<table>
<thead>
<tr>
<th><strong>Title</strong></th>
<th>Research Activities of JWRI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Author(s)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Citation</strong></td>
<td>Transactions of JWRI. 48 P.1-P.35</td>
</tr>
<tr>
<td><strong>Issue Date</strong></td>
<td>2019-12</td>
</tr>
<tr>
<td><strong>Text Version</strong></td>
<td>publisher</td>
</tr>
<tr>
<td><strong>URL</strong></td>
<td><a href="http://hdl.handle.net/11094/73825">http://hdl.handle.net/11094/73825</a></td>
</tr>
<tr>
<td><strong>DOI</strong></td>
<td></td>
</tr>
<tr>
<td><strong>rights</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Note</strong></td>
<td></td>
</tr>
</tbody>
</table>

_Osaka University Knowledge Archive : OUKA_

[https://ir.library.osaka-u.ac.jp/repo/ouka/all/](https://ir.library.osaka-u.ac.jp/repo/ouka/all/)

Osaka University
Research Division of Materials Joining Process, Dep. of Energy Control of Processing

Research summary

The main research subject is the development of the high density energy source for processing advanced materials having special functions and properties. We undertake fundamental investigations of the properties of the high energy source interacting with materials, and we study advanced control techniques for optimizing the energy transport.

Major emphasis is placed on the generation, control and energy transport in arc plasmas, which are a high density energy source which have been applied to a variety of materials processing techniques such as welding, cutting, heating, high temperature processing, surface modification and the creation of powders.

Research subjects

(1) Generation and control of thermal plasmas, and their application to welding and joining processes
(2) Arc physics, molten pool behavior, and transport theory in fusion welding
(3) Development of new arc electrodes based on the analysis of electrode-plasma interaction
(4) Development of advanced high quality clean welding processes
(5) Development of new generation welding and joining processes employing atmospheric pressure plasma
(6) Control of arc discharge in lighting and electrical devices

Major Papers


Optical measurement of electron density and plasma temperature during spray transfer and globular transfer in gas metal arc welding process (a) Electron density, (b) Spray transfer, (c) Globular transfer. An addition of CO₂ into shielding gas causes constriction of arc current toward the arc axis, which leads to globular transfer due to increase in arc pressure.

Numerical simulation on effects of constricted nozzle on arc phenomena in TIG welding process (a) Temperature distribution in conventional TIG welding, (b) Temperature distribution in TIG welding with a constricted nozzle, (c) Heat flux to the anode surface. In TIG welding with a constricted nozzle, arc temperature increases due to constriction of arc. Consequently, larger heat flux to the anode surface is obtained compared with that of conventional TiG welding.
Research of Materials Joining Process, Dep. of Energy Transfer Dynamics

Research summary

Our research activities encompass works on development of process control technologies of surface and interface for advancement of materials joining science and processing technologies through creation of novel process-energy sources (plasmas and particle beams), and span the range of applications from to functionalization of materials to their process control. These research activities are based on fundamental studies on energy transfer dynamics involved in a variety of materials processing with process-energy sources.

Research subjects

(1) Development of novel plasma sources and particle beams for advanced process technologies (CVD, PVD)
(2) Development of novel large-area, low-damage and high-density plasma sources for advanced process control of functional materials
(3) Development of novel large-area, low-damage and high-density plasma sources for advanced process control of functional materials
(4) Creation of softmaterial processing science for development of advanced green nanotechnologies with inorganic/organic flexible hybrid structures
(5) Studies on temporal and spatial control of discharge for development of innovative plasma sources for plasma medicine

Major Papers


Research Division of Materials Joining Process, Dep. of Manufacturing Process

Research summary

The main research objectives are to analyze the mechanisms of material process including joining by various energy sources, and to develop advanced processes with high efficiency and high productivity. Especially, for a micro joining process in electronics packaging, the creation of the functional joint materials, the development of novel advanced micro processes by various energy sources, and the enhancement of the highly reliable joints based on the control of interfacial structure and performance are performed to produce micro joints with superb functionality and high reliability. In addition, we are resolving the joining problems of newly-developed materials. And we are aiming to develop new appropriate material processes for these materials.

Research subjects

(1) Development and evaluation of advanced micro joining process
(2) Elucidation of micro joining phenomena and defect suppression
(3) Control and analysis of microstructure at soldered interface
(4) Development of eco-friendly fluxless soldering process using a reducing atmosphere
(5) Formation of high heat-resistance joint using three-dimensional nanostructure

Major Papers


Y.-A. Shen, C. M. Lin, J. Li, R. Gao and H. Nishikawa, “Suppressed Growth of (Fe, Cr, Co, Ni, Cu)Sn$_2$ Intermetallic Compound at Interface between Sn-3.0Ag-0.5Cu Solder and FeCoNiCrCu$_{0.5}$ Substrate during Solid-state Aging”, Sci. Rep., 9 (2019), 10210. doi
Research Division of Materials Joining Process, Dep. of Laser Materials Processing

Research summary

Fundamental studies are performed concerning welding, joining, cutting, surface modification and removal processing with laser beams, aimed at advanced fusion between laser science and production engineering. We focus on clarification of welding or joining mechanisms on the basis of the visualization of material processing phenomena with high-speed optical observation or X-ray transmission imaging techniques. Moreover, laser should be utilized with not only high thermal efficiency but also physicochemical effects induced by interaction between light and material. Thus we create innovative processes including laser direct joining of metal and plastic, put these processes to practical use and disseminate achievements of our research to the world.

Research subjects

(1) Development and evaluation of joining and welding processes for the advanced functional materials
(2) Development of additive manufacturing technologies with blue diode laser
(3) Creation of new function by surface modification with laser
(4) Fundamental studies on laser interaction with materials and fundamental studies of materials processing utilizing laser

PMMA film surface after femtosecond laser irradiation.
(a) SEM image with periodic nanostructures oriented to the direction perpendicular to the laser polarization vector (The period of the periodic nanostructure is about 230nm) on PMMA film surface.
(b) Fluorescence microscope image of cell cultivation test. Cells adhered to the periodic nanostructures surface rather than bare surface.

Copper cladding using blue diode laser
(a) Blue diode laser
(b) X-ray observation of laser coating with blue laser
(c) Cross section image
(d) Surface image of pure copper coating layer
(e) 3D object of pure copper by Blue diode laser

Major Papers


Research Division of Materials Joining Mechanism, Dep. of Welding Mechanism

Research summary
Mechanisms controlling the joint performance of structural and functional materials, which obtained by fusion welding, liquid-state/solid-state bonding, and solid-state bonding, are metallographically characterized to establish a scientific basis to produce joint materials featuring superior performance. The microstructures of the weld-deposited metal, the heat-affected zone of fusion-welded joints, and the interfacial region of solid-state bounded joint are thoroughly investigated utilizing various methods such as X-ray diffraction, electron-microscopy observation, elementary analysis, EBSP analysis, and numerical modeling and simulation. Formation processes of the microstructures and their relation to joint performance are discussed from the material scientific viewpoint.

Research subjects
(1) Weld microstructure analyses of structural material such as steel
(2) Bonding mechanism of solid-state joining of metals and ceramics, and its application to microstructural control
(3) Application of welding and joining phenomena to development of advanced materials
(4) Synthesis of new functional materials at welding and joining interface
(5) Evaluation of the effect of microstructure on mechanical behavior of structural materials joints

Major Papers
doi

doi

doi

doi
Research Division of Materials Joining Mechanism, Dep. of Joint Interface Structure and Formation Mechanism

Research summary

In this department, based on the elucidation of the various phenomena at the joint interfaces of ferrous, nonferrous, non-metal materials at both macroscopic and microscopic levels, the interface formation mechanisms during various joining processes are clarified to create new interface control methods.

