JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

A REVIEW PAPER ON ALUMINIUM-BASED HYBRID COMPOSITE FABRICATED USING FRICTION STIR WELDING METHOD

[1]RAJKUMAR DUHAN, [2]SAHIL

Mechanical Engineering, Uiet MDU Rohtak

er.rajkumarjas@gmail.com

ABSTRACT

This paper includes microscopic and mechanical research on friction stir of greater polymers manufactured using friction stirring processing. Contact stir preparation (FSP) is a sturdy processing technology with unique features, including minimal heat generation, wide plastic flow, attainment of extremely fine micro in the stirred zone, and healing of defects and castings defects. FSP permits the customization of a structure's attributes at the local level. It is a technique for altering the material characteristics of surfaces by the stirring action of a tool moving across the contact of a substance whose mechanical properties must be adjusted. In this study, an effort was made to evaluate the improvement of the surface mechanical characteristics of metal matrix composites produced by stir casting. Carbides (SiC) and aluminates (Al2O3) with a particulate capacity of 200 m or a weight percentage of 5% were used as a hybrid hardening filler in metal matrix materials in the production of composites. On the face of the composites, FSP has been performed to refine and sizes of suggested composite materials. The grain size has been significantly reduced from 84 m to 7 m, as determined by microstructural experiments investigating grain size fluctuations. As process parameters, three distinct tool rotation rates and three distinct linear tool motions were investigated. From the testing results, the optimal process parameters for obtaining the suggested composite material's tiny grain size and enhanced hardness values, tensile characteristics, and wear properties were determined.

Keywords: Resistance spot processes, metal MC, aluminum stir molding, frictional; weld;

1.Introduction

Dynamic stir processed (FSP) is an application of resistance spot welding; the following characteristics of resistance spot welding may be exploited to design new methods based on the principle of friction stirring.

- Low amount of heat generated.
- Extensive plastic flow of material.
- Extremely fine average crystallite size as in stirring area.
- Restoration of defects & sealing of pores.
- Randomized dispersion of grain growth surfaces in the area of mixing.
- Merging of superficial or deeper layers mechanically

FSP utilizes the managed machining properties of method to undertake metallurgy preparation and microstructural alteration of particular regions of a part's surface. In this method, a metal rod with just a pin & shoulder is incorporated as a solid component of the material for targeted histological alteration to accomplish the particular property improvement shown in Figure 1.

FSP is a quick, sturdy integration services for one preparation that provides histological improvement, compression, and consistency, among other benefits. It geometrical and biomechanical performance of the public health policy may be accurately manipulated by adjusting design, FSP setting, including efficient cooling.

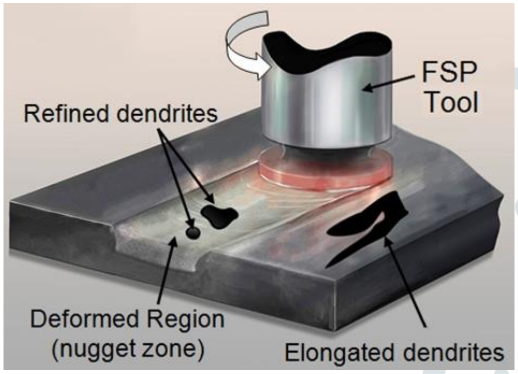

Fig 1:Schematic representation of friction stir processing

By determining the height of both the rotating tool, the depth of the workpiece may be optionally adjusted across hundreds of nanometers and dozens of millimeters; traditional metalworking procedures are incapable of producing an optionally changeable treated depth. FSP is a flexible technology with several applications in resource extraction, refining, & syntheses. Percussion or polymer bending create heat through FSP, providing it a safe & resource process free of hazardous gases, light, & pollution. In contrast, FSP does not alter the size and form of the components being processed. FSP was used to generate a good architecture for rising chance to develop new in commercial Al7075 alloy.

1.1 Friction Stir Welding (FSW):

1.1.1 Examples using resistance spot melting

Welding using friction stir has applications in several aluminum-using sectors.

Shipbuilding: FSW was first employed to weld aluminum panels for fishing vessels. Today, this technology is often employed to join steel refrigeration plates used during boat hulls and bodies. Due to the fact that FSW causes low deformation, copper plates will keep their form after long welding.

Aerospace: FSW is used in spaceship fuel tanks that contain cryogenic oxygen. These gasoline tanks are assembled by welding the dome to a tubular framework.

Boeing employed FSW in the Docking adapter Module of such a successful Delta II launch in August 1999. Material is used to link the airplane fuselage's lightweight aluminum frames. This is due to the fact that the method provides much lower alternatives than bolting or riveting.

Railroad: For the production of high-speed railways, friction stir soldering is used to thin shapes or T-stiffener castings.

Automotive industry: The automobile industry has selected aluminum as the best material for constructing automobile chassis. Consequently, it is among the principal adopters of FSW technology.

Conventional welding techniques are incapable of producing high-tolerance products comparable to FSW. The rapid weld periods of FSW therefore make it preferable to other metal welding techniques.

