

Friction Stir Welding Comsol

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Advances in Manufacturing Engineering and Materials II Sergej Hloch 2021-03-16
This book reports on cutting-edge research and technologies in the field of advanced manufacturing and materials, with a special emphasis on unconventional machining process, rapid prototyping and biomaterials. It gathers contributions to the International Conference on Manufacturing Engineering and Materials (ICMEM 2020), which was originally planned in June 2020, but will actually take place in 2021, in Nový Smokovec, Slovakia, because of the Covid-19 pandemic. Despite the challenging times, submitted contributions were peer-reviewed, and upon a careful revision, included in this book, which covers advances that are expected to increase the industry's competitiveness with regard to sustainable development and preservation of the environment and natural resources. Condition monitoring, industrial automation, and diverse fabrication processes such as welding, casting and molding, as well as tribology and bioengineering, are just a few of the topics discussed in the book's wealth of authoritative contributions. A special emphasis is given to problems connected to climate change and solution manufacturer and engineers may adopt and develop to prevent and cope with them.

Advanced Welding Techniques Mukti Chaturvedi 2021-02-01 This book provides an insight into the welding techniques with a cross-disciplinary treatment to address the shortcomings of contemporary learning of welding terminology. Various topics covered include introduction to welding processes, design requirements, prominence of design, case studies presenting structural defacements due to inappropriate design, comprehensive surveys on welding processes selected from various process categories, design calculations to be adopted for specific applications and sample calculations. This book is useful for researchers, engineers and professionals working on welding equipment and technologies.

Closed-loop Control of Temperature in Friction Stir Welding Axel Fehrenbacher 2008

Residual Stresses in Friction Stir Welding Nilesh Kumar 2013-11-20 This book describes the fundamentals of residual stresses in friction stir welding and reviews the data reported for various materials. Residual stresses produced during manufacturing processes lead to distortion of structures. It is critical to understand and mitigate residual stresses. From the onset of friction stir

welding, claims have been made about the lower magnitude of residual stresses. The lower residual stresses are partly due to lower peak temperature and shorter time at temperature during friction stir welding. A review of residual stresses that result from the friction stir process and strategies to mitigate it have been presented. Friction stir welding can be combined with additional in-situ and ex-situ manufacturing steps to lower the final residual stresses. Modeling of residual stresses highlights the relationship between clamping constraint and development of distortion. For many applications, management of residual stresses can be critical for qualification of component/structure. Reviews magnitude of residual stresses in various metals and alloys Discusses mitigation strategies for residual stresses during friction stir welding Covers fundamental origin of residual stresses and distortion

Recent Advances in Mechanical Engineering K.M. Pandey 2021-01-10 This book presents the select proceedings of the International Conference on Recent Advancements in Mechanical Engineering (ICRAME 2020). It provides a comprehensive overview of the various technical challenges faced, their systematic investigation, contemporary developments, and future perspectives in the domain of mechanical engineering. The book covers a wide array of topics including fluid flow techniques, compressible flows, waste management and waste disposal, bio-fuels, renewable energy, cryogenic applications, computing in applied mechanics, product design, dynamics and control of structures, fracture and failure mechanics, solid mechanics, finite element analysis, tribology, nano-mechanics and MEMS, robotics, supply chain management and logistics, intelligent manufacturing system, rapid prototyping and reverse engineering, quality control and reliability, conventional and non-conventional machining, and ergonomics. This book can be useful for students and researchers interested in mechanical engineering and its allied fields.

Digital Twin - Fundamental Concepts to Applications in Advanced Manufacturing Surjya Kanta Pal 2021-08-12 This book provides readers with a guide to the use of Digital Twin in manufacturing. It presents a collection of fundamental ideas about sensor electronics and data acquisition, signal and image processing techniques, seamless data communications, artificial intelligence and machine learning for decision making, and explains their necessity for the practical application of Digital Twin in Industry. Providing case studies relevant to the manufacturing processes, systems, and sub-systems, this book is beneficial for both academics and industry professionals within the field of Industry 4.0 and digital manufacturing.

Friction Stir Welding and Processing VI Rajiv S. Mishra 2011-04-12 Friction stir welding has seen significant growth in both technology implementation and scientific exploration. This book covers all aspects of friction stir welding and processing, from fundamentals to design and applications. It also includes an update on the current research issues in the field of friction stir welding and a guide for further research.

