes and the matrix material it acting homogeneous distribution of CNTs in a matrix material. This paper showed a detailed report of process and properties of CNTs and their composites. We study the literature work on the processing and properties of CNTs in addition to development of mechanical and electrical properties of CNTs reinforced composites.

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Materials Today: Proceedings
Volume 27, Part 2, 2020, Pages 1137-1141

Mechanical properties of magnesium-silicon carbide composite fabricated through powder metallurgy route

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https://doi.org/10.1016/j.matpr.2020.01.592

Abstract

In this present work, Magnesium metal matrix composites reinforced by silicon carbide were synthesized and fabricated by means of powder metallurgy process. Magnesium powder with 0, 4, 8 & 12 wt% SiC was blended in ball mill for 10 min. Then the cold compaction was done by using compression machine was compressed pressure of 650Mpa at suitable die. The sintering method was performed at 500°and 670 °C and hold time of 30 min using microwave furnace and to achieve better result to sinter the Mg metal matrix composites. The microstructure, density, compressive strength and hardness of the resultant Magnesium-Silicon carbide composites were studied. It was observed that the 12 wt% Silicon carbide reinforcements lead to the improvement in mechanical properties such as high density, high hardness, high compressive strength and high impact strength. Moreover, the outcome exposed that the density, hardness, compressive strength and impact strength of the composite was obviously higher than that of the Cast Magnesium and

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Materials Today: Proceedings
Volume 27, Part 2, 2020, Pages 1132-1136

Investigations on properties of Mg-Al_2O_3 composites fabricated via stir casting route

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Outline | Share Cite

https://doi.org/10.1016/j.matpr.2020.01.586

Abstract

Magnesium metal matrix composites are extremely attractive for application of light and strong materials in various industries. In the present work, Magnesium matrix composites reinforced by Al_2O_3 with different weight percent of particles were synthesized and fabricated by means of Stir casting process. The property of Al_2O_3 particle content with different weight percent of particles on the mechanical properties of the composites such as density, porosity, hardness and tensile strength were investigated. The microstructures of magnesium metal matrix composites were studied using scanning electron microscope. It showed the uniform distribution of Al_2O_3 in Mg metal matrix composites and bonded to the composites. The results show that the hardness and the tensile strength of the composites increased with increasing weight fraction of Al_2O_3 particles.

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Materials Today: Proceedings
Volume 27, Part 2, 2020, Pages 853-858

A Taguchi coupled desirability function analysis of wire cut EDM behaviour of titanium dioxide filled aluminium matrix composite

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Outline | Share Cite

https://doi.org/10.1016/j.matpr.2020.01.021

Abstract

The current investigation was, to optimize the parameters for wire cut electric discharge machining (WCEDM) of Al7075 alloy based matrix composite. The Al7075 alloy incorporated with TiO_2 (10 wt.%) particles was produced by stir casting process. Experiments were carried out by selecting the various WCEDM parameters like pulse current (amps), pulse on-time (μs) and pulse off-time (μs). A Taguchi coupled desirability function analysis was employed to determine the optimal parameters with an objective to maximize the material removal rate (MRR) and minimize the surface roughness (SR). The optimum level of WCEDM parameters were obtained by a largest value of composite desirability (d_G). The optimal level of parameters obtained are pulse current at 160 amps, pulse on-time at 120 μs and pulse off-time at 50 μs. Moreover, analysis of variance (ANOVA) was applied to indicate the significant effect of parameters to the

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Materials Today: Proceedings
Volume 27, Part 2, 2020, Pages 1192-1196

Prediction of optimum electric discharge machining parameters for AA7075-SiC composites

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https://doi.org/10.1016/j.matpr.2020.02.082

Abstract

In this research, Electric Discharge Machining parameters current, pulse on time and voltage were optimized for machining Aluminium7075-8%SiC composites. The composites were fabricated by stir casting route. The experiments were designed and carried out as per design of experiments approach using L9 Orthogonal Array. The response values selected in this research were surface roughness and material removal rate (MRR). Taguchi optimization technique was employed to identify the optimum parameter for minimum surface roughness and maximum MRR. Analysis of Variance (ANOVA) was employed to determine the ultimate contributing parameter for the response values. From this study, the optimum parameter for lower surface roughness was $A_3B_2C_1$ and for higher MRR was $A_2B_1C_2$.

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Materials Today: Proceedings
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Parametric optimization for friction stir welding with AA2024 and AA6061 aluminium alloys by ANOVA and GRG

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https://doi.org/10.1016/j.matpr.2019.11.257

Abstract

Aluminium alloy AA2024 and AA6061 welding and its combinations have been consistently represented a respectable challenge for creators and expertise. The alloys 2024 and 6061 composites, especially heat-readable materials, are hard to bond by combination affixing systems. The different combination of welding, for example, AA2024 and AA6061 Alloy is a significant issue during FSW. In this article, the impact of Rotation speed; Travel Speed; and Different Diameter of Tool Pins of 2024 and 6061 alloy through FSW was examined by GRA (Grey Relational Analysis). The ANOVA was utilized to try out the preeminent significant travel speed of welding and speed of tool rotation influencing the responses. The essential and collaboration effect of data features on the ordinary responses are analyzed. The normal qualities and estimated qualities are truly close.

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Materials Today: Proceedings
Volume 27, Part 2, 2020, Pages 946-950

Optimization on machining parameters of friction surfacing of SS304 over iron plate

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Abstract

Surface engineering deals with the surface of the material and it was sub-discipline of materials science. Wear can be reduced by modifying the surface properties of solids by coating hard material or by use of lubricants. Friction surfacing is one of the surface coating method which gives better bonding on plane surfaces. In this work, iron plate was taken as substrate and stainless steel (SS) 304 was used as coating material. The experiment was conducted based on L9 orthogonal array. The parameters chosen for the experiment were rotational speed, axial load and traverse speed. The response values were hardness and maximum displacement in order to improve the wear, corrosion and bonding strength. The results were analyzed using Taguchi method to find the optimum machining parameters and to identify the effect of machining parameter for maximum hardness and displacement. ANOVA was employed to confirm the

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Optimization of material removal rate in CNC turning of AA2024 via Taguchi technique

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https://doi.org/10.1016/j.matpr.2020.02.045

Abstract

The aim of the research work is to achieve higher material removal rate in CNC Turning of AA2024 via Taguchi Technique. The present work examines the effects of cutting parameters like speed, feed and depth of cut on material removal rate of AA2024. Taguchi methodology has been applied to optimize cutting parameters. The experiments were conducted using L16 orthogonal array. The research exposures that the material removal rate is directly driven by the speed, feed rate and depth of cut. It was identified that the material removal rate increases with related to feed rate, spindle speed and frequently for all depth of cut.

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Materials Today: Proceedings
Volume 27, Part 2, 2020, Pages 1051-1054

Optimization of electric discharge machining process parameters on AA6351-Al_2O_3 composites

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Abstract

Electrical discharge machining (EDM) erstwhile considered as significant method for machining hard to-machine materials specifically metal matrix composites. In this research work an effort has been conducted to examine the effect of electric discharge machining process parameters Current (I), Pulse On Time (T_{ON}) and Voltage (V) on metal removal rate (MRR) and surface roughness (SR) of AA6351-10 wt%.Al_2O_3 composites produced through stir casting technique. Taguchi L9 orthogonal array was utilized to attain optimum parameters. From the examination it has been exposed that current is the foremost noteworthy parameter that distresses the MRR and SR.

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Volume 27, Part 2, 2020, Pages 1006-1012

Optimization of electric discharge machining parameters on surface roughness for Al/ZrO_2 composite through response surface methodology

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https://doi.org/10.1016/j.matpr.2020.01.344

Abstract

In present investigation, aluminium matrix composite reinforced with 15 wt% zirconium dioxide (ZrO_2) particulates was fabricated through stir casting route. Electric discharge machining (EDM) was carried out to machine the produced composite using copper electrode. Pulse current, pulse on-time and pulse off-time were chosen as input parameters and surface roughness (SR) was considered as output machining performance characteristic. The experimental plan has been adopted by Box Behnken design (BBD) of response surface methodology (RSM). This technique was used to developed a mathematical model for analyze the machining performance characteristic. Furthermore, analysis of variance (ANOVA) was applied

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Materials Today: Proceedings
Volume 27, Part 2, 2020, Pages 925-930

Influence of CNC turning variables on high strength Beryllium-Copper (C17200) alloy using tungsten carbide insert

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https://doi.org/10.1016/j.matpr.2020.01.260

Abstract

The current investigation is, to determine the optimum process variables on CNC turning operation of Be-Cu (C17200) alloy using grey relational approach (GRA). In GRA, optimum level of turning variables can be identified by the grey relational grade as the performance index. In present work, the three turning variables were chosen namely cutting speed (V_1=800 rpm, V_2=1000 rpm and V_3=1200 rpm), feed rate (F_1=0.10 mm/rev, F_2=0.12 mm/rev and F_3=0.14 mm/rev) and depth of cut (D_1=0.8 mm, D_2=1.0 mm and D_3=1.2 mm) and the output responses such as material removal rate (MRR) and surface roughness (SR) were considered. A grey relational grade attained from the GRA was used to identify the optimum turning process variables on multi response characteristics with an objective to maximize the MRR and minimize the SR. Based on the grey relational grade, optimum level of turning variables was identified as $V_3F_3D_2$ that