1.1.2 Working Principles of FSW

Steel is conceptually equivalent to fusion welding. Friction is employed to create heat at the contact surface in this process. This heat initiates the diffusion process between two surfaces. The application of a pressurized force to these contact surface, this promotes the metal rate of diffusion and forms a material junction. This is the fundamental concept of friction welding. A revolving tool is employed to apply frictional and pressure force to the plates during friction stir welding. This tool spins in its own spindle & moves longitudinally at the plates' interface, where friction between the revolving work piece creates heat. By exerting a pressurized force, this heat deforms the surface contact or dissolves the two work pieces into one another. The contact surface was subjected to a thermo mechanical treatment to produce this joint. The fact it is able to be readily mechanized and yields a faster rate of metal joining is a significant benefit that contributes to its versatility. Typically, it is used to connect aluminum alloy.

FSW characteristics have prompted the introduction of pioneering for tiny - small connecting of electrical components; nevertheless, the method is also employed for the manufacturing of automotive parts and cnc machines device parts in large segment steel.

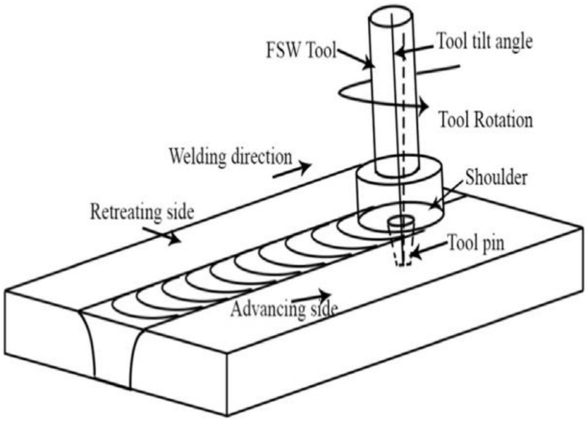

Fig 2 : Schematic Diagram of FSW

1.1.3 Advantages and Disadvantages:

Advantages:

1. Sturdy soldering does not require spark, metal powder, etc.
2. FSW may be employed to weld metals that are both comparable & different.
3. This method produces welds with a small grain size and a good quality.
4. Reduced energy use due to the lack of heat exchange.
5. Highly mechanized.
6. Little upkeep needed.

Disadvantages:

1. Requirement for a difficult or unique fitting placement.
2. It produces a noticeable hole on welded plates.
3. High upfront or startup expenses.
4. It's less adaptable than the arc weldment.
5. FSW cannot manufacture filling joints.
6. Non-Forgeable substances could be welded.

1.2 Aluminium Based Hybrid Composite Material

The objective of the experimental technique is to create a Hybrid Aluminum and Metal Matrix Composites. Various concentrations of silicon carbide particles were used to accomplish this result. For the development, a 2 different mixture of the stir casting method was used. This was carried out to ascertain a low-cost, conventional approach for manufacturing and obtaining a uniform dispersion of carbon fiber. Aluminum 6063 and 320-mesh Fused Silica, Lignin, Diamond Mandrel (WC), & Aluminum Powder were selected. Silicon Dioxide (Sic) percentages varied form 5% to 10% of about 15% of about 20% throughout sampling 1, 2, 3, & 4, although all others proportions remained constant. Table 1 presents the answer for Aluminum AA6063.

Table 1: Chemical Composition of Aluminium Alloy AA6063

Element	Mg	Si	Fe	Cu	Cr	Ti	Zn	Mn	Al
Weight (%)	0.89	0.73	0.23	0.21	0.1	0.08	0.48	0.45	Bal.

1.3 Composites

A composite substance has at least two physiologically or chemically distinct phases. The composite has characteristics that predominate over those of its 14 constituent components. One of the component materials serves as the composite's matrix, while at least one other component material serves as the reinforcement. Innovative interest and research activity in the enhancement of composites made of metals may be developed rapidly via the introduction of novel handling processes.

Carbon fibre, titanium alloys, titanium boride, &aluminum are the reinforcements most often utilized. Aluminum, Titanium, and magnesium alloys may often be employed as the matrix step.

1.4 Applications of Aluminum composites

Since the 1950s, the construction materials have seen considerable changes. A small number of super polymeric and thermal materials have already been created for a range of modern applications, including airplane and protection. The automotive, rehabilitative, and gaming equipment industries have pushed material advancements to provide next generation materials with low thickness, low weight, and great quality, durability, and toughness. Composites are a vital component of these propelling composites. Due to their exceptional mechanical qualities, hybrid materials are important for usage in design. As snipping construction materials, composites with metal matrix are applied in several applications requiring great wear resistance, such as chambers liners, chopper cut outs, rear blades, and reduced drag propeller landing gears in modern military aircraft. In contrast to related type, the tool life of MMCs is greatly enhanced by the introduction of an alternative step for the fabrication of grating earthenware attached to a flexible aluminum matrix.

2. Literature Review

2.1 General

These chapters summarize the efforts of earlier researchers using various techniques & others methodologies, as well as their whole body of work. Participants took part on Friction stir processing with metal composite materials in this study.

Omar S. Salih (2015)"A overview of friction emulsify soldering of aluminum alloy" was the topic of this study.

This study presents a summary of the current status of FSW for AMC materials. Analyses & quantitative evaluations have been performed on (a) the macro organization& shape of the AMC junction, (b) the assessment of shared physical behavior, &(c) Attributed to the existence of reinforcing materials in anodized matrices, the corrosion of FSW weapons. This study closes with suggestions for future lines of investigation. Lastly, the aging of FSW tools, namely the needle, is just a significant challenge when interconnecting AMCs or a significant obstacle to the industrial adoption of the FSW technique.Using innovative tool designs with frustum forms (self-optimized shape), barrier layer of pin with a suitable material that is compliant with the surface, and thermal radiation treatment procedures might be effective approaches for enhancing both the wear resistance and joint efficiency.