Friction Stir Welding and Processing IX Yuri Hovanski 2017-02-06 This books presents a current look at friction stir welding technology from application to characterization and from modeling to R&D. It is a compilation of the recent progress relating to friction stir technologies including derivative technologies, high-temperature applications, industrial applications, dissimilar alloy/materials, lightweight alloys, simulation, and characterization. With contributions from leaders and experts in industry and academia, this will be a comprehensive source for the field of Friction Stir

Welding and Processing.

Welding Journal 2008

Mechanics of Materials in Modern Manufacturing Methods and Processing

Techniques Vadim V. Silberschmidt 2020-04-03 Mechanics of Materials in Modern Manufacturing Methods and Processing Techniques provides a detailed overview of the latest developments in the mechanics of modern metal forming manufacturing. Focused on mechanics as opposed to process, it looks at the mechanical behavior of materials exposed to loading and environmental conditions related to modern manufacturing processes, covering deformation as well as damage and fracture processes. The book progresses from forming to machining and surface-treatment processes, and concludes with a series of chapters looking at recent and emerging technologies. Other topics covered include simulations in autofrettage processes, modeling strategies related to cutting simulations, residual stress caused by high thermomechanical gradients and pultrusion, as well as the mechanics of the curing process, forging, and cold spraying, among others. Some non-metallic materials, such as ceramics and composites, are covered as well. Synthesizes the latest research in the mechanics of modern metal forming processes Suggests theoretical models and numerical codes to predict mechanical responses Covers mechanics of shot peening, pultrusion, hydroforming, magnetic pulse forming Considers applicability of different materials and processes for optimum performance

Advances in Friction-Stir Welding and Processing M.-K. Besharati-Givi 2014-12-08 Friction-stir welding (FSW) is a solid-state joining process primarily used on aluminum, and is also widely used for joining dissimilar metals such as aluminum, magnesium, copper and ferrous alloys. Recently, a friction-stir processing (FSP) technique based on FSW has been used for microstructural modifications, the homogenized and refined microstructure along with the reduced porosity resulting in improved mechanical properties. *Advances in friction-stir welding and processing* deals with the processes involved in different metals and polymers, including their microstructural and mechanical properties, wear and corrosion behavior, heat flow, and simulation. The book is structured into ten chapters, covering applications of the technology; tool and welding design; material and heat flow; microstructural evolution; mechanical properties; corrosion behavior and wear properties. Later chapters cover mechanical alloying and FSP as a welding and casting repair technique; optimization and simulation of artificial neural networks; and FSW and FSP of polymers. Provides studies of the microstructural, mechanical, corrosion and wear properties of friction-stir welded and processed materials Considers heat generation, heat flow and material flow Covers simulation of FSW/FSP and use of artificial neural network in FSW/FSP

Welding Engineering David H. Phillips 2016-02-16 Provides an introduction to all of the important topics in welding engineering. It covers a broad range of subjects and presents each topic in a relatively simple, easy to understand manner, with emphasis on the fundamental engineering principles. • Comprehensive coverage of all welding engineering topics • Presented in a simple, easy to understand format • Emphasises concepts and fundamental principles

Friction Stir Welding and Processing III Kumar V. Jata 2005-02 Date and place of meeting on t.p. is erroneous.

Recent Advances in Energy Technologies N. Lakshmi Narasimhan 2022-09-29 This book presents the select proceedings of the first International Conference on Energy and Materials Technologies (ICEMT) 2021, organized by the Department of Mechanical Engineering, Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam, India. It covers the recent technologies in two broad thematic areas: energy and materials. Various topics covered in this book include hybrid energy, advanced energy systems, energy management, energy policy, geothermal, nuclear energy, bio-energy, waste to energy, power plants, and automotives. The book will be useful for students, researchers, and professionals in the area of mechanical engineering, especially various domains of energy.