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Materials Today: Proceedings
Volume 27, Part 2, 2020, Pages 748-751

Friction stir processing (FSP) of numerical study based on design of experiment-review

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https://doi.org/10.1016/j.matpr.2019.12.035

Abstract

An article of review formulates the fundamental standard and numerical approach of FSP. The quality of friction stir processed joint and methods can be enclosed by specialized analytical conditions. An audit about the use of reaction surface technique (RSM) in the advancement of systematic strategies is introduced. The hypothetical standards of RSM and ventures for its purpose are portrayed to explain peruses with this multivariate measurable method. Even the test plans like central composite design, three-level factorial and Box-Behnken) are thought about as far as qualities and productivity. Besides, ongoing references of their uses in friction stir processing are exhibited. The applying of multi response

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Materials Today: Proceedings
Volume 27, Part 2, 2020, Pages 1118-1121

Effect of various reinforcements on properties of metal matrix composites: A review

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Abstract

Nowadays metal matrix composites (MMCs) playing an energetic role in engineering applications in the field of aerospace, automobile and structural despite of superior properties. The inclusion of various reinforcement into the metal matrix enhances the strength, hardness, stiffness and reduces the wear and density of the materials. This article made an effort to present the influence of various reinforcement such as B_4C, TiC, SiC, WC, Cr_3C_2, Al_2O_3, TiO_2, ZrO_2, SiO_2, MoO_3, MoS_2, AlN, Si_3N_4, ZrB_2, TiB_2 and Gr on the

IOT AND Wi-Fi BASED HOME AUTOMATION CONTROL FOR VARIOUS APPLIANCES

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ABSTRACT

This IoT that allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for much direct integration of physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit. In research, we have integrated Solar-based system to implement home automation. The objective of research is Home automation using IoT within integration of Solar based energy system. Integration of sensing systems, connected to Internet, is likely to optimize energy consumption as a whole. It is expected that IoT devices would be integrated into all forms of energy consuming devices (switches, power outlets, bulbs, televisions, etc.) and be able to communicate within utility supply company in order to effectively balance energy generation and energy usage. Solar Energy System is that properly installed and adequately sized will not really require much in way of management.

Keywords: IoT, Energy consumption, Solar based system

I. INTRODUCTION

The objective of the research is Home automation using IoT within integration of Solar based energy system. Integration of sensing & actuation systems, connected to the Internet, is likely to optimize energy consumption as a whole. It is expected that IoT devices will be integrated into all types of power consuming devices (switches, power outlets, bulbs, televisions, etc.) & be able to communicate within utility supply company in order to effectively balance power generation & energy usage. Solar Energy System that is properly installed & adequately sized would not really require much in way of management as shown in fig. 1.

I have designed and wrote it simulation to demonstrate basic operation of a solar energy electric power system only for three things need to be considered.

(i) Level of charge on battery bank. (AmpHour Meter)
(ii) Amount of charging power coming in. (Solar Amps Meter),
(iii) Amount of power being used. (AC Amps Meter).

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A Survey on Emergence of Citation Network using Knowledge Core

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ABSTRACT: The major aims of this method a secure multi-owner data sharing scheme. It implies that any user in the group can securely share data with others by the un trusted cloud. This scheme is able to support dynamic groups. Efficiently, specifically, new granted users can directly decrypt data files uploaded before their participation without contacting with data owners. User revocation can be easily achieved through a novel revocation list without updating the secret Keys of the remaining users. The size and computation overhead of encryption are constant and We present a secure and privacy-preserving access control to users, which guarantee any member in a group to anonymously utilize the cloud resource. Moreover, the real identities of data owners can be revealed by the group manager when disputes occur. We provide rigorous security analysis, and perform extensive simulations to demonstrate the efficiency of our scheme in terms of storage and computation overhead. Cloud computing provides an economical and efficient solution for sharing group resource among cloud users. Unfortunately, sharing data in a multi-owner manner while preserving data and identity privacy from an untrusted cloud is still a challenging issue, due to the frequent change of the membership.

I. INTRODUCTION

AN enduring empirical observation on the connectivity among intellectual artifacts (e.g. patents, academic articles, etc.) is that, described as networks, they often hold a core-periphery structure – A group of densely interconnected artifacts contains the *core* knowledge to the field, which is commonly cited by *peripheral* artifacts.

This article is primarily interested in explaining how the core-periphery structure emerges over time in citation networks. A citation network is viewed as collection of artifacts created by individual authors in a decentralized manner. In creating an artifact, each author both makes citations to existing artifacts and creates new knowledge in the present artifact, in order to maximize their own utility. Both citation and knowledge creation are costly activities to the author. We furthermore incorporate the heterogeneity of artifacts: Knowledge stored in an existing artifact is only partially useful for creating a new artifact. In this line, our analysis reveals an explicit relation between artifact heterogeneity and the characteristics of knowledge core.

After all, our research delivers two streams of insights on the growth of citation networks:

- *Network structure*: What is the architecture of the citation network formed by decentralized, self interested knowledge contributions?
- *Knowledge creation*: How much knowledge does one create and how does the level of knowledge creation change over time? As an answer to the first question, our model produces a *core-periphery* landscape for the citation network. As for the second question, we characterize the optimal individual knowledge creation as a decreasing function of time. Compared to conventional statistics-based modeling of Networks.

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COAL MINE BASED ON WIRELESS UNDER-GROUND SENSOR NETWORK

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Abstract – Wireless underground sensor networks (WUSNs) can enable many important applications such as intelligent agriculture, pipeline fault diagnosis, mine disaster rescue, concealed border patrol, and crude oil exploration. The key challenge to realize WUSNs is wireless communication in underground environments. Many accidents have been done in the coal mine industry with serious casualties and large economic losses. By reducing the accidents in the global mining industry to improve overall mining safety and increase operational efficiency. This paper proposes a WUSN based coal mining safety monitoring. This system also provides an early warning, which will be helpful to all miners present inside the mine to save their lifes before any casualty occurs.

Keywords— WUSN, Coal mine, accidents, environments, safety.

I. INTRODUCTION

India is a large country with rich coals. However, the current safe production level of the coal mine is still low, especially in recent years, disasters in coal mine occur frequently, which lead to great loss of possession and life. The safety problems of coal mine have gradually become the focus that the nation and society concern on. The disasters happening in a coal mine are due to the complexity of mine environment and the variety of work condition of a coal mine, so it is very necessary to monitor mine working environment. It plays an important role in coal mine safe production monitoring systems and tends to be wired network systems. With continuous enlarging of exploiting areas and extension of depth in the coal mine, many laneways become blind areas, wherein there are lots of hidden dangers.

In order to solve the problems, we will design a coal mine safety monitoring system based on wireless underground sensor network(WUSN), which can improve the level of monitoring production safety and reduce accident in the coal mines Wireless sensor networks are composed of a large number of micro-sensor nodes which have small volume and low cost. It possesses self-organized capability by wireless Communication. Underground mines are usually extensive labyrinths, of which the tunnels are generally long and narrow with a few kilometers in length and a few meters in width. Thousands of mining personnel are needed to work under extreme conditions according to the construction requirements, and hundreds of miners die from mining accidents every year. It is now widely approved that underground mining operations are of high risk. However, a monitoring and control system needs to be established as one important infrastructure in order to ensure the mining safety and coordinate various tasks.

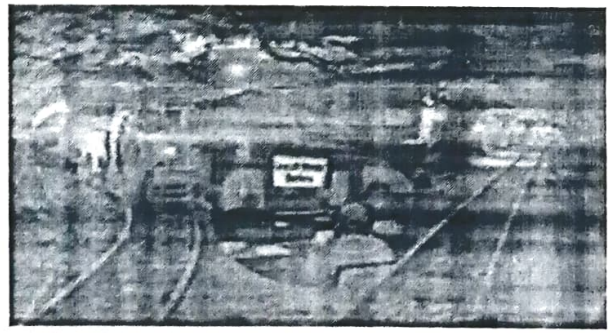

Fig. 1 Minning area

It consists of random passages, branch tunnels, and this disorganized structure makes it very difficult to deploy any networking skeleton. In such a case, the utilization of a wireless underground sensor network (WUSN) and other sensing devices may have special advantages for realizing the automation of underground monitoring and control due to the rapid and flexible deployment. In addition, the multi-hop transmitting method can well adapt to the tunnel structure and thus provide enough scalability for the construction of a mining system, and it is very suitable to the comprehensive monitoring and control in coal mines, which can effectively compensate the deficiencies of the existing underground cable monitoring

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Analysis and Experimentation of Grid Integrated PV-Battery System for Residential and Electrical Vehicle Applications

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Abstract- **A new control approach of integrating a solar PV (Photovoltaic) with battery storage is presented to a single phase grid for residential and electric vehicle application. Our aim of the proposed work is to increase the security of the system for that we are providing continuous power to the grid thereby enhancing the feasible of the charging and discharging power of storage support battery energy level and load level. In our system, once the alleviation of failure has been achieved it will be automatically rectified in the proposed system. The multifunctional voltage source converter acts as an active power filter and performs the harmonics mitigation along with reactive power compensation. The overall control of the system is adaptable under various practically occurring situations such as disconnection of PV array, battery, and grid from the system. The validity of the proposed system is performed through a laboratory prototype developed for a power rating of 2.2kWconnected to the utility grid. The performance of the system is found satisfactory under various disturbance and the recorded results have been demonstrated.**

Keywords: Solar PV, harmonics mitigation, electric vehicle, grid, energy level, load level

I. INTRODUCTION

A micro-grid is a localized group of electricity sources and loads that normally operate connected to and synchronous with the traditional wide area synchronous grid (micro-grid), but can also disconnect to "island mode" and function autonomously as physical or economic conditions dictate. Always renewable energy sources can supply emergency power and renewable electricity in a micro-grid whereas it is the combination of various sources of distributed generation, changing between the island and connected modes. Control and protection are challenges to micro-grids. A very important feature is also to provide multiple end-user needs as heating, cooling, and electricity at the same time since this allows energy carrier substitution and increased energy efficiency due to domestic hot water, waste heat utilization for heating, and cooling purposes. It can enable to operate in both connected or island-mode from the grid. A micro-grid can connect and disconnect from the grid The EU research project describes a micro-grid as comprising Low-Voltage (LV) distribution systems with distributed energy resources (DERs) (micro-turbines, fuel cells, photovoltaic (PV), etc.), storage devices (batteries, flywheels) energy storage system and flexible loads. From the main grid, it can operate either connected or disconnected for such systems. By using this system it provides an advantage to the overall system performance if managed and well organized.