Michael Oluwatosin Bodunrin (2015)"Aluminium matrix mixed injection molded parts: a review of reinforcing philosophies; biomechanical, corrosion, & interfacial features" is the subject of this article.

This research examines the various combinations of reinforcing elements used during fabrication of mixed aluminum composites and how they influence the tensile, chemical, & wearing properties of the materials. The fundamental techniques for creating these metals are discussed briefly, and study subjects for the continued expansion of nanocomposite alumina are suggested.Aluminum biocomposites are a new breed of metallic materials that have the capacity to meet the most current technical application requirements. Aluminum composite materials satisfy these requirements owing to their better mechanical qualities, suitability for standard manufacturing techniques, and potential for reduced production costs.

Namrata Gangil, (2019) Stir casting examination of welded joints welding of laminate epoxy matrix on Al–Zn–Mg–Cu alloy.

This study examines solid microstructure evolution features of surface roughness rivet of materials reinforced by stir casting with exceptional characteristics. Al–Zn–Mg–Cu alloy reinforced with hybrid. Surface hybrids (SCs) were manufactured using FSP, slice to the treated thickness, and cut along their longitudinal axis. They were then resistance spot butt repaired using a variety of tool rpms (560–900 rpm). For the welds, the mechanical characteristics, microstructural analysis, and micro-hardness profile were determined. In contrast to composites, the reinforcing particle diameter is more homogeneous during FSW owing to the weld pass.

V. Preethi, (2021),"Optimization of abrasive water jet machining welding settings for improved hardness in weld nuggets of hybrid aluminum composites"

This research investigates the hardenability of such a composite aluminum leads to achieving by the stir casting method. Utilizing friction stir welding, the weldability of the composite was determined. As reinforce for the a composite, various percentages of quarry dust (4, 8, & 12 wt%) or a constant percentage of selenide are used. For the weldability assessment, the static stir welding technique was applied. As input parameters, tool rotates and strain rate are selected, whilst weld particle hardness is selected as the output waveform. The Taguchi method was used to design the experiment and determine the effect of the input parameter on the output response. Demonstrated tool rotation rate adds considerably (57.3%) to output response, according to the results.

Samuel Olukayode Akinwamide, (2020), Review of research conducted on "Characterization of microstructure, mechanical characteristics, & corrosive reaction of aluminum alloy composites manufactured via casting"

This research examines the various production methods, impacts of alternative reinforcing, general characteristics, and industrial applications of aluminum matrix composites. Integrating between front and/or third-phase molecules into matrix alloy resolves the vast majority of these difficulties. It has been observed that typical additions, such as agricultural waste, carbon nanotubes, aluminum gallium, and corrosive agents of specific alloys, improve the morphological, mechanical, and corrosion properties of AMCs produced by various casting techniques. However, the functionality of all these AMCs is dependent on the processing approach used to apply the additions to the matrix material.

NAMRATA GANGIL,(2017),Review of research titled "Metal In-situ Composites Synthesis through Friction Stir Welding: A Review"

This article examines the current status of manufacturing in-situ AMMCs using the FSP approach. The objective of this paper appears to be review or summarize advanced forms from AMMCs forgery, such like Abou metals (TM), Abou alkynes (MO), and Al-Salt multiple parts, at multiple operating temperature increases and FSP specifications, as well as their effect upon that crystalline structure but not the resistance decreases of the manufactured materials. This review will be useful to professors, investigators, or operators since it offers extensive data on AMMCs utilizing FSP.

Suresh Babu B,(2018),Production and characterization of both the microstructural and mechanics of frictionless saute Al6063 fiber containing Gr/B4C/SiC particles

This study examines the influence of strengthening grit on the mechanical properties of welded joints. silver (Al

6063) hybrid. Different weight percentages and combinations of additives (graphite (gr), B4C, etc SiC) were used to effectively produce composites using the stir casting process. All composite specimens were fused using the solid state joining procedure of static stir soldering. Measurements including spindle. To describe the composites, velocity (800, 1000, & 1200 rpm), tool diameter (20 to 40 mm/min), and axis pressure (10 to 20 kN) were assessed.

T. Nithyanandhan,(2017),Appraisal of project titled "Independent inquiry the Physical properties with Aluminum alloys Combination With physical."

This research aims to utilize wastage of metal matrix composites (MMCs) using a more prevalent stir castings. These MMCs might be utilized in the fabrication of lighter, stronger components for the car and aviation industries. Ash derived from coconut shells is a sticky waste that, if not disposed of appropriately, may cause impacts to the environment. The plan is to utilize this trash to create inexpensive composite materials. The article describes the manufacture of aluminum-based metallic matrix composites before describing their physical behavior, including compressive & hardness.This study's objective is to give a thorough evaluation of the effect of hybrid reinforcements, such as pineapple shell ash, on the mechanical performance of titanium alloys.

NAMDEV A. PATIL,(2020), "A REVIEW OF THE FABRICATION OF ALUMINUM HYBRID SURFACE COMPOSITES USING FRICTION STIR PROCESSIN"

In support of this research need, this work examines the current level of knowledge & developments in aluminum alloys low activation composite structures fabrication by FSP employing in-situ and ex-situ techniques.In order to illustrate the impacts of different types of reinforcements, deposition procedures, hybrid material properties, and FSP machine parameters upon that morphology, structural, & tribological characteristics of various Al alloys, the relevant literature was reviewed and comprehensively categorized. The conclusion summarizes the challenges and potential in this sector, which will be useful to scientists working upon metal oxide FSP approach.