In addition, novel welding and modification processes are developed, mainly based on fusion welding methods and friction welding methods such as the friction stir welding, rotary friction welding and linear friction welding methods, which is the core of the fundamental technologies having a great potential to produce new values. These developments are going to be used and focused simultaneously in our society in order to create a new research field and elevate the continuous growth of industrial competitiveness of our country.

Research subjects

(1) Control of interface and elucidation of formation mechanism during friction welding (FSW, Friction welding, Linear friction welding)
(2) Development of novel joining and modification processes
(3) Elucidation of formation mechanism of weld interface and molten pool
(4) Analysis of joint interface structure
(5) Control of solid-liquid interface formation

Major Papers


Research Division of Materials Joining Mechanism, Dep. of Composite Materials Processing

Research summary

From a viewpoint of the energy saving and environmental problem solutions, the research fields of this department focus on both of the effective reuse of resources and energy including renewable ones and reduction of life hazardous materials and air pollutions. In particular, by controlling the interfacial mechanics and high-performance of materials, atomic/nano-scale composite materials and processing designs for the environmentally benign are established, and applied to innovative industrial development.

Research subjects

(1) Titanium materials with high-strength and ductility via atomic-scale microstructure optimization by first principle calculation
(2) Nano-carbon materials reinforced metal matrix composites through interfacial mechanics
(3) Surface modification by 3D-nano structuring and application to novel biomaterials
(4) Direct bonding of plastic materials to metals by molecular structure control
(5) Ni-rich TiNi shape memory alloys with nano-precipitation and expansion ability evaluation in application to stent devices

Major Papers


Research Division of Materials Joining Assessment, Dep. of Joining Mechanics and Analyses

Research summary

The mathematical and numerical modelling is a basis of AI and one of the most efficient approaches to look into various detail phenomena involved in joining & welding & additive manufacturing processes. In addition, assessment to residual stress/strain and defects in various types of joints between dissimilar materials is being studied through both the advanced measuring technology and numerical computational approaches.

Research subjects

(1) Computational and experimental study of nonlinear thermo-mechanical-metallurgical phenomena in multi-materials solid-state joining, fusion welding and additive manufacturing.
(2) Field Measurement and FEM (M-FEM) for identification of internal residual stress and fracture criteria of materials and various types of joints.
(3) AI for full manufacturing processes including metal forming, joining, welding and assembling of structures.

Major Papers

S. Ren, Y. Ma, S. Saeki, Y. Iwamoto and N. Ma, ”Numerical Analysis on Coaxial One-Side Resistance Spot Welding of Al5052 and CFRP Dissimilar Materials”, Materials and Designs (2019), 1-10. [doi]


Research Division of Materials Joining Assessment, Dep. of Structural Integrity and Failure Assessments

Research summary

The welding & joining design should use the properties and qualities of materials to their best advantage in service conditions. A need has been increased for more creative joint design and manufacturing in the industry. This department focuses on the development of a procedure for fitness-for-service assessment, in particular fracture assessment of metallic structures constructed by joining & welding. The methodology is founded on the local approach to fracture, which enables the transferability analysis between the strength of fracture toughness specimen and the performance of structural component. With this procedure, the critical allowance of flaw and damage in service conditions is predicted. The results are published as national and international standards or guidelines for user friendliness.

Research subjects

(1) Structural integrity assessment by the Weibull stress approach
(2) Development of fitness-for-service assessment procedure for welded structures in service
(3) Interface strength evaluation of dissimilar joints
(4) Fracture performance assessment under dynamic loading
(5) Science of go/no-go of dynamic crack propagation

Major Papers


Research Division of Materials Joining Assessment, Dep. of Joining Design and Dependability

Research summary

In evaluating the reliability of the structures, this department investigates not only the conventional optimization for the safety and the durability in constructing steel structures but also the reliability (Dependability) including the maintenance, the repair/reinforcement and the evaluation of lifetime considering cultural science and social science. Moreover, making researches on the procedure to safely break up the structures completing the lifetime, the circulating loop in which the members or the units are reused is concretized.

The department purposes to establish the evaluating methods to satisfy the high accuracy and the high quality in cutting, processing and assemblage for “products of steel structures” based on the dependability in the circulating loop containing the maintenance, the repair/reinforcement and the evaluation of lifetime.

Research subjects

(1) Soundness diagnosis of structural members and joints
(2) Development of simulation technology of mechanical behavior
(3) Development of fatigue life assessment tool (crack nucleation, propagation)
(4) Development of measurement technology of deformation and crack
(5) Development of life extension technology for structural members and joints
(6) Assessment of Weldability and Quality of New and Functionally Graded Materials

Major Papers


Research Division of Materials Joining Assessment, Dep. of Reliability Evaluation & Simulation

Research summary

Development of innovative manufacturing technology is required to manufacture high-performance machine products and structures of the next-generation. Department of Reliability Evaluation & Simulation conducts research and education for elucidation and control of the factors on weldment properties by high accurate evaluation based on material science and engineering. In order to create innovative and attractive technique of welding & Joining as a final aim, our department are working on elucidation of metallurgical phenomenon such as solidification and transformation, and on developing the predication method for the microstructures and the properties of weldments.

Research subjects

(1) Effect of solidification on microstructural formation and mechanical properties of high strength steel weld metal

(2) Investigation of controlling factor of weld hot cracking susceptibility and establishment of the prediction technology of weld hot cracking

(3) Clarification of influential factors of corrosion resistance of stainless steel dissimilar weld

(4) Analysis of solidification/transformation behavior and accurate evaluation of hot crack susceptibility by using In-situ observation method

(5) Investigation of peritectic reaction mechanism on carbon steel during welding process

Major Papers


Smart Processing Research Center, Dep. of Smart Coating Processing

Research summary

This department deals with smart coating processing based on nanoparticle processing, which leads to advanced manufacturing technology as well as safe, security, environmental and energy issues. By making use of new properties of nanoparticles, nanoporous or multi-component films can be created without any heat assistance. Nano and microscale design of particles will lead to high reliability and functional coating films with various kinds of coating processes. Smart coating on the surface of particles will make key materials for new areas such as DDS (Drug Delivery System) or Fuel Cells.

Research subjects

(1) Development of solid-state processing in water vapor for functional fine-particle synthesis
(2) Low temperature synthesis of composite oxide nanoparticles by mechanochemical method
(3) Development of Li ion battery electrodes by controlling their composite structure
(4) Wet processing for composite nanoparticles and their applications for fuel cells
(5) Development of fuel cell electrodes for PEFC and SOFC
(6) Development of low thermal conductivity materials using composite particles
(7) Development of 3D direct-assembly process of nanoparticles
(8) New recycling process of composite materials by bonding and disassembling of their interface

(a) Fabrication of cathode particle with gradient composition for Li ion battery by dry processing
(b) Fabrication of both cathode and anode nanostructure for SOFC by wet processing

Major Papers


T. Kozawa, K. Fukuyama, A. Kondo and M. Naito, “Wet Mechanical Route to Synthesize Morphology-Controlled NH4MnPO_4·H_2O and Its Conversion Reaction into LiMnPO_4“, ACS Omega., 4 (2019), 5690-5695. doi

H. Bai, J. Hu, Y. Duan, T. Kozawa, M. Naito, J. Zhang and S. Dong, “Surface Modification of Li_1.3Al_0.3Ti_1.7(PO_4)_3 Ceramic Electrolyte by Al_2O_3-doped ZnO Coating to Enable Dendrites-Free All-Solid-State Lithium-Metal Batteries”, Ceram. Int., 45, 12 (2019), 14663-14668. doi
Smart Processing Research Center, Dep. of Nano/Micro Structure Control

Research summary

Additive Manufacturing (AM) was newly developed as novel process to create three dimensional (3D) structures through two dimensional (2D) layer laminations. Metal and ceramic nanoparticles were dispersed into resin paste to use for our original process. In lithography techniques, a high power laser beam was scanned on the spread paste for 2D layer drawing and 3D structure forming. In deposition techniques, the paste was introduced into high temperature plasma or gas flame for 2D cladding and 3D patterning. Created electric devices, biological implants and energy modules will contribute to sustainable development.