II. LITERATURE SURVEY

Moacyr Aureliano et.al (2013) The main experimental results are presented for conventional MPPT algorithms and improved MPPT algorithms named IC based on proportional–integral (PI) and perturb and observe based on PI. Moreover, the dynamic response and the TF are also evaluated using a user-friendly interface, which is capable of online program power profiles and computes the TF.

Leopoldo Gil-Antonio at.al (2016) Despite their numerous advantages, PV systems have two major drawbacks: low energy conversion efficiency and loss of energy due to variations in meteorological conditions; for this reason, Maximum Power Point Tracking (MPPT) control techniques play a key role in exploiting the maximum energy caught by PV modules.

Yousef Mahmoud at.al (2016) This paper develops a fast modeling approach for partially shaded PV systems. By utilizing three developed rules that govern the formation of power peaks in partially shaded PV systems, the proposed approach can quickly find the power peaks of these systems without simulating the entire power curve. The effectiveness of the proposed approach in finding the power peaks of PV systems quickly and accurately.

Chinmay Jain et.al (2017) To implement adjustable DC link voltage structure, the reference DC link voltage is adjusted with variation in CPI voltage in real time. A PI (Proportional-Integral) controller is used to regulate DC link voltage to set reference value. A wide range of experimental results are shown to demonstrate the features of proposed system. The THD (Total Harmonics Distortion) of grid current has been found well under IEEE-519 standard even under nonlinear loads at CPI.

Rahul Kumar Agarwal et.al (2016) In order to increase the efficiency and maximum power to be extracted from the SPV array at varying environmental conditions, a single stage system is used along with P&O (Perturb and Observe) method of MPPT (Maximum Power Point Tracking) integrated with the LMF based control technique.

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Optimization of Turning Process Parameters for EN24 Steel Alloy using Experimental Design

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IJTSRD22911

ABSTRACT

The overarching aim of this work is to optimize the various process parameters involved in turning of EN 24 Steel alloy using Tungsten Carbide inserts to enhance the tool life and surface finish. Appropriate or random selection of cutting parameters have serious effect over the final output responses such as Surface Roughness , Tool life and other related properties of both the work piece and tool . Controlling the effective parameters is the need of the hour in any product manufacturing system. In the present work three different turning process parameters such as Cutting Speed, Feed rate and Depth of cut are considered for optimization study by varying them with three levels. The experimental design matrix for conducting experiments were prepared using Taguchi's Orthogonal Array and calculation of Signal to Noise ratio is done for identifying the best combination of parameters. Through ANOVA it is observed that Cutting speed is the most influencing parameter with a maximum contribution of 80.23% comparing to the other input parameters over surface roughness. The S/N ratio method (Smaller is Better) have shown that the parameter level combination A3B1C1 (2000m/min, 0.05 mm/rev, 0.2 mm) can provide good surface finish of the material with enhanced tool life.

Keywords: EN-24 Steel, Orthogonal Array, Optimization, Taguchi Technique

1. Introduction

Manufacturing is term which used to describe an activity which converts a completed design in to tangible real life products or components. A manufacturing process which is considered consists many parameters involved and each parameter selected for manufacturing the product leads to the degree of acceptability and rejection of manufactured products. The process of identifying the correct combination of parameters involved in a manufacturing process is an essential task before proceeding to the process. Turning is a process which is performed in lathe to reduce the diameter of an work piece using a single point cutting tool to move over the work piece. Various parameters such as Cutting speed, Depth of cut, Feed rate, Nose radius, temperature of the lubricant are generally considered as parameters for optimization by various authors in their study [1-4].

The material considered for study by different authors are Steel with different grades, Composite materials etc. The effect of cutting parameters is reflected on surface roughness, surface texture and dimensional deviations of the product. Surface roughness is a measure of the technological quality of a product and factor that greatly influences manufacturing cost. It describes the machined surfaces and combined with surface texture [1]. Various techniques such as Taguchi's Experimental Design , Response Surface Methodology , Definitive Screening Design , Genetic Algorithm are generally adopted for optimization of machining parameters. Taguchi method seems to be the most suitable approach to determine the optimal cutting parameters for turning operations in a machine shop [1].

2. Literature Survey

L.B. Abhang (2012) et.al has made an attempt to study the effect of three different parameters namely Feed rate, Depth of Cut and Lubricant Temperature while turning out EN-31 steel using tungsten carbide inserts. The authors have adopted Taguchi's Experimental method and ANOVA analysis to find out the optimal parameter combination and also the influencing parameter over the calculated output response surface roughness. By means of L_9 Orthogonal Array nine different experiments have been conducted and surface roughness of individual work piece have been measured and the measured data is inputted to MINITAB software to calculate Signal to Noise ratio. The authors have

Application Of Taguchi's Experimental Design And Range Analysis In Optimization Of FDM Printing Parameters For PET-G, PLA And HIPS

N. Mohammed Raffic, Dr.K.Ganesh Babu P.Madhan

Abstract: The present work aims to conduct optimization of Fused Deposition Modeling printing parameters for three different materials namely PET-G, PLA and HIPS which has less consideration than the conventionally adopted material ABS by various authors in the area of research in past decades for the assessment of specimen weight and fatigue strength. The FDM printing parameters such as Slice Height, Infill Density, Shell Thickness and Raster Angle are varied with three levels (3^4) to create the experimental design matrix as per Taguchi's experimental design.Taguchi's S/N ratio method and Range Analysis are the analysis tools considered for obtaining the optimum parameter combination and significant factor over the output responses measured. From both the above mentioned methods it is observed that Infill density is the most significant factor which affects the specimen weight by contributing 92.14% , 88.86% , 63.52% and fatigue strength by 60.18% , 50.86% , 53.90% for PET-G,PLA and HIPS. PET-G is found to have more fatigue strength than PLA and HIPS. The specimens made out of HIPS are found to weigh less than other materials considered. The optimum parameter combination for both the responses are found to have good agreement in all the three materials considered. Inclusion of other input printing parameters associated with the process and adoption of various DOE methods and optimization techniques are suggested as further research directions from the present work to have a deep insight of the study concerned respectively

Index Terms: ANOVA, Fatigue Strength ,FDM , Range Analysis, Signal to Noise Ratio,Taguchi's Orthogonal Array.

I. INTRODUCTION

The continuous growth and long time success of any industry in the market has a linear relationship with customer satisfaction it attains through its products and best services it provides. Optimization is a procedure adopted by engineers and scientists in order to reduce the variation occurring in a product by controlling the parameters and characteristics pertinent to product design and development. The input process parameters selected will have a serious effect over the final performance of a product or system with no doubt. Many methods like Taguchi's Orthogonal Array, Response Surface Methodology are generally adopted by authors to create the experimental plan and the experimental data is further analyzed to obtain the optimum parameter combination and also the significant parameter which has the maximum effect over the final response under study. Samir Kumar Panda [1] et.al has conducted studies to optimize the FDM input parameters such as layer thickness, build orientation, raster width, air gap and raster angle for ABS – P400. The authors have experimentally identified the various mechanical properties like mechanical, flexural and impact strength of FDM samples through the experimental plan devoloped by Central composite design. The experimental results obtained are further analysed using bacterial foraging technique for identifying the optimum parameter combination.