S. Arokiasamy, (2017),"Research instrument on the enhancement of the dynamic mechanical properties hybrid composite material using friction stirred processing."

In this investigation, the enhancement of the exterior physical behavior of metallic matrix composites generated by melt blending was evaluated. Contact swirl preparation (FSP) is just a sturdy information products with unique features, including minimal heat generation, wide plastic material flow attainment of incredibly fine micro in the shear zone, and healing of defects and casting porosity. FSP permits the customization of a structure's attributes at the local level. It is a technique for altering the physical behavior of interfaces by the circumstance that puts of a tool moving across the contact of the substance that material characteristics must be adjusted.

A.K. LAKSHMINARAYANAN, (2011),"Designing the windows for aluminum metal AA2219 turning operation welded"

For successful joining of AA2219 aluminum alloy, a friction stir welded window was devised. Different variants of process variables, including speed of rotation & heat input, were utilized to create joins. Microstructural studies was used to create the aperture for weld friction stir welding. Using tensile properties and microstructural investigations, the tensile properties of connectors in various areas of the friction stir melting window were examined, and the fracture site of joints was connected with the microhardness distribution characteristics. This screens should serve as guides for determining the proper friction stirred weld bead settings for producing high-quality welds in AA2219 aluminum alloys.

Noor Zaman KHAN,(2017),"Evaluation of defects in the cleaning production chain for friction stirring welding"

This research provides a comprehensive characterization of prevalent FSW joint abnormalities. The majority of defects are caused by inadequate heat generation, improper products circulation it around pin, and inadequate material condensation while behind lock, as determined by the results of the present study. The quantity of heat generated and material churning is dependent on a number of FSW factors, the improper selection of which may result in the production of defects. The conclusions provided in this paper are based on extensive research and testing. Prescriptions are provided in the form of flaws' features, such as the probability of their placement and the primary relevant elements, as well as suggestions for their reduction.

S. Rajakumar, (2011),"Optimization of Multiple Responses for Contact pressure AA1100 Anodized Alloy Fittings"

In this study, correlations were established between FSW factors (speed of rotation, spindle speed, thrust force, work piece, pin angle, & cutting hardness) and indeed the response (tensile stress, hardness, and material removal rate). For AA1100 aluminum, the ideal weld procedures to enhance tensile strength & decrease ductility have been determined and reported.

V. Balasubramanian, (2008),"Connection amongst metals properties & contact stir riveting processing methods"

The FSW process variables, like milling cutter, tools angular speed, axial load, etc., have a substantial impact on the weld quality. In this study, a correlation was sought between surface texture attributes and FSW process parameters. FSW joints were manufactured using five separate kinds of brass (AA1050, AA6061, AA2024, and AA7075) and many permutations of process settings.A morphological investigation was performed to evaluate the efficiency of the welds (defective or defect free). The statistical parameters between base metal characteristics, tool rotating speed, and welding parameters have already been established. Utilizing the discovered empirical connections, accurately predict essential FSW system configuration to generate defect-free welds.

S. Rajakumar,(2010),"The effect of frictional stir method and tool settings on the mechanical characteristics of AA7075-T6 aluminum alloy joints"

This research evaluated the influence of processing and machine setting on the structural rigidity characteristics of agitation stir-welded AA7075-T6 joints. Various process and tool characteristics were used to manufacture square butt couplings. The microstructure and microhardness of the weld nugget were examined and associated with the joint's strength parameters. The joint created at a spindle speed at rotation speed, tool rotation at 60 mm/min, ultimate strength of 8 k N, and utilizing a device with just a shoulders radius of 15 mm, a pin width of 5 mm, and a tip harshness of 45 HRc had greater strength attributes than other joints.

Ch Mohana Rao, (2017),"Analyses Upon That Tension Simmer OF Equivalent Aluminums 6061 With 6061"

Frictional stir welding (FSW) was used to connect 4mm-thick 6061-to-6061 aluminum plates of same composition. By the Edm process, a so-called fabrication pin revolving at speeds often exceeding a few hundred revolutions per minute travels along the lengths of interacting metal plates, forming an extremely plasticised zone through the accompanying tension and mechanical heat. FSW converting Aluminum to Metal has attracted significant interest from the industrial sectors, including Shipbuilding, Automotive, Railway, and Aircraft manufacture. The impact of Categorized as follow and Tensile Properties has been examined using Variable Process Parameters. This influence on spindle speed here on crystallites, smoothness uniformity, and stress profiles of weld zone was investigated. By adjusting the process settings, fault, high-performance welded joints were manufactured.

Karan Singla,(2014), "Welding by Friction Stirring"

Welding is a technique for methodologically sound, often metals or thermo settings. During welding, the components to be joined are melted at the combining surface, and a material is most often added to produce a weld area that solidifies it in to a real attachment. Soldering & brazing, but in the other extreme, do not involve melting the workpiece; instead, a substance with a low melting temperature is heated to join the workpieces.In December 1991, Wayne Thomas invented Probabilistic Percussion Heated (Pwht) called TWI (Their Welder Technology), though the first filing are made in the United Kingdom. Initially, the method was viewed as "scientific curiosity," but still it soon became clear that FSW provided major benefits in the production of aluminum products. Soldering is a technique wherein materials are joined while melting. This paves the way for whole new welding technologies. Using FSW, hitherto unweldable 2xxx & 7xxx range alloy may now be joined with speed and superior quality.