Research subjects

(1) Stereolithographic Additive Manufacturing of Metal and Ceramic Parts Using Nanoparticles Pastes
(2) Structural Fabrication of Photonic Crystals with Diamond Structures for Terahertz Wave Control
(3) Modulation of Micro Porous Structures in Biological Ceramic Implants for Artificial Metabolism
(4) Manufacturing of Micro Metal Lattices for Effective Controls of Heat Flow and Stress Distributions
(5) Advance Development of Thermal Nanoparticles Spraying for Additive Manufacturing Technique
(6) Fine Separator Formation in Solid Oxide Fuel Cells by Using Thermal Nanoparticles Spraying
(7) Fine Ceramic Coating with Thermal Conductivity and Corrosion Resistance for Heat Exchanger Tubes
(8) Layer Laminations by Fine Particles Spraying and Sintering to Create Functionally Graded Structures

Major Papers

Research summary

The aim of this division is to develop the environmentally conscious smart technology to reduce the environmental impact in manufacturing, waste treatment and recycle processing. Especially, the research focuses on the following topics; substitution of materials to toxic free and eco-materials in electronics assembly, the use of low environmental impact materials in joining process, enhancement of reliability of fine-pitch high density packaging, and design for reuse. Also low temperature joining, substitution of rare materials and precious metals to popular substances, and development of low energy consumption new smart joining process which can make highly reliable joint are the targets of research in smart green processing department.

Research subjects

(1) Promotion of toxic-free manufacturing of fine pitch high density packaging in electric equipments and electronics
(2) Interfacial reaction between lead-free solder and materials
(3) Improvement of joint lifetime by controlling microstructures at interface
(4) Nano-particle assisted smart bonding
(5) High reliability of Cu filler conductive adhesive bonding
(6) Low temperature joining of metallic glasses

Major Papers


**Research summary**

This department focuses on developments of new materials and their processing technologies that contribute to the life-innovation, aiming to realize a sustainable and healthy society from the viewpoint of advanced process science. In particular, we will develop functional materials including magnetorheological fluids that have human-friendly power transmission for next-generation rehabilitation robots. In addition, we will explore processing methods for the life-innovation materials, based on nanostructural controls of various joint configurations including solid-liquid interfaces.

**Research subjects**

1. Synthesis of Fine Particles using Solution as Reaction Field and their Function Search
2. External Stimulus Response of Fine Particle Dispersion System and its Applications
3. Development and Applications of Directed Patterning of Fine Particles on Soft Matters
4. Development and Applications of Advanced Assembling Technology of Fine Particles

**Major Papers**


Research summary

This research chair has been developing welding technology to realize international competitive manufacturing for wide range of thick-plate structures by fusing advanced technologies owned by JWRI and Hitachi Zosen Co. It aims to realize smart manufacturing factory.

The high power laser technology for thick plate welding developed in this chair has reached a practical level at the factory. Now, we are developing the foundation of the digital welding technology required at next generation like process simulation technology and waveform controlled the high heat input digital submerged arc welding technology.

Furthermore, as a new development of laser welding technology, we will promote the development of three dimensional overlay welding technology that realizes high wear resistance by utilizing blue laser etc.

Research subjects

(1) Development of Laser Welding Technology for Thick Plate
(2) Development of High Efficiency SAW Technology
(3) Development of Overlay Welding Technology using Additive Manufacturing
(4) Smart Welding & Manufacturing System

Major Papers


Osaka Fuji "Advanced Functional Processing" Joint Research Chairs

Research summary

This research chair aims to develop advanced functional processing technics by combining laser processing technology and materials knowledge in JWRI and advanced functional manufacturing technologies of Osaka Fuji Corporation.

The main purpose is to develop the surface functioning of various materials by laser cladding method, low weldability materials. Finally, these fruits are applied to the next generation of manufacturing technology for various industrial fields.

Research subjects

(1) Development of highly functional surface by laser cladding
(2) Development of functional surfaces of small or thin parts
(3) Development of hybrid technology of laser and conventional surfacing technologies
(4) Fundamental research of laser additive manufacturing technology

Major Papers


Development Base on Development of Interdisciplinary and International Researchers for Creation of Life Innovation Materials

Research summary

The Project, Development Base on Creation of Life Innovation Materials for Interdisciplinary and International Researcher Development, has started from 2016 as inter-university cooperative research project (Joining and Welding Research Institute, Osaka Univ., Institute for Materials Research, Tohoku Univ., Laboratory for Materials and Structures, Tokyo Institute of Tech., Institute of Materials and Systems for Sustainability, Nagoya Univ., Institute of Biomaterials and Bioengineering, Tokyo Medical and Dental Univ., Research Organization for Nano & Life Innovation, Waseda Univ.) This development base promotes the joint research for development of life innovation materials for applications in the environment and medical fields through the inter-university cooperative researches by the 6 research institutes at 6 universities.

Research subjects

(1) Environmental and sustainable materials
(2) Biomedical and healthcare materials
(3) Base materials and technology

6 universities cooperative research project

(1) Joining and Welding Research Institute, Osaka Univ.
(2) Institute for Materials Research, Tohoku Univ.
(3) Laboratory for Materials and Structures, Tokyo Institute of Tech.
(4) Institute of Materials and Systems for Sustainability, Nagoya Univ.
(5) Institute of Biomaterials and Bioengineering, Tokyo Medical and Dental Univ.
(6) Research Organization for Nano & Life Innovation, Waseda Univ.

Research subjects

(1) Environmental and sustainable materials
(2) Biomedical and healthcare materials
(3) Base materials and technology

Major Papers


Center to Create Research and Educational Hubs for Innovative Manufacturing in Asia

Summary

From FY 2013-FY 2018, the project called “Center for the Project to Create Research and Educational Hubs for Innovative Manufacturing in Asia” were implemented to establish new joining and welding technologies, to create global research networks, and to cultivate global leaders in the region.

From FY 2018 namely the second phase, based on the research network established through former activities, the project will continue aiming to strengthen and obtaining higher international competency both in institution wide and in university wide through high quality international collaborative research by having organic cooperation with ASEAN Campus Programme and with Global Knowledge Partners promoted by Osaka University.

As in detail, two pillars are set as follows: 1) Strengthen International Collaborative Research: Increase number of international co-authored papers by implementing international collaborative research with overseas universities, establish international joint laboratory, 2) Conduct practical Global Leader Training: Implement Inbound & Outbound Coupling Internship (CIS) both overseas and domestic which is composed of students from different majors and cultural background.

Activities

(1) Strengthen International Collaborative Research: Increase number of international co-authored papers by implementing international collaborative research, establish international joint laboratory

(2) Conduct practical Global Leader Training: Implement Inbound & Outbound Coupling Internship (CIS) both overseas and domestic which is composed of students from different majors and cultural background.