Next Generation Materials and Processing Technologies Swarup Bag 2021 This book presents the select proceedings of Conference on Research and Developments in Material Processing, Modelling and Characterization (RDMPMC 2020). It highlights the new technologies developed in the generation of rational materials for various applications with tailored properties. It covers fundamental research in emerging materials which includes biomaterials, composites, ceramics, functionally graded materials, energy materials, thin film materials, nanomaterials, nuclear materials, intermetallic, high strength materials, structural materials, super alloys, shape memory alloys and thermally enhanced materials. It includes the numerical modeling and computer simulation to investigate the properties and structure of materials. Few of the most relevant manufacturing techniques highlighted in this book are welding, coating, additive manufacturing, laser-based manufacturing, advanced machining processes, casting, forming and micro and nanoscale manufacturing processes. Given its contents, this book is beneficial to students, researchers and industry professionals. .

Friction Stir Welding and Processing VII Rajiv Mishra 2016-12-01 This collection focuses on all aspects of science and technology related to friction stir welding and processing.

Advances in Manufacturing Processes K. S. Vijay Sekar 2018-09-10 This book comprises selected proceedings of the International Conference on Engineering Materials, Metallurgy and Manufacturing (ICEMMM 2018). It discusses innovative manufacturing processes, such as rapid prototyping, nontraditional machining, advanced computer numerical control (CNC) machining, and advanced metal forming. The book particularly focuses on finite element simulation and optimization, which aid in reducing experimental costs and time. This book is a valuable resource for students, researchers, and professionals alike.

Applied Technologies Miguel Botto-Tobar 2020-03-02 This second volume of the three-volume set (CCIS 1193, CCIS 1194, and CCIS 1195) constitutes the refereed proceedings of the First International Conference on Applied Technologies, ICAT 2019, held in Quito, Ecuador, in December 2019. The 124 full papers were carefully reviewed and selected from 328 submissions. The papers are organized according to the following topics: technology trends; computing; intelligent systems; machine vision; security; communication; electronics; e-learning; e-government; e-participation.

Eine Methode zur Wärmequellenkalibrierung in der Schweißstruktursimulation
Alexander Schober 2014-11-14

Friction Stir Welding Daniela Lohwasser 2009-12-18 Friction stir welding (FSW) is a highly important and recently developed joining technology that produces a

solid phase bond. It uses a rotating tool to generate frictional heat that causes material of the components to be welded to soften without reaching the melting point and allows the tool to move along the weld line. Plasticized material is transferred from the leading edge to trailing edge of the tool probe, leaving a solid phase bond between the two parts. Friction stir welding: from basics to applications reviews the fundamentals of the process and how it is used in industrial applications. Part one discusses general issues with chapters on topics such as basic process overview, material deformation and joint formation in friction stir welding, inspection and quality control and friction stir welding equipment requirements and machinery descriptions as well as industrial applications of friction stir welding. A chapter giving an outlook on the future of friction stir welding is included in Part one. Part two reviews the variables in friction stir welding including residual stresses in friction stir welding, effects and defects of friction stir welds, modelling thermal properties in friction stir welding and metallurgy and weld performance. With its distinguished editors and international team of contributors, Friction stir welding: from basics to applications is a standard reference for mechanical, welding and materials engineers in the aerospace, automotive, railway, shipbuilding, nuclear and other metal fabrication industries, particularly those that use aluminium alloys. Provides essential information on topics such as basic process overview, materials deformation and joint formation in friction stir welding Inspection and quality control and friction stir welding equipment requirements are discussed as well as industrial applications of friction stir welding Reviews the variables involved in friction stir welding including residual stresses, effects and defects of friction stir welds, modelling thermal properties, metallurgy and weld performance

Energy: Nuclear Michael Ratner Part of the government series on energy, from TheCapitol.Net, this text discusses the nuclear energy issues facing Congress including federal incentives for new commercial reactors, radioactive waste management policy, research and development priorities, power plant safety and regulation, nuclear weapons proliferation, and security against terrorist attacks.

Laser Welding João Pedro Oliveira 2020-05-13 Laser welding is a high-energy process used in a wide range of advanced materials to obtain micro- to macro-sized joints in both similar and dissimilar combinations. Moreover, this technique is widely used in several industries, such as automotive, aerospace, and medical industries, as well as in electrical devices. Although laser welding has been used for several decades, significant and exciting innovations often arise from both the process and/or advanced materials side.