Ravi Kumar,(2014),"Innovation Resistance Spot Welder Uses for Aluminum"

This study reviews the friction stirred spot welding, its components, the creation and movement of heat, the microstructural characteristics and the material management during FSW. As per the prosecution's findings, resistance welders are really the best approach for combining similar & dissimilar aluminum. The pretty significant of FSW joints is superior to that of other joining processes. The generated heat transfer model is validated by comparing the calculated thermal characteristics with experimental data at comparable welding settings.

N. Altnkok,(2013),"Clean Sliding Wearing Characteristic of Al2O3/SiC Particulate Reinforced Aluminum-Based MMCs Made by Stir Casting"

Using stir casting, Al2O3/SiC reinforced aluminum matrix hybrids with particle reinforcement were manufactured. At 1200 degrees Celsius, Al2O3/SiC powdered was generated by heating an aqueous phase of alkaline liquid and ammonium chloride with just a solution containing Particles.During first continuous stirring between eutectic point and liquidus over inert conditions, 10 wt% of this hybrids clay with nanoparticles of varying sizes was added to a melting environments alloy. A friction- and wear- tester was used to perform dry sliding wear testing. Using an electron microscope, the shapes of the wear test were investigated to evaluate the wear features and analyze the wear process. After room-temperature, dry wear testing, the precipitations of hybrid porcelain composites with reinforced metal matrix were examined using an optical microscope. It was discovered that hybridization and two - way particulate reinforcement lowered weight loss, particularly when bigger particle sizes SiC powder was utilized.

K. Elangovan, (2008), "The Effect of Workpiece Material & Tool Pressure here on Structural Properties of Vibratory Deglaze AA6061 Aluminum"

Magnesium alloys AA6061 (Al-Mg-Si alloy) have attained universal acceptance in the fabrication of lightweight structures requiring a high grades ration & superior corrosion resistance. The Frequency Stir Joining

(FSW) methodology is a growing high performance joins method using which the elements to be fused is not melted or recast, unlike many standard fusion welding processes used for fusing structural aluminum. This method employs a nonconsumable instrument to create frictional heat between two surfaces. The joint attributes are mostly determined by the welding parameters, such as tool rotating frequency, welding current, thrust force, etc., & tool geometry profile. In this inquiry, the influence of rotational velocity and tool geometry profile on the mechanical characteristics of AA6061 aluminum alloy was examined.

S. Vijayakumar,(2022),"Wear Analysis of the Face of such a Super alloy Fabricated using Friction Stir Processing"

The dry sliding wear rate of contact stir welder AA6262/AA5456 combination was examined utilizing a Taguchi technique in this research paper. Utilizing acceptable process variables like load (LD), traverse velocity (SS), & sliding speed (SE), wore tests are conducted to identify the individual and combined impacts of factors. Utilizing the taguchi orthogonal L27 mode, a number of tests are conducted to determine the maximum and lowest wear amounts. Using the Pin in Disc (POD) setup, the weight of materials is measured and during the test in order to calculate the wear (WR). Then, using MINITAB software, a number of statistical studies are run, including ANOVA, association plot between factors, and regression model.

Ramanjaneyulu KADAGANCHI, (2015),"Improvement of process variables for friction stirring welding of aluminum AA 2014-T6 that used a three-dimensional surface approach."

Because of its likely feels ratio and remarkable plasticity, its warm air alumina cobalt hybrid AA2014 is widely used in the military and military sectors. The Vibratory Friction Welder (FSW) procedure, a developing solid state joining technology, is preferable to fuse welded processes for combining this alloy. This research proposes the development of a quantitative equation encompassing process circumstances and workpiece material to determine the elastic modulus, compressive modulus, and ductility with AA 2014-T6 al sheet surface roughness welding. The most significant process factors to consider are travel frequency, wire feed, pitch angle, or tool pin form. Using a complex, five-core compound construction & high current ratio methods (RSM), regressors for predicting response been developed. As responses, the mechanical characteristics yields strengths (YS), extreme structural stress (UTS), and percent elongation (%El) are examined.

G. Elatharasan, (2013), "An experimental examination & adjustment of process parameters for RSM residual stress welders of AA 6061-T6 aluminum"

Friction force stir welders (FSW) is a revolutionary steady method of joining in which the material being welded is neither melted nor reformed. The resistance spot welding, like process parameter, wire tension, or thrust load, have just a substantial effect upon that joint qualities. This study demonstrated the link between FSW characteristics (revolutions per minute, traverse speed, axial force) and the response (compressive stress, Yield strength (YS), and %Elongation (%E)) using linear regression methods using three parameters, three levels, and twenty runs.

Chenwei Shao,(2019),"Architecture of rising aluminum–matrix composite manufactured using an innovative microcasting technology"

Cast anodized alloys have been utilized extensively with in rail and aircraft sectors as significant lightweight concrete structures. Cetera materials account for over 90 percentage among all molds due to their exceptional machinability and greater durability. However, despite the introduction of several reinforcements, the toughness of these materials is not very great, which significantly restricts their usage in some increased applications.