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The authors have advised to avoid small raster angle which may result in stress accumulation in the direction of deposition and higher raster width may improve strong bond formation between the rasters. Vishwas M [2] et.al has optimized the FDM process parameters for materials such as ABS and Nylon by considering the input parameters model orientation, shell thickness and layer thickness. The taguchi's L9 orthogonal array experimental plan has been devised for conducting the experiments for identifying the ultimate strength and dimensional accuracy of the parts prepared by both ABS and Nylon using FDM Pramaan Mini machine. The results observed are further analysed through Signal to noise ratio method and it has been identified that both shell thickness and orientation angle are most impacted process parameters over the mechanical properties of both the materials. The optimum parameter combination has also been communicated for good achievement of dimensional accuracy of parts printed. John Ryan C. Dizon [3] et.al has made a detailed review on various additive manufacturing techniques commercially available in the market such as Fused Deposition Modeling, Stereo lithography, Digital Light Processing, Selective Laser Sintering, Polyjet Printing and Laminated Object Manufacturing their capabilities, advantages and applications in various sectors. The authors have finally made a conclusion by developing various reasonable questions by having deep insight into the technological capabilities, testing standards, open source software used and mechanical properties arrived through various research methods and the standards followed in conducting the mechanical tests for the evaluation of Tensile, Compressive , fatigue and impact. Anoop Kumar Sood [4] et.al has made a study to improve the dimensional accuracy of FDM processed parts using grey taguchi method by considering layer thickness, raster width , air gap and orientation. J.Santhakumar [5] et.al has made an attempt to enhance the impact strength of polycarbonate material processed by FDM by considering the four input parameters such as layer thickness, build orientation , raster angle and raster width through taguchi's experimental design . Imthiyaz Khan and Dr.A.A.Shaikh [6] has reported a review on FDM based parts to act as rapid tooling and discussed about stair case effect

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Design Evaluation and Optimization of IC Engine Connecting Rods – A Review

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ABSTRACT

Fatigue analysis and Optimization of connecting rod are the modern trend in automotive engineering industry emphasis on many parameters like total deformation, life, factor of safety, stress biaxiality and fatigue sensitivity. The main scope of this work comprises detailed review on various methods and procedures adopted by different researchers in Fatigue analysis of commercially used Engine Connecting rod. The objective of conducting fatigue analysis varies from each other like Weight reduction, Cost reduction, Shape optimization and fatigue life calculation at varying boundary conditions and loads. Fatigue analysis has a very dominant position in product design and development as more than 50% of the products, structural failures are due to fatigue concept only. The review have emphasized the importance of conducting the fatigue analysis of the connecting rod to identity its critical points, fatigue life and factor of safety etc., for its better performance and life period extension.

Keywords: ANSYS, Fatigue Life, GLARE, Stress Biaxiality

1. INTRODUCTION

The Life, sensitivity and Maximum durability of any engineering component has become a common desire of any customer with no doubt. Product design and development has many phases out of which analysis of a product with varying objective have more importance. Product analysis can be different types like Static, Dynamic, Fatigue, Harmonic and so on.

The Connecting rod of IC engine is a crucial component of high volume production. Connecting rod acts as a link between piston and crankshaft to transfer the reciprocating motion of piston to rotary motion of connecting rod as well power and energy. The forces acting over a connecting rod during engine operation are 1. Force on the piston due to gas pressure and inertia of the reciprocating parts 2. Force due to inertia of the connecting rod 3. Force due to friction of the piston rings and of the piston 4. Force due to the friction of the piston pin bearing and crank pin bearing. The connecting rod is generally made with I section to provide maximum rigidity with minimum weight [4] and the stress distribution is even in I sections when comparing to the other cross sections. The Fig 1.0 shows the various sections used for design and production of a connecting rod.

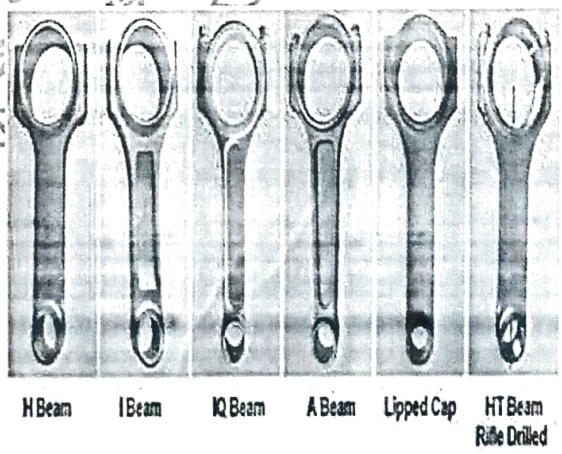

Fig 1.0 Different Cross Sections for Connecting Rod

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Evaluation of Wear Behaviour for Al/B4C/Fly Ash Composites by Stir Casting Process

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In this study, the wear behaviors of aluminum matrix composites Al 6082 matrix reinforced with Boron carbide and Fly ash particles using Taguchi method were evaluated. Wear tests of unreinforced aluminum alloy and Al/5%B4C and Al/5%Flyash particles reinforced composites were carried out. The stir casting method was used to manufacture the aluminum and its composites. The wear tests were carried out at the sliding speeds of 0.5, 1.0 and 1.5 m/s with loads of 15, 30, 45 N. Type of the material, Sliding speed, Applied load are the input parameters and Specific wear rate is the output parameter for the conditions tested. Taguchi technique was applied for optimizing the selected composites. Analysis of variance (ANOVA) has been used to determine the significance of design parameters influencing the response. The influence of these parameters on the response has been evaluated using Signal to Noise (SN) ratio analysis. The experimental results proposed optimal combination of parameters which give the minimum specific wear rate. The microstructure examination was also done using Scanning electron microscope to assess the uniform distribution of reinforcement in aluminum composites.

Keywords: Aluminum Composites, B4C, Fly Ash, Stir Casting, Taguchi Method, Wear Behaviour

Introduction

The Metal Matrix Composite materials have limitations in achieving good combination of strength, stiffness, toughness, and density. Metal matrix composites are advanced materials resulting from a combination of two or more materials in which tailored improved properties including high specific strength, damping capacity, and good wear resistance as compared to unreinforced alloys[1]. Aluminum alloys with SiC and Rice husk to form hybrid composites, it is reported that to accelerate the precipitation kinetics of the composites[2]. Ceramic particles such as Al_2O_3, SiC are the most widely used materials for reinforcement of aluminum[3]. R.M. Mohanty *et al* suggested Boron carbide could be an alternative reinforcement material with properties like high strength, low density (2.52 g/cm^2), extremely high hardness; good wear resistance and good chemical stability[4]. (Al_3Zr_{mp} + ZrB_{2np})/AA5052 composites have been synthesized by the direct melt reaction of AA5052 alloy and inorganic salts (K_2ZrF_6 and KBF_4). The results indicate the second phase reinforcement particles namely Al_3Zr and ZrB_2 in the AA5052 alloy matrix. Grain refinement of Al-rich phase observed in the composites, increases with increase in the vol.% of reinforcement particles[5]. Use of the precipitator fly ash in aluminum decreases the density of composites while it increases the wear resistance[6]. The microstructural investigation of Al 6061, SiC and Graphite hybrid metal matrix composite with varying percentage reinforcements 2.5%, 5%, 7.5% and 0% have been carried out. SEM analysis was done to accumulate the distribution of composites. Stir casting route was used to fabricate the composites[7]. Sathish kumar *et al* has carried out microstructural analysis on the monolithic alloy as well as cast composite samples[8]. The number of runs required for a full factorial design increases geometrically. Taguchi method is a statistical method to improve the quality of manufactured goods and more recently, it is also applied to engineering, biotechnology, marketing, and advertising[9]. MATLAB software package was used for the regression and graphical analysis of the experimental data and for analyzing the response surface and contour plots. ANOVA was used to estimate the statistical parameters[10]. Taguchi's robust design is an important tool for

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Synthesis, properties and EDM behavior of 10 wt.-% ZrB_2 reinforced AA7178 matrix composites

Synthese, Eigenschaften und Funkenerosionsverhalten von mit 10 wt.-% ZrB_2 verstärkten AA7178 Aluminiummatrix-Kompositen

Sundaram Dinesh Kumar and Manickam Ravichandran

From the journal Materials Testing
https://doi.org/10.3139/120.111226

Abstract

The present study outlines the optimization of process parameters in the EDM of AA7178-10 wt.-% ZrB_2 composites. The composites were fabricated by using stir casting and the mechanical properties are evaluated. The mechanical properties of AA7075, AA7178 and AA7178-10

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Aluminium Metal Matrix Composite with Zirconium diboride Reinforcement: A Review

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Abstract

Aluminium metal matrix composites have the abilities of sustaining the present demands of advanced engineering applications. The physical and mechanical properties that can be acquired with aluminium metal matrix has developing demand in aircraft, automotive and other industries owing to its light weight, high strength to weight ratio, corrosion resistance and workability. More in recent times, particulate reinforced MMCs have concerned significant attention are preferable due to their low cost, constant properties and their skill to be like monolithic materials and characteristic isotropic properties. The potential of these materials is mostly reliant on on choosing the correct combination of reinforcing materials since most of the processing parameters are related with the reinforcing particulates. This article made an effort to review the reinforcing material ZrB_2 used in the synthesis of aluminium metal matrix composite and the way it effects the mechanical, corrosion and wear performance of the materials.