Table 1. Some major international joint research topics in FY 2019 (Excerpt)

<table>
<thead>
<tr>
<th>Partner</th>
<th>Research Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shanghai Jiao Tong University</td>
<td>Coaxial one-side resistance spot welding (COS-RSW) of Al and CFRP</td>
</tr>
<tr>
<td>Shanghai Jiao Tong University</td>
<td>Friction self-piercing riveting of high strength aluminum alloy AA7075-T6</td>
</tr>
<tr>
<td>University of Technology Malaysia</td>
<td>Synthesis of copper matrix composites with TiB2 particles</td>
</tr>
<tr>
<td>University of Technology Malaysia</td>
<td>Microstructure control of high oxygen concentration dual phase Ti via hot extrusion</td>
</tr>
</tbody>
</table>

Table 2. Some major papers issued in FY 2019 (Excerpt)

<table>
<thead>
<tr>
<th>Papers</th>
</tr>
</thead>
</table>

Table 3. List of Coupling Internship in FY 2019

<table>
<thead>
<tr>
<th>Location</th>
<th>Host Company</th>
<th>Partner University</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thailand</td>
<td>OTC Daihen</td>
<td>Kasetsart Univ.</td>
</tr>
<tr>
<td>Vietnam</td>
<td>IHI Infrastructure Asia</td>
<td>Hanoi Univ. of Science and Tech.</td>
</tr>
<tr>
<td>Myanmar</td>
<td>J&amp;M Steel Solutions</td>
<td>Yangon Tech. Univ.</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Cilegon Fabricators</td>
<td>Indonesia Univ.</td>
</tr>
<tr>
<td>Aioi, Japan</td>
<td>IHI Aioi Works</td>
<td>Indonesia Univ.(Indonesia)</td>
</tr>
<tr>
<td>Kobo, Japan</td>
<td>Daihen Corporation</td>
<td>King Mongkut Univ. of Tech. Thonburi (Thailand)</td>
</tr>
</tbody>
</table>
R&D Project for Environmental Resources and ECO Joining

Research summary

We study concerning the energy system/environmental resources and ECO-joining in this project. An environment harmony energy device, for example, Mg-air battery is being developed to prepare lighting for blackouts due to natural disasters of earthquakes and typhoons. It is, also, very important to improve energy efficiency and to save resources by establishing bonding technologies adequate for manufacturing ecological products without toxic substances. Micro-joining processes for advanced electronic assembly such as wire and ribbon bonding have been studied. These micro-joining processes can be applied as a low temperature bonding method to ECO electronic packaging. This is applied to rapid bonding of dissimilar materials. Also, the study of joint-defect detection is necessary to repair and restore the concrete infra-structures. We have conducted the defect detection, using a laser Doppler technique and AI (artificial intelligence) deep learning system. Establishment of the way to sustainable human society overcoming global environmental problems is the final purpose of the R&D project.

Research subjects

(1) Cathode materials design of Mg-air battery
(2) Improvement of structures of Mg-air battery for establishing the long lift and high power
(3) Development of Mg-air battery for charging smartphones
(4) Solid state micro joining (ultrasonic joining) for power electronic packaging
(4) Interfacial nanostructures between wide-gap semiconductors and their electrodes.
(5) Study of joint-defect detection of infra-structures, using the laser Doppler technique and AI deep learning system
(6) Study of separation and collection of toxic substances
(7) Study of sustainable system for cleating environmental resources.

Schematic illustrations of structures and working principle of Mg-air battery. (a-1) Overall structures of Mg-air battery and chemical reactions. (a-2) Surface morphology of Mg anode, (b) Carbon cathode when flooding is produced, (c) When drying condition, (d) Adequate condition. Carbon cathodes should have hydrophilic and hydrophobic characteristics.

In-situ observation results (video captures) of the bonding interface between Al ribbon and silica substrate taken at $F_{applied} = 10^3$ fps. The bonding condition was $F_0 = 7$ N and $P_0 = 4$ W. (a) $t = 0$ ms, (b) $t = 1$ ms immediately after introducing ultrasonic vibration, (c) Apparent bonded area increases at $t = 5$ ms, (d) Apparent bonded area decreases at $t = 10$ ms due to Al ribbon warping, (e) $t = 20$ ms, (f) Central belt zone begins to be observed at $t = 50$ ms, (g) $t = 100$ ms, (h) $t = 400$ ms.

Major Papers


20
CONTRIBUTIONS TO OTHER ORGANIZATIONS
(January 2019 ~ December 2019)

[Physics, Processes, Instruments & Measurements]

U. K. MOHANTY, A. SHRMA, M. NAKATAN, A. KITAGAWA, M. TANAKA and T. SUGA
A Comparative Study between Linear and Nonlinear Regression Analysis for Prediction of Weld Penetration Profile in AC Waveform Submerged Arc Welding of Heat Resistant Steel

M. TANAKA
Visualizations and Numerical Simulations in Welding Processes

M. TANAKA
Introduction to Welding Technology

M. TANAKA
Introduction to Welding Process

M. TANAKA
Welding Dictionary (Book)
Published by The Japan Welding Engineering Society, (2019).

M. TANAKA
Introduction to Welding and Joining Technologies (Book)

K. TANAKA, T. YAMADA, M. SHIGETA, M. TANAKA and S. NAKABAYASHI
The Relation Between Electrode Lifetime and Additive Consumption During TIG Welding
WL, 37, 4 (2019), 4WL-6WL.

K. TANAKA, M. SHIGETA, M. TANAKA and A. B. MURPHY
Investigation of the Bilayer Region of Metal Vapor in a Helium Tungsten Inert Gas Arc Plasma on Stainless Steel by Imaging Spectroscopy

M. SHIGETA and M. TANAKA
Visualization of Electromagnetic-Thermal-Fluid Phenomena in Arc Welding

M. SHIGETA, M. TANAKA and E. GHEDINI

M. SHIGETA, M. TANAKA and E. GHEDINI

B. XU, S. CHEN, F. JIANG, H. L. PHAN, S. TASHIRO and M. TANAKA

B. XU, S. TASHIRO, F. JIANG, S. CHEN and M. TANAKA

L. H. PHAN, S. TASHIRO, H. V. BUJ, T. SUGA, T. SATO and M. TANAKA

S. MAENAKA, S. TASHIRO, A. B. MURPHY, K. FUJITA and M. TANAKA

A. V. NGUYEN, D. WU, S. TASHIRO and M. TANAKA
D. Wu, S. Tashiro, X. Hua and M. Tanaka
Analysis of the Energy Propagation in the Keyhole Plasma Arc Welding Using a Novel Fully Coupled Plasma Arc-Keyhole-Weld Pool Model

L. Xiao, D. Fan, J. Huang, S. Tashiro and M. Tanaka
A Simplified Numerical Model of Metal Transfer Phenomena for Highcurrent GMAW Process

S. Tashiro, N. Mukai, Y. Inoue, A. B. Murphy, T. Suga and M. Tanaka

D. Wu, S. Tashiro, Z. Wu, K. Nomura, X. Hua and M. Tanaka
Analysis of the Coupled Interaction of Arc, Droplet, Keyhole and Weld Pool in the Hybrid KPAW-P-GMAW Process

B. Xu, S. Chen, F. Jiang, S. Tashiro, V. A. Nguyen and M. Tanaka
In-situ Observation of Keyhole Detouring Flow in VPPA Flat Welding of Aluminum Alloy by X-ray Transmission System and Tracer Particles

S. Tashiro, N. Mukai, Y. Inoue, A. B. Murphy, T. Suga and M. Tanaka

Q. N. Trinh, H. L. Phan, S. Tashiro, V. H. Bui and M. Tanaka
Optical Measurement of Surface Temperature Distribution of Weld Pool in AC Tungsten Inert Gas Welding of Aluminium A1050

B. Xu, S. Tashiro, F. Jiang, M. Tanaka and S. Chen
The Effect of Electrode Energy Balance on Variable Polarity Plasma Arc Pressure

T. Morichi, K. Hama, S. Itoda, S. Tashiro, M. Tanaka and A. B. Murphy
Simulation Technology to Quantify Arc Interruption Phenomena