Ikubanni Peter P, (2019)"A research of enameled hybrid reinforcing aluminum matrix composites" was the topic of the study.

The increased physical and mechanical characteristics of aluminum composites (AMCs) augmented with organic fibres of varied sources have made them a suitable advanced material, according to research conducted over the last several decades. Such replacements may be solitary (use of a single reinforcement) or hybridized (use of several reinforcements) with synthetic fine sediments; however, they improve the physico-mechanical and wear properties of the aluminum alloy matrix. Consequently, this article covers several of these composites created by stir-casting techniques and their characteristics, which are presently trending in the field of materials research. By adjusting parameters like as stirring throughput and reinforcement kinds and composition, the stir casting technique may create AMCs with desirable physical qualities, mechanical behavior, and wear characteristics. AMCs are extraordinarily beneficial for the manufacture of components for the automotive, aerospace, & aviation sectors.

P. Vignesh Kumar,(2020), "Taguchi method parameter improvement of friction stirring welding process for combination aluminum- wheat osterwalder ash- graph compound"

In the current study, a hybrid aluminum composite was manufactured with various percentages of quarry dust (4, 8, and 12 wt%) and a constant quantity of diamond (2 wt%). To assess the Ductility of the newly developed alloy, welding with friction stir was used. Using the Taguchi method, experiments were designed and the influence of input variables on output response was analyzed. As input parameters, varying percent of tool rotational speeds (1000, 1250, rotations a min (rpm)), tool angular velocity (3, 6, 9 mm/min), & reinforcements weight% were chosen, while weld strength was set as the output variable.

P. Venkateshwar Reddy,(2020),"Mechanical and Corrosion Performances of Metal Metallic Matrix Composites: A Review" Technological advances are being used to generate tens of thousands of goods every day for the comfort and opulence of human life. Likewise, the need for materials with contradictory qualities, such as low weight and great strength, is growing. This need for novel materials with unorthodox features has led to the introduction and development of Metallic Materials (MMC). MMC is easily produced by reinforcing fiber materials with a base metal matrix if they contain desirable features such as strong durability, excellent stiffness, or high strength, among others.

G. Padmanaban, (2010), "An experimental study of dynamic stir melting of magnesium alloy AZ31B"

The typical soldering of aluminum alloys often results in holes in the joint, which degrades the material's mechanical qualities. For connecting magnesium alloys, frictionless stir welders (FSW), a steady welding process, may be used to alleviate this issue. This research investigated the effect of FSW characteristics such as tool revolving speed, tool rotations, & tensile stress upon those tensile properties of AZ31B carbonfiber.

B. Suresh Babu,(2020),"Studies on the mechanical characteristics of hybrid composites based on aluminum"

Aluminum alloy outperforms common metal alloys, making it a perfect alternative to metals with in automobile and aerospace. Because of its sparse population, good stiffness, and remarkable structural rigidity, Hybridized Alum Manganese Metal Connectors (HMMCs) are of great relevance to the aerospace and automobile industries sectors.The metallic & mechanical properties of Aluminum 6063-Silicon Mortar &Aluminum 6063-Silicon Calcinated combined metal matrix ceramics are manufactured and analyzed in this work. The composites were made using stir casting procedures with reinforcement amounts ranging from 5% to 15% in increments of 5% by weight each sample.

Sabina Luisa Campanelli, (2013), "Solid State Welding (FSW) is just a sturdy joining method; no melting occurs. Spot welding is facilitated along the weld's center by the movement & translation of such a rotation, non-consumable probe.Hence, FSW can perform at far temperatures lower than conventional hot forging, despite a number of disadvantages.The modest overheating seems to have a positive impact on the welding medium. Material flow all around tool pins is improved, while toughness is concurrently raised. As LAFSW of aluminum alloy was effectively attained, with certain advantages for weld, it is fair to investigate the advantages of this invention for work piece, greater welding rates, and reduced clamping force.

G. Liu,(1997)," MICROSTRUCTURAL ASPECTS OF THE FRICTION-STIR WELDING OF 6061-T6 ALUMINUM"

It seems that resistance welding is a variant of conventional formability (1). Within vibrational weld region, this so manufacturing pin travels down the length of two contacting metal plates, generating a highly plasticized zone as a result of the associated force or contact heating. Such an elasto - plastic sector is "provoked" into a steady weld on the lead side of such a soldering headed pins, for instance. Replicating this action in a real material is as easy as driving the rotating hammer bit into to the object, due to the production of a remnant weld region on the tail side. Figure 1 illustrates contact pressure welding

Y. N. Zhang,(2012), "A review of frictional stirring soldering & process equipment"

Due to energy performance and environmental friendliness, fluid stir weld (FSW) is just a unique green manufacturing process. That solid state joining method utilizes a shoulders and/or a probe on a spinning tool. The shoulder exerts a downward force on the surface of the workpiece, constrains the plasticized material it around probe, creates heat via friction, and induces deformation in a fairly narrow layer under the shoulder's bottom surface. In the surface layer, the revolving probe primarily pulls, plasticizes, and mixes the neighboring material to create a non-fusing junction. Friction stir preparation (FSP), a variant of friction stir welding (FSW), has been applied to produce composites, regionally eliminate deformation, refine microstructure, and/or improve the related mechanical and physical properties, such as fortitude, ductility, fatigue, creep, formability, and corrosion resistance. Nonetheless, significant obstacles like as design and fabrication and wear still restrict use of FSW/P in industrial applications, especially for high softening point or super strength alloy. In this overview, the FSW/P tool types, forms, dimensions, materials, and wear characteristics are briefly summarized.