Simulations for Design and Manufacturing Uday S. Dixit 2018-04-19 This book focuses on numerical simulations of manufacturing processes, discussing the use of numerical simulation techniques for design and analysis of the components and the manufacturing systems. Experimental studies on manufacturing processes are costly, time consuming and limited to the facilities available. Numerical simulations can help study the process at a faster rate and for a wide range of process conditions. They also provide good prediction accuracy and deeper insights into the process. The simulation models do not require any pre-simulation, experimental or analytical results, making them highly suitable and widely used for the reliable prediction of process outcomes. The book is based on selected proceedings of AIMTDR 2016. The chapters discuss topics relating to various simulation techniques, such as computational fluid dynamics, heat flow,

thermo-mechanical analysis, molecular dynamics, multibody dynamic analysis, and operational modal analysis. These simulation techniques are used to: 1) design the components, 2) to investigate the effect of critical process parameters on the process outcome, 3) to explore the physics of the process, 4) to analyse the feasibility of the process or design, and 5) to optimize the process. A wide range of advanced manufacturing processes are covered, including friction stir welding, electro-discharge machining, electro-chemical machining, magnetic pulse welding, milling with MQL (minimum quantity lubrication), electromagnetic cladding, abrasive flow machining, incremental sheet forming, ultrasonic assisted turning, TIG welding, and laser sintering. This book will be useful to researchers and professional engineers alike.

Advances in Manufacturing Engineering Mithilesh K. Dikshit 2022 This book presents select peer-reviewed proceedings of the International Conference on Futuristic Advancements in Materials, Manufacturing, and Thermal Sciences (ICFAMMT 2022). The contents of this book provide an overview of the latest research in the area of manufacturing sciences such as metal cutting, metal forming, casting, joining, micromachining, nonconventional machining, and additive manufacturing. Some of the other themes covered in this book are metal-based additive manufacturing, polymer-based additive manufacturing, hybrid additive manufacturing, optimization approach for minimizing GD, and error in additive manufactured parts. The book will be useful for researchers and professionals working in the field of manufacturing engineering.

Friction Stir Welding of Dissimilar Alloys and Materials Nilesh Kumar 2015-03-05 This book will summarize research work carried out so far on dissimilar metallic material welding using friction stir welding (FSW). Joining of dissimilar alloys and materials are needed in many engineering systems and is considered quite challenging. Research in this area has shown significant benefit in terms of ease of processing, material mixing, and superior mechanical properties such as joint efficiencies. A summary of these results will be discussed along with potential guidelines for designers. Explains solid phase process and distortion of work piece Addresses dimensional stability and repeatability Addresses joint strength Covers metallurgical properties in the joint area Covers fine microstructure Introduces improved materials use (e.g., joining different thicknesses) Covers decreased fuel consumption in light weight aircraft Addresses automotive and ship applications

Properties of Aluminum Alloys John Gilbert Kaufman 1999-01-01 A compilation of data collected and maintained for many years as the property of a large aluminum company, which decided in 1997 to make it available to other engineers and materials specialists. In tabular form, presents data on the tensile and creep properties of eight species of wrought alloys and five species of cast alloys in the various shapes used in applications. Then looks at the fatigue data for several alloys under a range of conditions and loads. The data represent the typical or average findings, and though some were developed years ago, the collection is the largest and most detailed available. There is no index.

Trends in Welding Research 2012: Proceedings of the 9th International Conference Tarasankar DebRoy, Stan A. David, John N. DuPont, Toshihiko Koseki, Harry K. Bhadeshia 2013-03-01 The Trends conference attracts the world's leading welding researchers. Topics covered in this volume include friction stir welding, sensing, control and automation, microstructure and properties, welding processes, procedures and consumables, weldability, modeling, phase

transformations, residual stress and distortion, physical processes in welding, and properties and structural integrity of weldments.

TMS 2014 143rd Annual Meeting & Exhibition, Annual Meeting Supplemental

Proceedings The Minerals, Metals & Materials Society (TMS) 2016-12-16 These papers present advancements in all aspects of high temperature electrochemistry, from the fundamental to the empirical and from the theoretical to the applied. Topics involving the application of electrochemistry to the nuclear fuel cycle, chemical sensors, energy storage, materials synthesis, refractory metals and their alloys, and alkali and alkaline earth metals are included. Also included are papers that discuss various technical, economic, and environmental issues associated with plant operations and industrial practices.