Previous Next

Keywords

Silicon
https://doi.org/10.1007/s12633-018-9802-7

ORIGINAL PAPER

Synthesis, Characterization and Wire Electric Erosion Behaviour of AA7178-10 wt.% ZrB_2 Composite

S. Dinesh Kumar[1] · M. Ravichandran[2]

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Abstract
In this work, AA7178-10 wt.% ZrB_2 Metal Matrix Composite was produced using stir casting route and the mechanical properties of the composites were studied. The microstructure and elemental verification were done by using Scanning Electron Microscope (SEM) and Energy Dispersive X-Ray Spectroscopy (EDS). Among the various non-traditional machining processes, Wire Electrical Discharge Machining (WEDM) is an important process for machining MMCs. The objective of this work is to investigate the effect of Peak current (I), Pulse On-Time (PT_{On}), Pulse Off Time (PT_{Off}) and Wire feed rate (WF) on the combined objective of maximum Metal Removal Rate (MRR) and minimum Surface Roughness (SR) during machining of AA7178-10 wt.% ZrB_2 composite using Taguchi based Grey Relational Analysis (GRA). L_{16} orthogonal array, for the four machining parameters at four levels each, was opted to conduct the experiments. Analysis of variance (ANOVA) was performed to find the validity of the experimental plan followed in the present work. Results show that, maximum MRR and minimum SR can be achieved for the peak current (11 A), Pulse On-Time (112 µs), Pulse Off Time (45 µs) and Wire feed rate (7 m/min).

Keywords AA7178 · ZrB_2 · Stir casting · Composites · Taguchi grey relational analysis · WEDM

1 Introduction

Metal Matrix composites (MMC's) have high strength, high stiffness, damping resistance, high wear resistance, light weight, very good elevated temperature properties, impact as well as good shock absorption, good dimensional stability and castability [1, 2]. MMCs have great potential for aerospace, automobile and other applications because of their good properties [3, 4]. Further these composites are of superior in nature for elevated temperature application when reinforced with ceramic particles [5, 6]. The type of reinforcement material has a considerable effect on the mechanical and structural properties of the composites [7]. Zirconium diboride (ZrB_2) is an ultra high temperature ceramic that has strong covalent bonding, which gives it a melting temperature of 3250 °C, high hardness of 23 GPa, and high elastic modulus of 546 GPa. The bonding also has metallic character, which results in high thermal conductivity (60 W/m K) and electrical conductivity (107 S/m). With this exceptional properties, ZrB_2 shows promise for diverse applications such as cutting tools, molten metal crucibles, thermal protection systems for hypersonic aerospace vehicles, and which makes it attractive for aerospace applications [8, 9]. To improve the mechanical properties of MMCs, many researchers have prepared composites by ex situ method. Many researchers fabricated zircon reinforced MMCs using different techniques and reported their microstructure and mechanical properties [10]. Many methods have been used for fabrication of Al matrix composites such as, infiltration, squeeze casting, mechanical alloying, powder metallurgy, ball milling, and stir casting [11]. The processing method influences the mechanical behavior of the AMCs because of the successful incorporation of ceramic particles into the matrix alloy is important to achieve good properties [12]. The particulate reinforced composite can be prepared by introducing the reinforcing particles into liquid matrix through liquid metallurgy route by casting. Casting route is preferred as it is less expensive and suitable for mass production [13,

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Effect of Sintering Temperature on the Microstructure and Forming Behavior of AA8079 (Al–Cu–Fe–Si–Zn)

M. Meignanamoorthy, M. Ravichandran, A. Elmariung and S. Dinesh Kumar

Abstract In this study, an attempt has been made to examine the influence of sintering temperature on the microstructure and forming behavior of AA8079 synthesized through powder metallurgy route. The AA8079 powders were milled using high-energy ball mill. The green compacts were prepared using suitable punch and die by applying a compaction pressure of 400 MPa using hydraulic press. The green compacts were sintered at three different temperatures 400, 500, and 600 °C. The sintering was done with the aid of electric muffle furnace under the controlled atmosphere. The sintered samples were subjected to microstructure analysis by using a scanning electron microscope (SEM). The cold upset tests were conducted in stages of 10 kN and the true axial stress, the true hoop stress, the true hydrostatic stress, and the true effective stresses were identified, and their behavior besides the true axial strain was systematically investigated.

Keywords Aluminum · Alloys · Sintering · Forming behavior

1 Introduction

Powder metallurgy is a familiar method to fabricate metal matrix composites with homogenous dissemination of the reinforcements [1]. Aluminum alloy possesses tremendous applications in the field of aerospace and automobile industries due to

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A STUDY ON MAKING OF COMPACT MANUAL PAPER RECYCLING PLANT FOR DOMESTIC PURPOSE

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ABSTRACT

Day by day wastes are increasing in the world which occupying more space. So we have to utilize that kind of wastages in to useful material or product. One of the easily re-usable wastage is paper. Paper is one of the most important products ever invented by man. Used paper is one of the reusable waste as well as degradable wastes. Before of its degradation recycling of waste paper may helps to use of papers in secondary level. A simple manual paper recycling plant is created for free home based work with compact and low cost of investment. Used papers were collected and recycled with the help of this setup.

KEYWORDS: Paper Recycle, Used Paper & Compact Recycling Plant

Original Article

INTRODUCTION

The most important resource of raw material for making paper is vegetable fiber, obtained mainly from plants [1-3]. The forests are most important in the current situation of environmental conditions so there is a need to give an alternative source of raw materials, this therefore leads to the creation of the process of recycling [4-7]. Recycling, which is the extraction and recovery of valuable materials from scrap or other useless materials is employed to supplement the production of paper [8-10]. Paper recycling plant will make sure that the source of raw material for paper production is multiplied and also waste paper that could have constituted into using papers as well as paper product [11, 12].

EXPERIMENTAL COMPONENTS

The experiment of manual paper recycling needs some machines and equipment to simplify the human work. The following components are used here.

- Mixer grinder (Blender)
- Filter setup
- Screw press
- Calendaring Machine

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Original Articles

Experimental investigation on the performance and emission characteristics of CI engine using waste cotton seed biodiesel with ZNO as a fuel additive

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ABSTRACT

The energy crisis created by depletion of fossil fuels and the toxic emissions from the fossil fuel demands for eco-friendly potential alternative sources of energy. Even

though unclean, biodiesel is found to be a potential alternative for the fossil fuels. In the present work, the emission characteristics and performance of biodiesel blend

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Reconfigurable Kernel for Cortex M3-1788 ARM

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ABSTRACT : Major issues in development of Embedded Systems include protecting available platforms to develop portable applications with optimal form factor, improving software design processes, providing reconfigurable kernels to manage IO resources and memory, etc. Traditional operating systems are too bulky and lack modularity and pluggable features. Reconfigurability can be achieved at architecture level or program level and involves the use of field programmable gate arrays (FPGAs), multiple ARM cores, Programmable kernel and user space options etc. In this paper, the design techniques customize a computational fabric for specific applications. The paper proposes reconfigurable process in Linux wherein after initially the target is bootloaded the basic commands that are used to execute and load files and handling of storage space is done dynamically.

KEYWORDS: Reconfigurable kernel, reconfigurable user space, bootloader, ARM core

I. INTRODUCTION

Embedded Linux is a small operating system (approximately100Kb size) which comes from the kernel cutting and optimizing of standard Linux. It is essential to maintain the kernel size optimal even when coupled with other necessary modules and applications. A typical embedded system consists of microprocessor, memory, network capability, intrinsic physical layer error detection schemes, ports (like USB/serial/parallel). Typical OS like Linux is based on an open-source and is popular in target embedded system, particularly ARM cores. Typical realtime appliances using embedded targets with linux kernel focus on such issues as boot-up time, power management, real-time and kernel size. To make fast boot-up time in the Embedded Linux, it is necessary to package root file-system through the configuration analysis of bootloader and different root file-system. In this paper, the focus is on optimal usage of kernel size and to make the target hardware reconfigurable with respect to kernel functions, device driver functions, user space functions and advanced user space functions. At every level, the memory utilization is monitored dynamically and includes the incremental variation, inode address location mapped etc.

To reduce the energy consumption the number of realized reconfigurations is kept dynamic using an external storage and offer power efficient, compact designs. The reconfiguration exposes the system to events that may or may not be known at design time and the programmable hardware at runtime allow alternative execution of various kernels that could conserve space in embedded systems, and thereby providing a balance between performance and area. The reconfiguration of the target can be implemented on a static or a dynamic level. In static reconfiguration (often referred to the compile time reconfiguration) hardware resources remain static for the life of the design and are possible only on the Register Transfer Level (RTL) development stage. The dynamic reconfiguration (often referred to the runtime reconfiguration) uses a dynamic allocation scheme that reallocates hardware at runtime. It can increase the system performance using highly optimized circuits that are loaded and unloaded or reconfigured dynamically during the operation of the system. The main design issues to be handled with the system modeling of the dynamic reconfigurable systems includes:

1) validation of reconfigurable systems behavior during the functioning and reconfiguration;
2) evaluation of the task execution time and resource utilization in a reconfigurable system;
3) preliminary evaluation of energy consumption during functionality and reconfiguration;

Design of Voltage Multiplier Cells for Automotive Applications

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Abstract— This paper aims to use a voltage multiplier cell based DC – DC converter for automotive applications. The voltage multiplier cell eliminates the use of transformer and thus reduces the size and volume of the converters. Thus, a compact converter with high power density can be obtained. A new non-isolated topology based converter is proposed in this paper. The proposed topology has higher efficiency due to soft switching of active devices. The simulation results obtained from PSpice software are used to verify the theoretical calculations.