3. Conclusion

The basic understanding of the FSW and the creation of the structures and characteristics must be merged in order to develop intelligent industrial automation models with the objective of achieving defect-free, structurally sound, and dependable welds. A project's success will assure the availability of almost the whole quantifiable base of knowledge of FSW weld characteristics and the fabrication of defect-free, structurally sound, and dependable welds. The research suggests indicated friction mix welding is the most suited approach for connecting aluminum alloys that are comparable or different. The strength, stiffness, wear resistance, & tensile properties of friction stir weld are much greater than those of traditional fusion welding. In additional as joining aluminum, dynamic stir welders has been used to effectively connect iron, manganese, brass, aluminum, or nanocomposite. Due to their high moisture content and poor ductility, effective FSW joining of materials with large melting points was often restricted to a small range of FSW variables.

Based on the data, welding by friction stir provides the most efficient technique for connecting aluminum having comparable structure.FSW demonstrates a considerable higher strength or ductility when compared to conventional fusion welding. Friction Stir Splitter is utilized to combine 6061 Metal plates with a thickness of 4mm under varied parameters (such as speed (rpm), cable process parameters (mm/min), & joining variables are determined).

References

- Shao, C., Zhao, S., Wang, X., Zhu, Y., Zhang, Z., & Ritchie, R. O. (2019). Architecture of high-strength aluminum–matrix composites processed by a novel microcasting technique. *NPG Asia Materials*, *11*(1). https://doi.org/10.1038/s41427-019-0174-2
- Liu, G., Murr, L. E., Niou, C. S., McClure, J. C., & Vega, F. R. (1997). Microstructural aspects of the friction-stir welding of 6061-T6 aluminum. *ScriptaMaterialia*, *37*(3), 355–361. https://doi.org/10.1016/S1359-6462(97)00093-6
- Liu, G., Murr, L. E., Niou, C. S., McClure, J. C., & Vega, F. R. (1997). Microstructural aspects of the friction-stir welding of 6061-T6 aluminum. *ScriptaMaterialia*, *37*(3), 355–361. https://doi.org/10.1016/S1359-6462(97)00093-6
- Lakshminarayanan, A. K., Malarvizhi, S., &Balasubramanian, V. (2011). Developing friction stir welding window for AA2219 aluminium alloy. *Transactions of Nonferrous Metals Society of China (English Edition)*, *21*(11), 2339–2347. https://doi.org/10.1016/S1003-6326(11)61018-2
- KHAN, N. Z., KHAN, Z. A., SIDDIQUEE, A. N., AL-AHMARI, A. M., & ABIDI, M. H. (2017). Analysis of defects in clean fabrication process of friction stir welding. *Transactions of Nonferrous Metals Society of China (English Edition)*, *27*(7), 1507–1516. https://doi.org/10.1016/S1003-6326(17)60171-7
- Arokiasamy, S., &Anand Ronald, B. (2017). Experimental investigations on the enhancement of mechanical properties of magnesium-based hybrid metal matrix composites through friction stir processing. *International Journal of Advanced Manufacturing Technology*, *93*(1–4), 493–503. https://doi.org/10.1007/s00170-017-0221-5
- Padmanaban, G., &Balasubramanian, V. (2010). An experimental investigation on friction stir welding of AZ31B magnesium alloy. *International Journal of Advanced Manufacturing Technology*, *49*(1–4), 111–121. https://doi.org/10.1007/s00170-009-2368-1
- Patil, N. A., Pedapati, S. R., &Mamat, O. Bin. (2020). A review on aluminium hybrid surface composite fabrication using Friction Stir Processing. *Archives of Metallurgy and Materials*, *65*(1), 441–457. https://doi.org/10.24425/amm.2020.131747
- Rajakumar, S., &Balasubramanian, V. (2012). Multi-response optimization of friction-stir-welded AA1100 aluminum alloy joints. *Journal of Materials Engineering and Performance*, *21*(6), 809–822. https://doi.org/10.1007/s11665-011-9979-z
- Campanelli, S. L., Casalino, G., Casavola, C., &Moramarco, V. (2013). Analysis and comparison of friction stir welding and laser assisted friction stir welding of aluminum alloy. *Materials*, *6*(12), 5923–5941. https://doi.org/10.3390/ma6125923
- Karthik, S. B., &Sriranga, B. K. (2017). *Investigation of Mechanical Properties on Vinyl Ester Based Hybrid Composites*. *April 2007*, 216–222. https://doi.org/10.21647/icctest/2017/48963
- Suresh Babu, B., Chandramohan, G., Boopathi, C., Pridhar, T., &Srinivasan, R. (2018). Production and characterization of mechanical and microstructural behaviour of friction stir welded Al6063 composites reinforced with Gr/B4C/SiC particles. *Journal of Ceramic Processing Research*, *19*(1), 69–74.
- Balasubramanian, V. (2008). Relationship between base metal properties and friction stir welding process parameters. *Materials Science and Engineering A*, *480*(1–2), 397–403. https://doi.org/10.1016/j.msea.2007.07.048
- Suresh Babu, B., Prathap, P., Balaji, T., Gowtham, D., SreeAdi, S. D., Divakar, R., &Ravichandran, S. (2020). Studies on mechanical properties of aluminum based hybrid metal matrix composites. *Materials Today: Proceedings*, *33*(xxxx), 1144–1148. https://doi.org/10.1016/j.matpr.2020.07.342
- Kumar, P. V., &Paranthaman, P. (2020). Friction stir welding process parametric optimization of hybrid aluminium-bagasse ash-graphite composite by Taguchi approach. *Materials Today: Proceedings*, *37*(Part 2), 764–768. https://doi.org/10.1016/j.matpr.2020.05.789