Environmental and Efficiency Aspects of Novel Manufacturing Processes Gilbert Haddad 2009

COMSOL5 for Engineers Mehrzad Tabatabaian 2015-07-24 COMSOL5 Multiphysics® is one of the most valuable software modeling tools for engineers and scientists. This book, an updated edition of the previously published, COMSOL for Engineers, covers COMSOL5 which now includes a revolutionary tool, the Application Builder. This component enables users to build apps based on COMSOL models that can be run on almost any operating system (Windows, MAC, mobile/iOS, etc.). Designed for engineers from various disciplines, the book introduces multiphysics modeling techniques and examples accompanied by practical applications using COMSOL5.x. The main objective is to introduce readers to use COMSOL as an engineering tool for modeling, by solving examples that could become a guide for modeling similar or more complicated problems. The book provides a collection of examples and modeling guidelines through which readers can build their own models. The mathematical fundamentals, engineering principles, and design criteria are presented as integral parts of the examples. At the end of chapters are references that contain more in-depth physics, technical information, and data; these are referred to throughout the book and used in the examples. COMSOL5 for Engineers could be used to complement another text that provides background training in engineering computations and methods. Exercises are provided at the end of the text for use in adoption situations. Features: •Expands the Finite Element Method (FEM) theory and adds more examples from the original edition •Outlines the new features in COMSOL5, the graphical user interface (GUI), and how to build a COMSOL app for models •Includes apps for selected model examples-with parameterization of these models •Features new and modified, solved model examples, in addition to the models provided in the original edition •Companion disc with executable copies of each model and their related animations eBook Customers: Companion files are available for downloading with order number/proof of purchase by writing to the publisher at info@merclearning.com.

Investigation of Weld Material and Process Parameter Influence on Forge Force in Friction Stir Welding Edward G. Cole 2009

Experimentelle und numerische Untersuchungen des Rührreibschweißens von Aluminium- und Aluminium-Stahl-Verbindungen zur Verbesserung der mechanischen Eigenschaften Martin Werz 2020-08-04 Die Reduktion des Fahrzeuggewichtes durch Leichtbau stellt eine effektive Möglichkeit zur Vergrößerung der Reichweite von E-Mobilen sowie zur Verringerung der Emissionen bei konventionellen Kraftfahrzeugen dar. Sowohl beim konstruktiven als auch beim Werkstoff-