A. Aoki, S. Tashiro, H. Kurokawa and M. Tanaka
Development of Novel MIG Welding Process with Duplex Current Feeding

H. L. Phan, S. Tashiro, V. H. Bui and M. Tanaka
Influence of the Magnesium Content on Cathode Spot Behavior in AC TIG Welding of Aluminum Alloy

A. Aoki, S. Tashiro, H. Kurokawa and M. Tanaka
Influence of Current Feeding Position of Duplex Current Feeding MIG Welding on Droplet Heat Quantity

S. M. Hong, S. Tashiro, M. Sarizam, M. Tanaka and Y. Koizumi
Development of Advanced Control Technology of Plasma-MIG Process and Application to Dissimilar Joining

Influence of Shielding Gas on Cathode Spot Behaviours in Alternating Current Tungsten Inert Gas Welding of Aluminium

B. Xu, S. Chen, S. Tashiro, F. Jiang, V. A. Nguyen and M. Tanaka
Material Flow Analyses of High-Efficiency Joint Process in VPPA Keyhole Flat Welding by X-ray Transmission System

L. Xiao, D. Fan, J. Huang, S. Tashiro and M. Tanaka
Numerical Study on Arc-Droplet Coupled Behavior in Magnetic Field Controlled GMAW Process
T. YUJI, N. KAMATA, H. KINOSHITA, K. YASUI, T. BOUNO, K. KAMEI, S. MAMAT, S. TASHIRO and M. TANAKA
Reduction of Blowholes in DC Modulated TIG Welding for Copper

N. MUKAI, Y. INOUE, S. TASHIRO, T. SUGA and M. TANAKA
The Effect of Cold Cracking Prevention of FCAW by the Welding Process for Reducing Diffusible Hydrogen

D. WU, S. TASHIRO, Z. WU, K. NOMURA, X. HUA and M. TANAKA
Analysis of Heat Transfer and Material Flow in Hybrid KPAW-GMAW Process Based on the Novel Three Dimensional CFD Simulation

Novel Structured Metallic and Inorganic Materials (Book)
Published by Springer, (2019).

K. TAKENAKA, M. ENDO, G. UCHIDA, Y. SETSUHARA and A. EBE

K. TAKENAKA, M. ENDO, G. UCHIDA and Y. SETSUHARA
Effects of Post-Deposition Plasma Treatments on Stability of Amorphous InGaZnO₅ Thin-Film Transistors Prepared with Plasma-Assisted Reactive Magnetron Sputtering
Jpn. J. Appl. Phys., 58, 2s (2019), SAAC03/1-SAAC03/5.

G. UCHIDA, Y. MINO, T. SUZUKI, J. IKEDA, T. SUZUKI, K. TAKENAKA and Y. SETSUHARA
Decomposition and Oxidation of Methionine and Tryptophan Following Irradiation with a Nonequilibrium Plasma Jet and Applications for Killing Cancer Cells

K. TAKENAKA, M. ENDO, H. HIRAYAMA, G. UCHIDA, A. EBE and Y. SETSUHARA
Low-temperature Formation of High-Mobility A-InGaZnO₅ Films Using Plasma-Enhanced Reactive Processes

K. TAKENAKA and Y. SETSUHARA
Droplet-Vaporization Behavior during Plasma-Assisted Mist Chemical Vapor Deposition of Zinc Oxide Films

K. TAKENAKA, Y. SETSUHARA, J. G. HAN, G. UCHIDA and A. EBE
High Rate Formation of Silicon Nitride Thin Films Using Plasma-Assisted Reactive Sputtering Deposition

Effects of Ti Addition on the Microstructure, Mechanical Properties and Electrical Resistivity of Eutectic Sn58Bi Alloy

C.-H. YANG, S. ZHOU, S.-K. LIN and H. NISHIKAWA
A Computational Thermodynamics-Assisted Development of Sn-Bi-In-Ga Quaternary Alloys as Low-Temperature Pb-Free Solders

Y.-A. SHEN, C.-M. LIN, J. LI, S. HE and H. NISHIKAWA
Effect of FeCoNiCrCu0.5 High-entropy-alloy Substrate on Sn Grain Size in Sn-3.0Ag-0.5Cu Solder

Y.-A. SHEN, S. ZHOU, J. LI, K. N. TU and H. NISHIKAWA
Thermomigration Induced Microstructure and Property Changes in Sn-58Bi Solders

R. GAO, S. HE, Y.-A. SHEN and H. NISHIKAWA
Effect of Substrates on Fracture Mechanism and Process Optimization of Oxidation-Reduction Bonding with Copper Microparticles

S. ZHOU, Y.-A. SHEN, T. URESTI, V. C. SHUNMUGASAMY, B. MANSOOR and H. NISHIKAWA
Improved Mechanical Properties Induced by In and In & Zn Double Additions to Eutectic Sn58Bi Alloy

R. GAO, J. LI, Y.-A. SHEN and H. NISHIKAWA
A Cu–Cu Bonding Method Using Preoxidized Cu Microparticles under Formic Acid Atmosphere
Proc. 2019 Int. Conf. of Electronics Packaging (ICEP), (2019), 159-162.
S. ZHOU, C.-H. YANG, Y.-A. SHEN, S.-K. LIN and H. NISHIKAWA

The Study of Sn-45Bi-2.6Zn Alloy before and after Thermal Aging

C.-H. YANG, S. ZHOU, S.-K. LIN and H. NISHIKAWA
Development of Sn-Bi-In-Ga Quaternary Low-Temperature Solders

J. HOU, C. LI, S. HUANG and H. NISHIKAWA
Bonding Strength of Cu-to-Cu Joints Using Cu Cold Spray Deposition by an Oxidation and Reduction Process for Power Device Package

S. JIN, O. MOKHTARI, S. KANAYAMA and H. NISHIKAWA
Effects of In Content on the Microstructure and Mechanical Properties of In-Bi Alloys During Isothermal Aging

S. ZHOU, Y.-A. SHEN, H. NISHIKAWA, T. URESTI, V. C. SHUNMUGASAMY and B. MANSOOR
Effects of In and Zn Double Addition on Eutectic Sn-58Bi Alloy

Y.-A. SHEN, S. ZHOU, J. LI, K. N. TU and H. NISHIKAWA
Microstructure and Property Changes in Cu/Sn-58Bi/Cu Solder Joints during Thermomigration

S. ZHOU, C.-H. YANG, Y.-A. SHEN, S.-K. LIN and H. NISHIKAWA
The Newly Developed Sn-Bi-Zn Alloy with a Low Melting Point, Improved Ductility, and High Ultimate Tensile Strength
Mater., 6 (2019), 100300.

Y.-A. SHEN, S. ZHOU, S. HUANG and H. NISHIKAWA
Preferred Orientation of Bi and Effect of Sn-Bi Microstructure on Mechanical and Thermomechanical Properties in Eutectic Sn-Bi Alloy
Mater., 6 (2019), 100309.