Key words: DC-DC converter, soft switching, Voltage multiplier cell

I. INTRODUCTION

With the advancement in automotive application, there is an incremental demand of efficient DC-DC converters. Automotive applications require high step up gain, high efficiency and reduced weight, volume and cost. Classical converter employs transformer which are magnetically coupled to achieve high step up voltage gain. However, the size of the transformer increases proportional to gain. Some of the disadvantages of using the transformers are leakage inductance and electromagnetic interference (EMI). These problems reduce the overall converter efficiency. The efficiency of classical converter is also affected when the switching frequency is increased with an idea of reducing the size. However by employing soft switching techniques the switching losses and electromagnetic interference generation can be minimized. In [1], a novel switching DC-DC converter is proposed in which large voltage step-down ratios can be achieved without a very small duty ratio and without a transformer. The absence of a transformer and the larger duty ratio permit operation at a high switching frequency and make the circuit to partial integration and hybrid construction techniques. However, the converter is limited to three stages, low voltage and low power.

A switch capacitor based step up DC-DC converter is proposed in [2] and [3]. The operation of the power switches are determined by the PWM circuit. The converters are operated with high efficiency with low duty cycle. These converters are suited only for small power since they use more numbers of capacitors.

In [4] and [5] a DC-DC converter using coupled inductors and diodes is used to provide high efficiency. High efficiency is achieved because the leakage energy is recycled and the

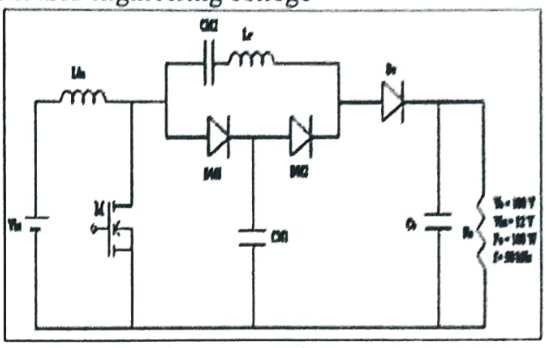

Fig. 1: Circuit diagram of the Existing converter

output rectifier reverse-recovery problem is reduced. These converters are applicable for fuel cell based converters.

The introduction of Voltage multiplier cell (VMC) based DC-DC converter is proposed in [6], [7],and [8]. This provides a high step up gain. This converter also uses non-isolated topology which provides reduction in size and volume. The VMC enables the use of zero current switching and minimize diode recovery problems. 3 to 4% of the total losses will be present in the circuit due to losses in diodes. In this paper, the losses of main switch and diodes are proposed to be minimized by incorporation soft switching. The efficiency of the proposed converter is found to be increase by around 2 %.

II. BOOST CONVERTER WITH SINGLE VOLTAGE MULTIPLIER CELL

Fig. 1 shows the circuit diagram of the classical boost converter with single voltage multiplier cell. This structure provides output voltage higher than the input voltage without use of magnetic elements. Additional voltage boost-up can be achieved by increasing the number of voltage multiplier cells as per requirements.

A. Circuit description of the existing converter

The basic structure of the single phase voltage multiplier cell is composed by the diodes DM1 – DM2, Capacitors CM1-CM2 and inductor L_r. This voltage multiplier cell can be used with classical converters as buck, boost, buck-boost composed by switch inductor, capacitor and output diode, as presented in Fig 1. voltage multiplier cell also operates without L_r. However this inductance inclusion of small inductance allows the power switch with ZCS and negative effects of the reverse recovery current of all diodes an minimized. When the voltage multiplier cell increases correspondingly, the output voltage increases. The Voltage multiplier cell can also be operated without the resonant inductor L_r. The resonant inductor enables the power switch to be operated in zero current switching (ZCS) turn on and minimize the effects of reverse recovery currents of all diodes.

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Interval Timers for Process Handling

Rajamohan L.* and Ravi S.**

ABSTRACT

An external asynchronous event may be either signals or software interrupts, used to alter the course of a program. These may occur at any time during the execution of a program and differ from other methods of inter-process communication. Processor scheduling delays prevent the process from handling the signal as soon as it is generated. This problem can be handled by implementing a timer such that each timer contains a field that indicates how far in the future the timer should expire. Linux considers two types of timers, dynamic and interval timer. Dynamic timer is used by kernel while interval timer can be created by processes in user mode. It can ensure that all processes (both parent and child) are executed either at proper time or after a delay. Additionally, to suit real-time application, the timers are designed with expiration time strictly enforced. This paper discusses how to track the passage of time using different kinds of alarm signals and manage the child process creation and avoid Zombie situations.

Keywords: Timers, Alarm signal, Profile, Virtual process timer, Dynamic thread affinity.

1. INTRODUCTION

Tasks can be dynamically scheduled for execution based on the mutual dependencies and on the computational resources available. The dynamic runtime system efficiently schedules the implemented kernels across the processing units & ensures the data dependencies are not violated. Linux supports process specific *interval* timers. A process can use these timers to send itself various signals each time that they cease. In this work, three types of interval timers are supported and are listed in Table 1.

The state of a timer is described by the interval_timer_status type which is a record with two fields (each a float) representing time:

The field it_interval is the period of the timer.

The field it_value is the current value of the timer; when it turns 0, the signal sigvtalrm is sent and the timer is reset to the value in it_interval.

A timer is therefore inactive when its two fields are 0 (as listed in Table 2).

Table 1
Different Timer intervals and their representation

Timer	*Representation*	*Value of type*	*Function*
Real	ITIMER_REAL	Real time (sigalrm)	The timer ticks in real time, and when the timer has expired, the process is sent a SIGALRM signal.
Virtual	ITIMER_VIRTUAL	User time (sigvtalrm)	This timer only ticks when the process is running and when it expires it sends a SIGVTALRM signal
Profile	ITIMER_PROF	User time and system time (sigprof)	This timer ticks both when the process is running and when the system is executing on behalf of the process itself. SIGPROF is signaled when it expires.

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EFFECT OF FDM PROCESS PARAMETERS ON VIBRATION PROPERTIES OF PET-G AND ABS PLASTICS

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***Abstract*—** The purpose of prototyping is to validate the material and geometrical shape of the design created for a product. The properties and quality of the prototype created plays a vital role in validating the design. The selection of an appropriate process parameters for making the prototype has more influence over the mechanical properties and quality characteristics of the finished prototype. In other words, the success and market life of a product entirely relies upon the prototyping results. Rapid prototyping techniques generally involve numerous process parameters which need to be optimized to build a prototype with superior performance. Fused deposition modeling is one of the familiar and fascinating RP technique which has gained interest in the field of prototyping products of Engineering, Architecture, Medical, Automotive and Aerospace due to its simplicity and flexibility in creating conceptual models and functional parts with desired quality. In the present work Impact Hammer testing of FDM processed PolyEthylene Terephthalate Glycol-modified(PET-G) and Acronitrile Butadiene Styrene (ABS) plastics is conducted to observe the influence of FDM process parameters. The major FDM parameters such as Infill Density (ID), Layer Thickness (LT) and Printing Speed (S) are considered to obtain Frequency Response Function (FRF) for PET-G and ABS plastics. The test results have shown considerable changes in vibration properties (Frequency and amplitude) in both the materials. A 2^3 (2 Levels, 3 Factors) design L_4 Orthogonal Array is created using Minitab 17.0 is used for conducting the experiments.

Keywords — ABS Plastics , FDM , Rapid Prototyping , PET-G , Layer Thickness, Printing Speed ,S/N ratio, Minitab 17.0

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I. INTRODUCTION

Prototypes are very important for realization of concepts in design, manufacturing and analysis. Prototyping is an essential part of product development and manufacturing cycle required for assessing the form, fit and functionality of a design before a significant investment is made[6]. Rapid prototyping is used to quickly fabricate a prototype of a part using 3D computer aided data with the layer-bylayer addition of the material. Fused Deposition Modelling (FDM) comes under the solid based Rapid Prototyping systems. The current range of materials include Paper, Wax, Resins, Nylon, Plastics, Thermo-plsatics, Metals and Ceramics.[15].

Fused deposition modeling (FDM) is an additive manufacturing technology commonly used for modeling, prototyping, and production applications. It is one of the techniques used for 3D printing. The technology was developed by S. Scott Crump in the late 1980s and was commercialized in 1990 .In FDM , material is stored as a filament in a spool or catridge.Rollers then guide the filament to a liquefier where it is heated to a semi liquid state and extrude through a nozzle. Fused Deposition Modeling (FDM) is an additive manufacturing technology that builds parts up layer-by-layer by heating and extruding thermoplastic filament. Ideal for building durable components with complex geometries in nearly any shape and size, FDM is the only 3D printing process that uses materials like ABS, PC-ISO polycarbonate, and ULTEM 9085. This means FDM can create parts and prototypes with outstanding thermal and chemical resistance, and excellent strength-to-weight ratios FDM has become a widely used additive fabrication technologies..The Fig 1 shows the schematic arrangement of FDM process.

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EFFECT OF FDM PROCESS PARAMETERS IN ABS PLASTIC MATERIAL

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Abstract— The overarching aim of this work is to make an attempt to study the effect of FDM process parameters using ABS plastics. Numerous interactive parameters are involved in Fused Deposition Modeling (FDM) process where a small change in a single parameter or a combination of parameters may produce a considerable effect in both economical and technical factors. In the present study Acronitrile Butadiene Styrene is the material considered. The major FDM parameters such as Infill Density, Layer thickness, Shell thickness, Raster width, Air gap, Speed are considered for mechanical testing and dimensional accuracy of the printed specimens. The major parameters Layer thickness, Infill density etc have shown considerable effect over model building time, material consumption and mechanical properties of the material considered for study.