Leichtbau kommt dabei der Füge­technologie eine entscheidende Rolle zu. Das hochfeste schweiß­technische Fügen niederlegierter ferritischer Stähle, wie sie im Karosseriebau eingesetzt werden, wird heute mit verschiedenen Schmelz- und Pressschweiß­verfahren wie z. B. dem Laser- oder Widerstandspunktschweißen beherrscht. Beim Verschweißen von hochfesten Aluminiumwerkstoffen mit heute gängigen Schweiß­prozessen kann es jedoch an der Füge­stelle zu signifikanten Einbußen der Festigkeit kommen. Die festigkeits­steigernden Mechanismen im Aluminium werden durch die hohe Wärme­einbringung beim Aufschmelzen reduziert bzw. gehen verloren. Bei der mit der Erstarrung einhergehenden Gefüge­neubildung können diese Mechanismen nicht mehr oder nur noch in geringerem Maße aktiviert werden. Darüber hinaus stellen, je nach chemischer Zusammensetzung der Aluminium­legierung, Heißrisse sowie im speziellen Fall des Widerstandspunktschweißens der hohe Elektrodenverschleiß generelle Probleme dar. Um diese mit dem Aufschmelzen bzw. Erstarren der hochfesten Aluminium­legierungen zusammenhängenden Probleme zu lösen bzw. vielmehr zu umgehen, wurde 1991 am The Welding Institute (GB) das Rührreibschweißen entwickelt. Dabei handelt es sich um ein spezielles Pressschweiß­verfahren, bei dem der Werkstoff vollständig in fester Phase verbleibt. Im Gegensatz zu herkömmlichen Reibschweiß­prozessen, wie z. B. dem Linear- oder Rotationsreibschweißen, wird dabei allerdings keine Relativbewegung zwischen den zu fügenden Bauteilen oder Werkstoffen benötigt. Vielmehr wird die Reibarbeit durch ein rotierendes Schweiß­werkzeug eingebracht, das in den Füge­spalt eingepresst und entlang desselben verfahren wird. Durch den Materialtransport um das rotierende Werkzeug bzw. dessen Pin wird die Schweiß­naht hergestellt. Aufgrund dieser Besonderheit, dass der Werkstoff in fester Phase verbleibt, sind neben hochfesten Aluminium­verbindungen auch Misch­verbindungen möglich. Solche Misch­verbindungen sind schmelz­metallurgisch nicht oder nur eingeschränkt möglich. Hierzu zählen insbesondere stoff­schlüssige Aluminium-Stahl-Misch­verbindungen, die für den ökonomischen Hybrid-Leichtbau der Karosserie von besonderem Interesse sind. Die Festigkeit solcher Verbindungen kann allerdings durch spröde intermetallische Verbindungen stark begrenzt werden. Dies stellt eine der technologischen Grundherausforderungen dieser Arbeit dar. Daher soll diese Arbeit dazu beitragen, den Rührreibschweiß­prozess als industrielles Fertigungsverfahren für hochfeste Aluminium- und Aluminium-Stahl-Hybrid-Verbindungen, besonders für den Karosseriebau mit seinen spezifischen Anforderungen, zu etablieren. Um den Prozess besser zu verstehen und die Auswirkungen auf die resultierenden Festigkeitseigenschaften quantifizieren zu können, werden in dieser Arbeit vorrangig experimentelle, aber auch numerische Ansätze entwickelt. Des Weiteren ist es das Ziel, die gewonnenen Erkenntnisse in Form von Prozess­erweiterungen, -verbesserungen oder -abwandlungen für industrielle Prozesse nutzbar zu machen. Da die in diesem Zusammenhang entwickelten Lösungen teilweise deutlich über den aktuellen Stand der Technik hinausgehen, wurden während dieser Arbeit eine hohe Zahl an Erfindungen mit nachfolgenden Patentanmeldungen gemacht (siehe Tabelle 8.1). Grundlage des ersten Teils der Arbeit ist die Entwicklung geometrisch neuartiger Schweiß­nahtkonfigurationen samt zugehörigem Herstellungsprozess, um Aluminium- und Stahlbleche unterschiedlichster Dicke hochfest fügen zu können. Hierbei wird explizit auf die Anforderungen für eine spätere Nutzung der Misch­verbindungen in hybriden Tailor Welded Blanks (TWB) eingegangen. Hierzu gehört besonders die Anforderung, die Schweiß­naht als Stumpfstoß und einseitig eben auszuführen. Ein weiteres Erfordernis besteht darin, dass die Tailor Welded Blanks in Tiefzieh­prozessen umformbar sind und dabei nicht im Bereich der Schweiß­naht aufreißen. Zwei unterschiedliche Lösungen wurden hierzu entwickelt: Bei der ersten Ausführung wird das höherfeste, aber dünnere Stahlblech entlang der Schweiß­naht umgebördelt, um so eine Vergrößerung des Anbindungs­querschnittes zu