Y. M. LEONG, A. HASEEB, H. NISHIKAWA and O. MOKHTARI
Microstructure and Mechanical Properties of Sn-1.0Ag-0.5Cu Solder with Minor Zn Additions

H. NISHIKAWA and X. LIU
Bonding Strength of Cu/Cu Joints Using Sintering Process of Micro-Sized Cu Particles for High-Temperature Application

F. KAWASHIRO, K. TAKAO, T. KOBYASHI, M. YOSHIKAWA, E. MIYAKE, T. ENDO, T. TONEDACHI and H. NISHIKAWA
Effect of Copper Over-Pad Metallization on Reliability of Aluminum Wire Bonds

Intermetallic Compound Growth between Sn-Cu-Cr Lead-Free Solder and Cu Substrate

A. SAITO and H. NISHIKAWA
Tin Whisker Growth Mechanism on Tin Plating of MLCCs Mounted with Sn-3.5Ag-8Sn-0.5Bi Solder in 30°C60%RH

H. NISHIKAWA, M.-H. ROH, A. FUJITA and N. KAMADA
Effect of Bonding Temperature on Shear Strength of Joints Using Micro-Sized Ag Particles for High Temperature Packaging Technology

Y. FUNADA, Y. YAMASHITA, Y. SAKON and M. TSUKAMOTO
Development and Bead Formation Properties of Multiple Laser Coating Technology with Centered Powder Feeding

R. HIGASHINO, M. TSUKAMOTO, Y. SATO, S. MASUNO, T. SHOBU and N. ABE
Experimental Analysis on Pure Copper Weld with High Intensity Blue Diode Laser by in Situ High Speed X-Ray Imaging
T. HARA, M. TSUKAMOTO, Y. SATO, R. HIGASINO, Y. FUNADA and N. ABE
Pure Copper Layer Formation on Copper Alloy Substrate by 100 W Class Blue Diode Laser Induced Laser Cladding

T. SHIBATA, M. TSUKAMOTO and Y. SATO
Effect of Input Energy on Densification of Pure Copper Fabricated by SLM with Blue Diode Laser

M. SUWA, N. WAKABAYASHI, T. HIROKI, K. TOJO, S. MASUNO, R. HIGASHINO and M. TSUKAMOTO
Development of BLUE IMPACT, a 450nm-wavelength Light Source for Laser Processing

K. TAKENAKA, M. TSUKAMOTO, M. HASHIDA, S. MASUNO, H. SAKAGAMI, M. KUSABA, S. SAKABE, S. INOUE, Y. FURUKAWA and S. ASAI
Ablation Suppression of a Titanium Surface Interacting with a Two-Color Double-Pulse Femtosecond Laser Beam

K. KODA, K. TAKENAKA and M. TSUKAMOTO
Laser-fluence Dependence of Microstructure Formed on Nickel by Backward Pulse Laser Deposition

S. KATO, A. SUNAHARA and M. TSUKAMOTO
Kinetic Model for Color-Center Formation in TiO2 Film Using Femtosecond Laser Irradiation

M. TSUKAMOTO and R. HIGASHINO
Development of High Power Blue Diode Laser for Additive Manufacturing

Y. SATO, S. SRIWATI, D. TANPRAYOON, M. TSUKAMOTO and E. HORI
Influence of Energy Input on Spatter Generation of 316L Stainless Steel Fabrication by SLM in Vacuum

Y. SATO, M. TSUKAMOTO, T. SHOBU, Y. FUNADA, Y. YAMASHITA, T. HARA, M. SENGOKU, Y. SAKON, T. OHKUBO, M. YOSHIDA and N. ABE
In Situ X-ray Observations of Pure-Copper Layer Formation with Blue Direct Diode Lasers

A. SHARMA, J. S. PANCHAGNULA, M. KUMAR, K. ITO, P. K. PARCHURI, S. SIMHAMBATLA and S. REDDY
Wire Arc Additive Manufacturing, Thermal Modelling, Build Direction, Mechanical Properties

H. ZARGARI, K. ITO, P. K. PARCHURI, H. YAMAMOTO, K. MANISH and A. SHARMA
Effect of Workpiece- Vibration on the Penetration Shape Change of Weld Bead in P-GMA Welds

H. SERIZAWA, N. NAKAZATO, Y. SATO, M. TSUKAMOTO, J. S. PARK and H. KISHIMOTO
Experimental Studies on Joinability of Zircaloy and SiC/SiC Composite with Titanium Powder

H. SERIZAWA, S. SATO and F. MIYASAKA
Computational Prediction of Penetration Shapes in MIG Welding of Practical Aluminum Alloy Joints

H. SERIZAWA, J. SHIMAOKA, Y. SATO, T. HARA, M. TSUKAMOTO and H. TANIGAWA
Laser Cladding of Copper Powder on Tungsten by Using Multiple Laser Beams Focusing System

S. SATO, H. SERIZAWA and F. MIYASAKA
Numerical Prediction of Penetration Shape in Practical Steel MAG Welded Joint with Point Heat Source
H. Serizawa, H. Ogura, K. Mitsufuji, and F. Miyasaka
Numerical Analysis of Friction Stir Welding Process
for V-Alloy/Stainless Steel Joint by Using Improved Particle Method

Manipulation of the Degradation Behavior of Calcium Sulfate by the Addition of Bioglass

M. Chen, G. Fan, Z. Tan, C. Yuan, D. Xiong, Q. Guo, Y. Su, M. Naito and Z. Li
Tailoring and Characterization of Carbon Nanotube Dispersion in CNT/6061Al Composites

M. Matsuoka, K. Yokoyama, K. Okura, N. Murayama, M. Ueda and M. Naito
Synthesis of Geopolymers from Mechanically Activated Coal Fly Ash and Improvement of Their Mechanical Properties

M. Naito, A. Buchacz, A. Baier, P. Topala and D. NeDELcu
Research and Innovation in Advanced Engineering Materials (Book)
Published by ModTech Publication House, (2019).

Bulk-type All-Solid-State Batteries with Mechanically Prepared LiCoPO₄ Composite Cathodes

T. Kozawa
Lattice Deformation of LiNi₀.₅Mn₁.₅O₄ Spinel Cathode for Li-ion Batteries by Ball Milling

T. Kozawa, K. Fukuyama, A. Kondo and M. Naito
Wet Mechanical Route to Synthesize Morphology-Controlled NH₄MnPO₄·H₂O and Its Conversion Reaction into LiMnPO₄

H. Bai, J. Hu, Y. Duan, T. Kozawa, M. Naito, J. Zhang and S. Dong
Surface Modification of Li₁₋ₓAlₓTi₁₋ₓ(PO₄)ₓ Ceramic Electrolyte by AlₓO₋ₓ-doped ZnO Coating to Enable Dendrites-Free All-Solid-State Lithium-Metal Batteries

T. Ohmura, T. Tasaka, K. Ishii, T. Tsuji, M. Minamide, R. Hayasaka, A. Kondo and M. Naito
Development of Simple Method to Measure Thermal Conductivity of Thermal Insulations

M. Akoshima, H. Abe, T.-W. Lian, A. Kondo and M. Naito
Thermal Diffusivity Measurement for Thermal Insulator Composite Materials with Silica Nanoparticles/Glass Fiber by the Laser Flash Method

K. Kanai, Y. Fukui, S. Ozawa, A. Kondo, T. Kozawa and M. Naito
Evaluation of YAG:Ce₃⁺ Phosphor Properties Synthesized by Mechanical Method

A. Kondo, S. Ishihara, K. Kushimoto, T. Kozawa, J. Kano and M. Naito
Correlation between Grinding Results in a Tumbling Ball Mill with Liquid Media and the Analysis of Ball Motion Using DEM Simulation

A. Kondo, S. Ishihara, K. Kushimoto, T. Kozawa, J. Kano and M. Naito
Correlation between Grinding Results in a Tumbling Ball Mill with Liquid Media and the Distribution of Ball Impact Energy Calculated by DEM Simulation

Study of Improvement of Power and Stability of Magnesium Air Battery - Influence of Cathode Materials and Structures on Battery Properties.
Z. HENG, S. UCHIDA, K. ITAKURA and Y. TAKAHASHI
Performance Boost for Mg-Air Batteries Based on Felt Separators and Composite Cathodes

Z. HENG, S. UCHIDA, K. ITAKURA and Y. TAKAHASHI
Performance Boost for Mg-Air Batteries Based on Felt Separators and Composite Cathodes