Keywords — ABS Plastics , FDM , Rapid Prototyping , Infill Density , Layer Thickness,Model building time

I. INTRODUCTION

The evolution and continuous growth of Rapid Prototyping (RP) techniques from the late 1980's have shown a propitious path for the product designers and manufacturing engineers in creating the prototypes or conceptual models for testing purposes.RP techniques are adopted to save time and cut costs at every stage of the product development process. Many RP techniques have been developed which are commercially available and each of them have potential application in the fields of Engineering ,Architecture and Medical due to their flexibility in building models at a faster rate with higher part quality.

Fused Deposition Modeling is one of the RP technique developed by Stratasys Inc, a leading 3D printer manufacturing firm headquartered at United States. In FDM , material is stored as a filament in a spool or catridge.Rollers then guide the filament to a liquefier where it is heated to a semi liquid state and extrude through a nozzle.FDM has become a widely used additive fabrication technologies. A plastic filament is unwound from a coil and supplies material to an extrusion nozzle. The nozzle is heated to melt the plastic and has a mechanism which allows the flow of the melted plastic to be turned on and off. The nozzle is mounted to a mechanical stage which can be moved in both horizontal and vertical directions. As the nozzle is moved over the table in the required geometry, it deposits a thin bead of extruded plastic to form each layer. the plastic cools and hardens immediately after being squirted from the nozzle and bonds to the layer below.The Fig 1 shows the schematic arrangement of FDM process.

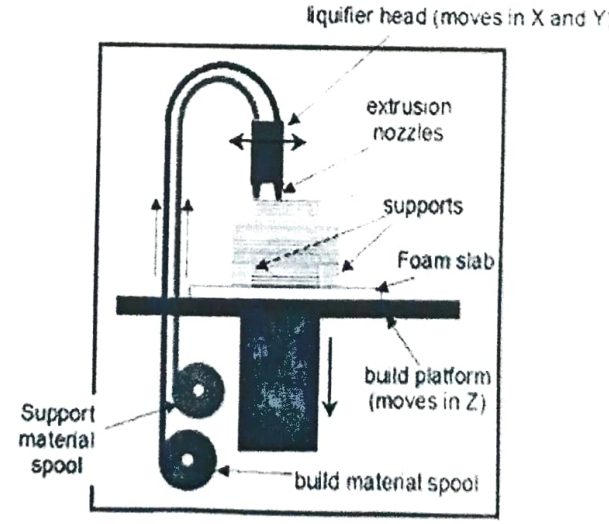

Fig. 1: Fused Deposition Modeling Process

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Mechanical properties and microstructure of stir casted Al/B_4C/garnet composites

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Article Information

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Keywords
B4C, garnet, mechanical properties, stir casting, microstructure

Aluminum based metal matrix composites are one of the advanced engineering materials that have been developed for low weight and high strength applications in automotive industries due to high specific strength and good wear resistance. In this context, aluminum alloy boron carbide and garnet composites were fabricated by the stir casting process. The microstructural examination was done by using a scanning electron microscope to assess the distribution of particulates in the aluminum matrix. The composites were characterized by hardness and tensile tests. The wear behavior of the composites was analyzed with the help of a pin-on-disc wear test. By increasing the amount of garnet in the composite, it has been observed that the tensile strength and hardness increase. The wear test analysis proved that the addition of reinforcements reduces the wear rate behavior of composite.

Aluminum metal matrix composites have considerable applications in automotive, aerospace and military industries due to their high strength to wear ratio, stiffness, light weight, good wear resistance and improved thermal and electrical properties [1, 2]. In the last few years considerable development has occurred in the potential use of metal matrix composites for automotive applications. The aluminum-silicon carbide composites are used in making connecting rods, brake rotors, drive shafts, and other components [3, 4].

Ranganath et al. suggested that addition of garnet increases the hardness, tensile strength, compressive strength and Young's modulus, but decreases the ductility of the composite material [5]. Sivakumar et al. proved that 15 wt.-% garnet exhibited a lower wear rate to applied loads, and the wear resistance was better at lower loads [6].

Ranganath et al. reported that the wear rate of composites is lower when compared to the matrix alloy and also decreases with the increase in garnet reinforcement [7]. Gomez et al. suggested that B4C composites showed an increased friction coefficient with more reduced wear rate [8]. Gopalakrishnan et al. studied Al-TiC casting with different volume fraction of TiC produced in argon atmosphere by stir casing process. They found out that the specific strength of the composite increases by the addition of higher percentage of TiC reinforcement [9].

Padmavathi et al. investigated the preheating of SiC to a temperature up to 620 °C. The preheated SiC was added to the molten metal at 750 °C and stirred continuously, the stirring speed was 450 rpm and a vortex was created in the melt which enhanced the distribution of the composite material particles [10]. The research of James et al. shows the addition of TiB_2 with aluminum matrix increases the hardness value. The increase in hardness value is due to cluster formation which leads to porosity, the high amount of reinforcements was proved to reduce the hardness value in metal matrix composites [11].

Microstructural characteristics of Al alloy composites containing fly ash particles (9 % by volume, 75-100 µm) were prepared by squeeze casting techniques and had higher structural homogeneity with minimum possible porosity levels, pitting corrosion, good interfacial bonding between matrix and reinforcements [12].

Sharma et al. reported that the interfacial bonding between the aluminum matrix and B_4C reinforcement proved to be better than that between aluminum and SiC or Al_2O_3 [13]. Sharma et al. performed the experiments on Al 6061-garnet particulate reinforced composites prepared by liquid metallurgical technique, and reported that addition of garnet particulate reduces the wear rate and coefficient of friction, and they also studied the effect of frictional heat on the wear properties at contact surfaces, mechanical load, sliding distance, sliding velocities, coefficient of friction and transition wear [14]. Feng Tang et al. fabricated an Al 5083 matrix with 5 wt.-% and 10 wt.-% B4C particles by cyromilling process. Dry sliding wear tests were conducted using pin-on-disk with a sliding distance of 3000 m, sliding speed ranged from 0.6 m × s^{-1} to 1.25 m × s^{-1} and the load ranges from 50 N to 80 N [15]. Investigations showed that the wear rates obtained for the as-cast and FSPed alloy at different sliding velocities with various normal loads exhibit better wear resistance con-

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Effect of Welding Parameters on Mechanical Properties of Plasma Transferred Arc Welded SS 202 Plates

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Keywords: Welding, PTAW, SS 202, Mechanical Properties.

Abstract. Plasma arc welding is an arc welding process wherein coalescence is produced by the heat obtained from a constricted arc setup between a tungsten electrode and the workpiece material. In the present work, the 6 mm thick stainless steel 202 plates are welded using plasma transferred arc welding. The welding parameters such as powder feed rate, welding voltage and welding current were carefully selected. The effect of these parameters on mechanical properties such as tensile strength, impact strength and hardness of the joints were studied. As a result, the increase in tensile strength and impact strength was obtained for the high current, low voltage and powder feed rate. But the highest hardness was attained for the joints made at low current, low feed rate and low voltage.

1.Introduction

Plasma arc welding (PAW) is an arc welding process similar to gas tungsten arc welding. The electric arc is formed between an electrode and the workpiece. The plasma is then forced through a fine-bore copper nozzle which constricts the arc and the plasma exits the orifice at high velocities and temperature. Arc plasma is the temporary state of a gas. The gas gets ionized after passage of electric current through it and it becomes a conductor of electricity. In ionized state atoms break into electrons (−) and ions (+) and the system contains a mixture of ions, electrons and highly excited atoms. Numerical analysis of the coupled arc–weld pool–keyhole behaviors in stationary plasma arc welding was reported by Jian et al. that as the keyhole depth increases the plasma arc shape, temperature profile and current density distribution undergo dynamic evolution so that the heat flux on the keyhole wall changes continuously. However, the plasma jet velocity is insensitive to the keyhole depth so that the plasma arc pressure at the keyhole wall is almost stable [1]. Micro-plasma transferred arc deposition process is a recently developed material and energy efficient additive layer manufacturing process for metallic deposition which is capable of bridging the gap between capabilities of high energy based and conventional arc-based deposition processes. Sagar et al developed model has wide applicability because it depends only on thermal properties of the substrate and deposition materials and is independent of form of the deposition material therefore it can be used for predicting deposition geometry for any combination of substrate and deposition materials and for any form of the deposition material [2]. Guokai et al developed common CCD camera equipped with a specially designed filter to constitute a vision system, which was used to capture the weld pool and the keyhole images during plasma arc welding process. Through image processing and calibration, the shapes and sizes of both the keyhole and the weld pool were measured under different welding conditions [3]. Rokanopoulou et al studied the use of a more thermodynamically stable ceramic, aluminum oxide, in order to reinforce the surface of the austenitic–ferritic steel SAF 2205 by the plasma transferred arc technique. The austenitic–ferritic

Experimental investigations of Al-TiO_2-Gr hybrid composites fabricated by stir casting

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Article Information

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Keywords
Metal matrix composites, TiO_2, stir casting, aluminum, cold forging

Al-TiO_2-Gr composites containing different weight percentages of TiO_2 and graphite (Gr) particles were produced by stir casting method. All samples were prepared by adding TiO_2 and Gr particles to the molten aluminum, then the resulting slurry was stirred at a specified temperature for a predetermined time. SEM and EDAX analyses were carried out for the as cast samples. The effects of the addition of reinforcement content on mechanical properties and workability behavior of the composites were investigated. Microstructural investigation of the final products proved that synthesized composites with well-distributed reinforcing particles could be fabricated by stir casting method. Tensile fracture analyses of the composites were conducted using SEM. The results show that the tensile strength of the composites increased with increasing weight fraction of TiO_2 and Gr particles. Workability studies show that, the addition of reinforcements increases the true axial stress (σ_z), true hoop stress (σ_θ), true hydrostatic stress (σ_m) and stress ratio parameters [(σ_z/σ_{eff}), ($\sigma_\theta/\sigma_{eff}$) and ($\sigma_m/\sigma_{eff}$)] during cold upsetting.