realisieren. Da dies einen zusätzlichen Bearbeitungsschritt erfordert und insbesondere hochfeste Stähle nicht rissfrei aufeinander umgelegt werden können, wurde im Verlauf dieser Arbeit eine zweite Lösung entwickelt. Hierbei wird ein Rührreibschweißwerkzeug mit abgestuftem Schweißstift verwendet, um eine kombinierte Überlapp- und Stumpfstoßverbindung herzustellen. Dabei führt der untere zylindrische Abschnitt des Schweißstiftes eine Stumpfverschweißung zwischen Stahl und Aluminium aus. Der stirnseitige Abschnitt der Stufe des Schweißstiftes erzeugt gleichzeitig eine Überlappverbindung zwischen den beiden Werkstoffen. Der Vergleich beider entwickelter Lösungen mit dem Stand der Technik wurde anhand der automobiltypischen Werkstoffkombination EN AW-6016-T4 2,0 mm (Aluminium-Magnesium-Silizium-Legierung) / HC340LAD 1,0 mm (mikrolegierter Feinkornstahl) durchgeführt. Dabei zeigt sich besonders in den Schwingfestigkeitsuntersuchungen eine signifikante Überlegenheit der kombinierten Stumpf- und Überlappverbindung gegenüber dem Stand der Technik. Kombinationen von Aluminium und Stahl, bei denen das Produkt von Blechdicke und Festigkeit seitens des Aluminiums etwas größer ist als das des Stahlblechs, zeigen in Napfziehversuchen Umformergebnisse ohne Aufreißen der Schweißnaht. Kombinationen, bei denen das Produkt von Blechdicke und Festigkeit seitens des Stahls größer war, zeigen auch nach Optimierung der Schweißparameter eine signifikante Dehnungslokalisierung mit nachfolgender Rissbildung in der WEZ des Aluminiums. Für diesen Fall der Dehnungslokalisierung in der Schweißnaht wird für aushärtbare Legierungen, basierend auf dem Aluminium-Magnesium-Silizium-Dreistoffsystem (6000er), eine neuartige Wärmebehandlungsmethode entwickelt. Ausgangspunkt dafür sind systematische Untersuchungen des Auslagerungsverhaltens des Grundwerkstoffs bei unterschiedlichen Auslagerungstemperaturen, -dauern und Zwischenauslagerungszeiten. Ferner werden die Grenzen für das Auftreten von Rekristallisation für den Grundwerkstoff, vorgedehnten Werkstoff und gleichartigen Schweißverbindungen experimentell untersucht. Überdies werden sowohl das Wachstum der intermetallischen Phasen in Glühversuchen von Aluminium-Stahl-Rührreibschweißverbindungen als auch die Auswirkung auf die Verbindungsfestigkeit untersucht. Es zeigt sich, dass der dickenabhängige, festigkeitslimitierende Effekt dieser Grenzschicht sehr gut mit der von Weibull entwickelten Theorie erklärt werden kann. Die quantitative Beschreibung dieses Zusammenhangs ergibt, dass herkömmliche Lösungsglühprozesse, aufgrund der zur Erwärmung der Bauteile benötigten Zeiten, nicht zielführend sind. Die neu entwickelte Wärmebehandlungsmethode nutzt daher den Schweißprozess selbst als lokalen Lösungsglühprozess. Grundvoraussetzung hierfür ist, dass der Schweißprozess ausreichend schnell ausgeführt wird, sodass es währenddessen nicht zu einer Überalterung der festigkeitssteigernden Ausscheidungen kommt. Durch die deutlich längere, logistisch bedingte Raumtemperatur-Zwischenauslagerung des Grundwerkstoffs im Vergleich zur Schweißnaht spricht dieser deutlich langsamer auf eine Warmauslagerung bei vergleichsweise niedrigeren Temperaturen an. Dies bedeutet, dass mit dieser Methode die Festigkeit der Schweißnaht durch Warmauslagerung gesteigert werden kann, ohne dass der Grundwerkstoff eine signifikante Festigkeitssteigerung erfährt. Für die Legierung EN AW-6016 werden Prozessdiagramme zur Ermittlung der minimal notwendigen Warmauslagerungsdauer entwickelt. Die Diagramme berücksichtigen dabei die Auslagerungstemperatur, die Dauer der Kaltauslagerung der Schweißnaht sowie den Nahtunterhang der Rührreibschweißnähte. Die Diagramme werden mittels gleichartiger Aluminium-Schweißnähte und Aluminium-Stahl-Mischverbindungen validiert. Der dritte und abschließende Teil dieser Arbeit beschäftigt sich mit der numerischen Modellierung des Rührreibschweißprozesses, um zukünftig numerische Prozessoptimierungen zur weiteren Steigerung der Festigkeit durchführen zu können. Anhand einer Literaturrecherche wird gezeigt, dass ein wesentliches Steigerungspotential hinsichtlich der Aussagekraft der