Y. TAKAHASHI, M. ARAI and M. MAEDA
Ternary Ti-Si-C Alloy Film Formation on GaN and Contact Properties

Y. TAKAHASHI, K. TAKASHIMA, K. MISAWA and Y. TAKAOKA
In-Situ Observation of Adhesion Behavior during Ultrasonic Al Ribbon Bonding

P. KOCHAR, A. SHARMA, T. SUGA and M. TANAKA
Prediction and Control of Asymmetric Bead Shape in Laser-Arc Hybrid Fillet-Lap Joints in Sheet Metal Welds

C. PHONGPISUTTHINAN, P. WATTANAPORNPHAN, T. SUGA, M. MIZUTANI and S. KATAYAMA
Laser Welding for Joining of Open-Cell Aluminum Foam to Solid Shell

[Materials, Metallurgy & Weldability]

K. MATSUMOTO, A. NISHIMOTO, T. ISHIKAWA, K. NAGATSUKA, K. ITO, M. TSUKAMOTO and K. NAKATA
Dissimilar Materials Joining of A6061 Al Alloy and AZ31 Mg Alloy by Laser Welding

P. K. PARCHURI, K. ITO, H. YAMAMOTO, A. MORI, S. TANAKA and K. HOKAMOTO
Cladding of a Crack-Free W Plate on Cu Plates Using Explosive Welding at Higher Collision Velocity with Lower Collision Angle

Novel Structured Metallic and Inorganic Materials (Book)
Published by Springer, (2019).

S. NISHIKAWA and M. TAKAHASHI
Interface Separation Phenomena during Immersion in Water of Anodically Bonded Kovar Alloy-Borosilicate Glass Joints with Application of Opposite Polarity

S. NISHIKAWA and M. TAKAHASHI
Effect of Application of Opposite Polarity Voltage on Interface Separation of Anodically Bonded Kovar Alloy-Borosilicate Glass Joints

P. K. PARCHURI, M. TAKAHASHI, K. ITO, H. YAMAMOTO and K. HOKAMOTO
TEM Characterization of Explosive Cladding Interfaces between Refractory Metal (group V or VI) and Cu Plates

P. K. PARCHURI, S. KOTEGAWA, H. YAMAMOTO, K. ITO, A. MORI and K. HOKAMOTO
Benefits of Intermediate-Layer Formation at the Interface of Nb/Cu and Ta/Cu Explosive Clads

S.-J. LEE, S. E. SHIN, Y. SUN, H. FUJII and Y. PARK
Friction Stir Welding of Multi-Walled Carbon Nanotubes Reinforced Al Matrix Composites
S.-J. Lee, T. M. Park, J.-H. Nam, W. S. Choi, Y. F. Sun, 
H. Fujii and J. Han
The Unexpected Stress-Strain Response of Medium Mn Steel after Friction Stir Welding

S.-J. Lee, K. Usioda and H. Fujii
Evaluation of Stacking-Fault Energy in Fe-Mn Based Twinning-Induced Plasticity Steels after Friction Stir Welding

Y. Sun, H. Fujii, S. Zhu and S. Guan
Flat Friction Stir Spot Welding of Three 6061-T6 Aluminum Sheets

Y. Hangai, K. Takada, H. Fujii, Y. Aoki and T. Utsunomiya
Foaming Behavior of Blowing- and Stabilization-Agent-Free Aluminum Foam Precursor during Spot Friction Stir Welding

Y. Tomita and H. Fujii
Influence of Bulk Density and Number of Contacts on Bending Strength of Additive Manufactured Sand Molds

M. N. Avettand-Fenoel, T. Nagaoka, H. Fujii and R. Taillard
Effect of a Ni Interlayer on Microstructure and Mechanical Properties of WC-12Co Cermet / SC45 Steel Friction Stir Welds

Y. F. Sun, H. Fujii, Y. Sato and Y. Morisada
Friction Stir Spot Welding of SPCC Low Carbon Steel Plates at Extremely Low Welding Temperature

N. Xu, Q. Song, Y. Bao and H. Fujii
Investigation on Microstructure and Mechanical Properties of Cold Source Assisted Friction Stir Processed AZ31B Magnesium Alloy

H. Fujii
Friction Welding Technology -Friction Stir Welding and Linear Friction Welding

Y. Hu, H. Liu and H. Fujii
Improving the Mechanical Properties of 2219-T6 Aluminum Alloy Joints by Ultrasonic Vibrations during Friction Stir Welding

Y. Aoki, R. Kuroiwa, H. Fujii, G. Murayama and M. Yasuyama
Linear Friction Stir Welding of Medium Carbon Steel at Low Temperature
ISIJ Int., 59, 10 (2019), 1853-1859.

T. Nishimura, R. Matsubayashi, K. Morishita, M. Yoshiya, T. Nagira and H. Yasuda
Selection of the Massive-like Δ-f Transformation Due to Nucleation of Metastable Δ Phase in Fe-18Mass%Cr-Ni Alloys with Ni Contents of 8, 11, 14 and 20 Mass%

X. C. Liu, Y. F. Sun, T. Nagira, K. Usioda and H. Fujii
Evaluation of Dynamic Development of Grain Structure during Friction Stir Welding of Pure Copper Using a Quasi in Situ Method

X. C. Liu, Y. F. Sun, T. Nagira, K. Usioda and H. Fujii
Strain Rate Dependent Micro-Texture Evolution in Friction Stir Welding of Copper

T. Nagira, X. C. Liu, K. Usioda, Y. Iwamoto, M. Ano and H. Fujii
Role of Annealing Twinning in Microstructural Evolution of High Purity Silver during Friction Stir Welding

Y. Gao, Y. Morisada, H. Fujii and J. Liao
Microstructure and Mechanical Properties of Friction Lap-Butt Welded Ultra-Thin Galvanized Steel Sheets

B. Vicharapu, H. Liu, H. Fujii, N. Ma and A. De
Probing Tool Durability in Stationary Shoulder Friction Stir Welding

H. Liu, K. Usioda and H. Fujii
Elucidation of Interface Joining Mechanism during Friction Stir Welding through Cu/Cu-10Zn Interfacial Observations
Z. Xiong, Y. Yang, K. Konoh and R. Misra

I. Ammarueda, K. Katsuyoshi, V. Patama, S. Tingting, Q. MA and U. Junko

M. Yoshiyia, T. Kobayashi, A.K. SaHa and K. Konoh

B. Chen, K. Konoh, J. Umeda, S. Li, L. Jia and J. Li

B. Chen, K. Konoh, J. S. Li and M. Qian

X. Zhang, S. Li, B. Pan, D. Pan, L. Liu, X. Hou, M. Chu, K. Konoh and M. Zhao

G. Ongtrakulkij, A. Khantachawana and K. Konoh
Effects of Media Parameters on Enhance Ability of Hardness and Residual Stress of Ti6Al4V by Fine Shot Peening Surf. Interfaces, 18 (2019), 100424.