Aluminum-based alloys are widely used as aerospace and automotive components, because of their high specific strength, stiffness and formability. On the other hand, Al alloy matrix composites are having better wear resistance and bulk mechanical properties [1]. The need for composites with unique properties is growing every day. Metal matrix composites (MMC) are widely used in various industries because of their high mechanical properties and wear resistance. Aluminum matrix composites (AMC) are widely desirable because of its low density, high toughness and corrosion resistance in the environmental conditions. These composites are being used in many industries such as aerospace, car industries, military and electronics [2].

Various researchers have successfully investigated and reported the dispersion of hard reinforcements such as graphite, SiC, Al_2O_3, TiC, VC, AlN, B_4C, Si_3N_4, TiB_2, AlB_2 and MgB_2 on aluminum-based mmCs using various manufacturing route.

Nevertheless, the use of TiO_2 as reinforcement in aluminum alloys has received a meager concentration because of its high hardness and modulus with superior corrosion resistance and wear resistance [3]. The incorporation of hard reinforcing particles into the matrix improves their mechanical and tribological behavior, but may result in deteriorated machinability together with rapid counterface wear. To overcome the abovementioned problems, hybrid composites containing both hard and solid lubricant materials with improved tribological properties have been developed [4].

Syntheses of aluminum-based lightweight composites by economic route of solidification processing have received considerable attention due to significant improvements in the mechanical properties [5]. Liquid method of processing is effective due to its simplicity, ease of adaption and applicability to large quantity fabrication. Liquid method of processing involves either adding ceramic particles externally to the molten metal or synthesizing in the melt itself [6]. It is generally believed that the mechanical behaviors of the composites are significantly influenced by the size and volume fraction of the reinforcements. In common, increasing the volume fraction of the reinforcements can help to improve the mechanical properties of the composites [7].

Kleiner et al. studied the decomposition of process control agent during mechanical milling and its influence on displacement reactions in the Al-TiO_2 system [8]. Araya Worede Tesfay et al. developed two types of composites by solidification processing with the addition of 3, 4 and 5 wt.-% TiO_2 and MoO_3 to molten aluminum alloy and studied the dry sliding wear behavior of cast composite [9]. Tensile and fracture behavior of spray formed and stir cast Al-2Mg-TiO_2 composites were studied by Sujoy Krishna Chaudhury et al. They reported that the ultimate tensile strength of as-spray formed Al-2Mg-TiO_2 composite is about 4-30 % higher than of as-spray formed Al-2Mg alloy [10]. Heguo Zhu et al. fabricated aluminum matrix composites with different B_2O_3/TiO_2 ratios by exother-

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Microstructure and Properties of Hot Extruded Al-TiO_2 Powder Metallurgic Composites

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Keywords: Metal Matrix Composites, Microstructure, Mechanical Properties,Powder Metallurgy .

Abstract. Aluminium metal matrix composites reinforced with TiO_2 were synthesized using powder metallurgy route. The compositions such as Al-2.5%TiO_2, Al-5%TiO_2, Al-7.5%TiO_2 and Al-10%TiO_2 were milled using ball mill for 1 hour. The green compacts were prepared using 400 kN hydraulic press. The sintering was done by using electric muffle furnace at a temperature of 550^{0}C for 1 hour. Hot extrusion was carried out for the sintered composite samples with suitable punch and die. The mechanical properties such as ultimate tensile strength, yield strength, percentage elongation and hardness have been studied for the hot extruded samples. The microstructures of the extruded composites were analyzed using optical microscope and reported. The high compressive strength was obtained for the Al-5%TiO2 composite.

1. Introduction

Metal matrix composites (MMCs) are a relatively new class of materials characterized by lighter weight and greater strength than those of conventional materials. MMCs are under attention for many applications in aerospace, defense, and automotive industries. Aluminium metal matrix composites (AMMCs) have been prepared for various applications in aerospace, automotive, military, and electronic industry due to their excellent properties [1]. The aluminum extrusion process is an attractive production method in industry because of its ability to achieve energy and material savings, quality improvement, and development of homogeneous properties throughout the component. Lightweight construction, especially in the area of transportation engineering, is of increasing significance even with decreasing numbers of pieces. But this production technology is quite a lot complicated, and process parameters must be carefully selected so that the desired production quality can be obtained [2]. Powder metallurgy can be defined as the art of producing powders of metals, alloys, ceramics etc. mixing them in necessary quantities which are blended, pressed into a desired shape (compacted) and then heated (sintered)in a controlled atmosphere to bond the contacting surfaces of the particles and establish the desired properties. MMCs could be produced by variety of methods such as Stir cast, Liquid Infiltration, Osprey, Powder metallurgy etc. Among this Powder Metallurgy processing is one of the effective methods to manufacture MMCs with high volume of reinforcement with fairly uniform distribution [3]. The powder metallurgy process is replacing traditional Metal forming process because of its low relative energy consumption, high materials utilization and low capital cost. Also the uniformity in reinforcement distribution can be achieved by powder metallurgy process to produce porous structures and this improves structural properties and also reproducibility [4]. Mechanical alloying is a high-energy milling process, which produces composite metal powders with a fine microstructure. It is a simple and useful technique offering a decrease in the ceramic particle size during mixing together with a better homogeneity of the reinforcement into the matrix alloy. The principles, several important

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Thermal Analysis of Diffusion Bonded Joints

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Abstract:
Titanium alloys are joined to medium carbon steels for applications in aerospace engines. Titanium alloys are joined to stainless steels for nuclear applications. The main purpose of the present study is to investigate and compare the characteristics of dissimilar joining of Ti-6Al-4V with AISI 4140 Medium carbon steel and Ti-6Al-4V with SS 304L Stainless steel using diffusion bonding process and analysis the temperature distribution and stress intensity with the help of ANSYS software. For the diffusion bonding, temperature, pressure and holding time are the key parameters. Diffusion bonding experiments for the two combinations of joints namely (i) Ti-6Al-4V with AISI 4140 Medium carbon steel and (ii) Ti-6Al-4V with SS 304L Stainless steel were carried out by varying the temperature 750°C, 800 °C and 850°C, stress 5 MPa, 10 MPa and 15 MPa and time 60 minutes, 90 minutes and 120 minutes. The results of ANSYS analyses on diffusion bonded joints of the two material combinations are in good correlation with the tensile test carried out at their joint interface.

Introduction

Titanium and its alloys find numerous applications in aerospace and nuclear industries due to their high strength to weight ratio and good corrosion resistance. Joining of various components is inevitable for the manufacture of machine, plant and equipment. Titanium alloys are joined with medium carbon steel alloys for aerospace engines to withstand high temperatures. Titanium - stainless steel joints are made in nuclear applications for better corrosion resistance. Conventional fusion welding is not a feasible technique to join these kinds of dissimilar joints due to the formation of chemical, mechanical and structural heterogeneities.

Solid state joining is a suitable alternate to overcome the difficulties. No melting is involved in solid state welding; hence melting related defects are avoided. The joining of immiscible or partially miscible alloy systems which is cumbersome in conventional fusion welding is also possible by solid state joining.

Diffusion Bonding Process

Diffusion bonding is a solid state joining process in which two metals with clean surfaces are brought into contact at elevated temperature and pressure for a predetermined time. International Institute of Welding (IIW) defines diffusion bonding as "a solid state bonding process for making a monolithic joint through the formation of bonds at atomic level, as a result of closure of the mating surface due to the local plastic deformation at elevated temperatures which aids inter-diffusion at the surface layers of the materials being joined".

Some of the solid state joining processes like cold pressure welding needs no significant heating. But they require extensive deformation. Hence the processes are applicable only for ductile materials. Processes like friction welding, magnetically impelled arc butt welding (MIAB) and explosive welding result in significant distortion due to plastic deformation at high temperatures. But diffusion bonding gives a sound bond without any macroscopic deformation because it involves only inter-atomic diffusion with microscopic deformation at the interfaces.

Diffusion Bonding Mechanism

The mechanism of diffusion bonding is schematically illustrated in Figure 1.1. During diffusion bonding, the surfaces, which are smooth and free from contaminants, are brought into intimate contact by applying sufficient pressure. First, the applied pressure causes yielding of the asperities at the interface, which establishes an intimate contact between the surfaces to be bonded. Subsequently continuous creep deformation and atomic diffusion take place leading to closure of interfacial voids followed by bonding of materials. The pressure applied will cause only deformation of asperities and not bulk deformation.

(i)

(ii)