Prozesssimulationen in den hierzu verwendeten Materialmodellen liegt. Hierzu werden die bislang in der Literatur bekannten Werkstoffmodelle daraufhin analysiert, wie gut diese die Fließspannung über die breiten Dehnraten-, Temperatur-, und Dehnungsbereiche abbilden, die beim Rührreibschweißen auftreten können. Da bekannte thermomechanische Werkstoffmodelle für andere Anwendungen wie z. B. ballistische Impacts oder Warmumformung entwickelt wurden, zeigt sich die Notwendigkeit für eine Neuentwicklung. Bei dieser Neuentwicklung wird bewusst ausschließlich auf Effekte eingegangen, die bereits in der Literatur bekannt sind und die für den Prozessbereich des Rührreibschweißens als relevant einzustufen sind. Das neu entwickelte Modell wird unter Berücksichtigung verschiedener Annahmen zum Werkstoffverhalten bei Temperaturwechseln als User-Subroutine für Abaqus/Explicit implementiert. Zur Bestimmung der benötigten Modellparameter werden mit einer Gleeble 2000 bei einem breiten Temperatur- und Dehnratenspektrum für die Werkstoffe Al 99,5, EN AW-5182, AlSi10Mg und EN AW-6016 Druckversuche durchgeführt. Das Materialmodell reduziert den Modellfehler bei der Anpassung der Versuchsergebnisse gegenüber bereits etablierten Materialmodellen erheblich. Hierdurch wird die Aussagekraft von Prozesssimulationen, die dieses Materialmodell gegenüber dem etablierten Johnson-Cook-Modell verwenden, erheblich gesteigert.

Integrative Production Technology Christian Brecher 2017-01-09 This contributed volume contains the research results of the Cluster of Excellence "Integrative Production Technology for High-Wage Countries", funded by the German Research Society (DFG). The approach to the topic is genuinely interdisciplinary, covering insights from fields such as engineering, material sciences, economics and social sciences. The book contains coherent deterministic models for integrative product creation chains as well as harmonized cybernetic models of production systems. The content is structured into five sections: Integrative Production Technology, Individualized Production, Virtual Production Systems, Integrated Technologies, Self-Optimizing Production Systems and Collaboration Productivity. The target audience primarily comprises research experts and practitioners in the field of production engineering, but the book may also be beneficial for graduate students.

Trends in Welding Research Stan A. David 2009-01-01

Prediction of Thermal Capacitance Variations During Friction Stir Welding Keith A. Tschohl 2006

The Chemistry of Inorganic Biomaterials Christopher Spicer 2021-08-18 This book overviews the underlying chemistry behind the most common and cutting-edge inorganic materials in current use, or approaching use, in vivo.

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Mechanical Engineering 2008

Innovations in Materials Manufacturing, Fabrication, and Environmental Safety

Mel Schwartz 2010-11-24 When people make a call on a cellphone, drive a car, or turn on a computer, few truly appreciate the innovations in material selection, technology, and fabrication that were required to make it all possible.

Innovations in Materials Manufacturing, Fabrication, and Environmental Safety explores expected developments in analysis, design, testing, and operations that will be essential to successful, practical, more cost-effective fabrication of products and their components. Determine how robotics and intelligent machine (RIM) technology can enhance YOUR manufacturing enterprise. From electronics to welding, this book covers manufacturing processes that incorporate intelligent machines into the material processing and fabrication cycle—and it explains how so many innovations are dependent on government funding and research assistance. With contributions from a panel of experts from industry, government, and academia, this book examines how materials are selected through a process that must account for economic issues and various requirements related to health and environmental safety, energy limitations, and more. It includes examples of existing and developing selection methods—and corresponding fabrication processes—used in the aerospace, industrial, commercial, military, and electronics industries. Some of these processes and fabrication methods include: friction stir welding infusion mold technologies heat treatment processing plasma brazing diffusion and adhesive bonding laser processes This book breaks down each process, covering everything from testing background, why and where a method is being used, applications, potential to replace existing processes, and environmental and safety concerns. This information enables engineers/specialists to select the best process and then make sound corresponding engineering decisions and evaluations through design and trade-off studies relative to comparative costs, equipment purchase and installation, and availability of raw and substitute materials, among other factors.

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The Minerals, Metals & Materials Society (TMS) 2014-01-13 These papers present advancements in all aspects of high temperature electrochemistry, from the fundamental to the empirical and from the theoretical to the applied. Topics involving the application of electrochemistry to the nuclear fuel cycle, chemical sensors, energy storage, materials synthesis, refractory metals and their alloys, and alkali and alkaline earth metals are included. Also included are papers that discuss various technical, economic, and environmental issues associated with plant operations and industrial practices.