- Preethi, V., & Das, A. D. (2020). Optimization of friction stir welding parameters for better hardness in weld nugget of hybrid aluminium composite. *Materials Today: Proceedings*, *37*(Part 2), 723–727. https://doi.org/10.1016/j.matpr.2020.05.729
- Bahrami, M., Dehghani, K., &BesharatiGivi, M. K. (2014). A novel approach to develop aluminum matrix nano-composite employing friction stir welding technique. *Materials and Design*, *53*, 217–225. https://doi.org/10.1016/j.matdes.2013.07.006
- Gangil, N., Siddiquee, A. N., &Maheshwari, S. (2017). Aluminium based in-situ composite fabrication through friction stir processing: A review. *Journal of Alloys and Compounds*, *715*, 91–104. https://doi.org/10.1016/j.jallcom.2017.04.309
- Rajakumar, S., Muralidharan, C., &Balasubramanian, V. (2011). Influence of friction stir welding process and tool parameters on strength properties of AA7075-T6 aluminium alloy joints. *Materials and Design*, *32*(2), 535–549. https://doi.org/10.1016/j.matdes.2010.08.025
- Mohana Rao, C., &Mallikarjuna Rao, K. (2017). Studies on friction stir welding of aluminium alloys 6061- to- 6061 similar metals. *International Journal of Mechanical Engineering and Technology*, *8*(1), 264–269.
- HIRANO, S. (2008). Friction Stir Welding. *Journal of the Japan Welding Society*, *77*(5), 446–448. https://doi.org/10.2207/jjws.77.446
- Kumar, R., Ghosh, A., &Chattopadhyaya, S. (2015). Emerging Friction Stir Welding for Aluminium and its Applications. *Manufacturing and Industrial Engineering*, *14*(1–2). https://doi.org/10.12776/mie.v14i1-2.460
- Zhang, Y. N., Cao, X., Larose, S., &Wanjara, P. (2012). Review of tools for friction stir welding and processing. *Canadian Metallurgical Quarterly*, *51*(3), 250–261. https://doi.org/10.1179/1879139512Y.0000000015
- Akinwamide, S. O., Abe, B. T., Akinribide, O. J., Obadele, B. A., &Olubambi, P. A. (2020). Characterization of microstructure, mechanical properties and corrosion response of aluminium-based composites fabricated via casting—a review. *International Journal of Advanced Manufacturing Technology*, *109*(3–4), 975–991. https://doi.org/10.1007/s00170-020-05703-1
- Altinkok, N., Özsert, I., &Findik, F. (2013). Dry sliding wear behavior of Al2O3/SiC particle reinforced aluminium based mmcs fabricated by stir casting method. *ActaPhysicaPolonica A*, *124*(1), 11–19. https://doi.org/10.12693/APhysPolA.124.11
- Peter P, I., Oki, M., &Adekunle A, A. (2020). A review of ceramic/bio-based hybrid reinforced aluminium matrix composites. *Cogent Engineering*, *7*(1). https://doi.org/10.1080/23311916.2020.1727167
- Elangovan, K., Balasubramanian, V., &Valliappan, M. (2008). Effect of tool pin profile and tool rotational speed on mechanical properties of friction stir welded AA6061 aluminium alloy. *Materials and Manufacturing Processes*, *23*(3), 251–260. https://doi.org/10.1080/10426910701860723
- Vijayakumar, S., Anitha, S., Arivazhagan, R., Hailu, A. D., Rao, T. V. J., &Pydi, H. P. (2022). Wear Investigation of Aluminum Alloy Surface Layers Fabricated through Friction Stir Welding Method. *Advances in Materials Science and Engineering*, *2022*. https://doi.org/10.1155/2022/4120145
- Bodunrin, M. O., Alaneme, K. K., &Chown, L. H. (2015). Aluminium matrix hybrid composites: A review of reinforcement philosophies; Mechanical, corrosion and tribological characteristics. *Journal of Materials Research and Technology*, *4*(4), 434–445. https://doi.org/10.1016/j.jmrt.2015.05.003
- Kadaganchi, R., Gankidi, M. R., &Gokhale, H. (2015). Optimization of process parameters of aluminum alloy AA 2014-T6 friction stir welds by response surface methodology. *Defence Technology*, *11*(3), 209–219. https://doi.org/10.1016/j.dt.2015.03.003
- Elatharasan, G., & Kumar, V. S. S. (2013). An experimental analysis and optimization of process parameter on friction stir welding of AA 6061-T6 aluminum alloy using RSM. *Procedia Engineering*, *64*, 1227–1234. https://doi.org/10.1016/j.proeng.2013.09.202
- Salih, O. S., Ou, H., Sun, W., & McCartney, D. G. (2015). A review of friction stir welding of aluminium matrix composites. *Materials and Design*, *86*, 61–71. https://doi.org/10.1016/j.matdes.2015.07.071