T. Eda, A. Khantachawana, J. Umeda and K. Konoh

S. Kariya, M. Fukuo, J. Umeda and K. Konoh
A. BAHADOR, S. KARIYA, J. UMEDA, E. HAMZAH and K. KONDOH

T. EDA, A. KHANTACHAWANA, J. UMEDA and K. KONDOH

M. FUKUO, S. KARIYA, J. UMEDA, K. KONDOH and M. YOSHIYA

J. UMEDA, K. KONDOH, H. SANNOMIYA, T. LUANGVARANUNT, M. TAKAHASHI and H. NISHIKAWA

A. BAHADOR, J. UMEDA, S. TSUTSUMI, E. HAMZAH, F. YUSOF, H. FUJII and K. KONDOH

A. BAHADOR, J. UMEDA, E. HAMZAH, F. YUSOF, X. LI and K. KONDOH

K. SHITARA, T. OGAWA, A. KUWABARA, F. TAKEIRI, H. KAGEYAMA and H. MORIWAKE

H. UBUKATA, T. BRoux, F. TAKEIRI, K. SHITARA, H. YAMASHITA, A. KUWABARA, G. KOBAYASHI and H. KAGEYAMA

H. IWAMOTO and F. MINAMI

S. UEDA, K. KADOI, S. TOKITA and H. INOUE

K. KADOI, M. HIRAOKA, K. SHINOZAKI and T. OBANA

K. KADOI

K. KADOI, C. CHENG, S. TOKITA, K. USHIODA, H. FUJII and H. INOUE
Effect of Cr and C on Microstructure Evolution of Medium Carbon Steels during Friction Stir Welding Process and Their Mechanical Property 7th Int. Conf. on Recrystallization and Grain Growth, (2019).

C. CHENG, K. KADOI, S. TOKITA, H. FUJII, K. USHIODA and H. INOUE

K. KADOI, S. OKANO, S. YAMASHITA, D. ABE, A. TAKEMORI, S. YAMADA, A. TAKADA and J. KAWATA

S. TOKITA, K. KADOI, Y. KANNO and H. INOUE
S. TOKITA, H. KOKAWA and Y. SATO
Effect of Thermomechanical Parameters on Grain Growth and Recrystallization during Grain Boundary Engineering of Austenitic Stainless Steel
7th Int. Conf. on Recrystallization and Grain Growth, (2019).

S. KISANUKI and S. KIRIHARA
Design and Fabrication of Sound Absorption Structures for Thermal Spraying by Using Stereolithographic Additive Manufacturing

H. NOZAKI and S. KIRIHARA
Stereolithographic Additive Manufacturing of Fluctuated Patterns for Streamline Modulations in Water Flows

S. KIRIHARA
Materials Tectonics Technology and Stereolithographic Additive Manufacturing

K. NONAKA and S. KIRIHARA
Three Dimensional Smart Processing by Ultra Violet Laser Lithography of Ceramic Additive Manufacturing

S. KIRIHARA
Ceramic Thermal Spraying

S. KIRIHARA
Stereolithographic Additive Manufacturing for Materials Tectonics as Practical Technology

S. KIRIHARA
Stereolithographic Additive Manufacturing of Ceramic Components with Micropatterns for Electromagnetic Wave Control
Ceram. Mod. Thecnol., 1, 2 (2019), 84-90.

K. SATO, C. IWATA, N. KANNARI and H. ABE
Highly Accelerated Oxygen Reduction Reaction Kinetics in Colloidal Processing-Derived Nanostructured Lanthanum Strontium Cobalt Ferrite/gadolinium-Doped Ceria Composite Cathode for Intermediate-Temperature Solid Oxide Fuel Cells
[Mechanics, Strength & Structural Design]

H. YAMAMOTO, H. IZUMI and K. ITO
Effects of Microstructural Modification by Friction Stir Processing on Fracture Toughness of Low-carbon Steel Welds

Y. MIKAMI, W. SADAKANE and M. MOCHIZUKI
Numerical Simulation of Microscopic Residual Stress Evolution in Polycrystalline Aggregate Subjected to Weld Thermal Cycle
Weld. World, 64, 1 (2019), 105-114.

H. HUANG, X. YIN, Z. FENG and N. MA

Y. ZHU, Y. LUO and N. MA

K. SAITO, T. HIRASHIMA, N. MA and H. MURAKAWA
New Approach of Characteristic Tensor to Mixed Mode Crack Propagation
The 25th Int. Conf. on Computational & Experimental Engineering and Sciences, (2019), 32-34.

H. HUANG, H. MURAKAWA, N. MA and Z. FENG
A Dual-Mesh Method for Efficient Thermal Stress Analysis of Large Scale Welded Structures

N. MA
Prediction Methods for Welding Residual Stress/strain and Their Application to Metal Forming Structural Components

X. HOU, D. DU, B. CHANG and N. MA
Influence of Scanning Speed on Microstructure and Properties of Laser Cladded Fe-Based Amorphous Coatings

Y. OKAWA, Y. KITANI, Y. MA and N. MA
Thermal-mechanical FE Analysis of Laser Assisted Lap Joining of Plastics and High Strength Steel

J. WANG, X.-T. LUO, C.-J. LI, N. MA and M. TAKAHASHI

S. REN, S. LI, Y. WANG, D. DENG and N. MA
Finite Element Analysis of Residual Stress in 2.25Cr-1Mo Steel Pipe during Welding and Heat Treatment Process

Y. MA, B. YANG, M. LOU, Y. LI and N. MA
Effect of Mechanical and Solid-State Joining Characteristics on Tensile-Shear Performance of Friction Self-Piercing Riveted Aluminum Alloy AA7075-T6 Joints

J. LIN, N. MA, X. LIU and Y. LEI
Modification of Residual Stress Distribution in Welded Joint of Titanium Alloy with Multi Electron Beam HeatingAA7075-T6 Joints AA7075-T6 Joints

Y. LI, Y. WEI, X. LUO, C. LI and N. MA
Correlating Particle Impact Condition with Microstructure and Properties of the Cold-Sprayed Metallic Deposits

S. REN, S. LI, Y. WANG, D. DENG and N. MA
Predicting Welding Residual Stress of a Multi-pass P92 Steel Butt-Welded Joint with Consideration of Phase Transformation and Tempering Effect

Y. GAO, C. SHAO, H. CUI, N. MA and F. LU
Failure Competition Behavior of 9Cr/617 Dissimilar Welded Joint during LCF Test at Elevated Temperature
S. Ren, Y. Ma, S. Saeki, Y. Iwamoto and N. Ma
Numerical Analysis on Coaxial One-Side Resistance Spot Welding of Al5052 and CFRP Dissimilar Materials
Materials and Designs, (2019), 1-10.

Y. Ma, Y. B. Li and N. Ma
Friction Self-Piercing Riveting of Magnesium Alloy AZ31B and Aluminum Alloy AA6061-T6

S. Ren, Y. Ma, S. Saeki, Y. Iwamoto, K. Narasaki and N. Ma
Numerical Analysis of Coaxial One-Side Resistance Spot Welding of Al5052/CFRP by Thermal Mechanical-Electric Weak Coupling FEM Solver

A. Kunugi, H. Ueda, N. Ma and H. Serizawa
Investigation about the Influence of Material Properties in High Temperature for Welding Deformation Analysis

Y. Noguchi, H. Okada, M. Miyahara and F. Minami
Thermo-Mechanical Fatigue Life Evaluation for Ni-23Cr-7W Alloy by Strain Range Partitioning Method

G. An, J.-U. Park, M. Ohata and F. Minami
Fracture Assessment of Welded Joints of High-Strength Steel in Pre-Strained Condition

Y. Honma, G. Sasaki, K. Hashi and F. Minami
Improvement on Toughness of Weld Heat Affected Zone of Cu-Containing Low Alloy Steel of Long Scale Forging for Offshore Applications by Optimizing Chemical Composition
ASME 2019 38th Int. Conf. on Ocean, Offshore and Arctic Engineering, OMAE2019-95816 (2019).

F. Minami
Strength and Fracture of Welded Joints

H. Yuta, G. Sasaki, K. Hashi and F. Minami
Mechanism of Improvement of Mechanical Properties of Cu-contained Low Alloy Steel by Intercritical Quenching

F. Minami
International Standardization of Brittle Fracture Assessment Procedure for Steel Structures: ISO 27306

T. Kawabata, F. Tonsho, Y. Nishizono, N. Nakamura and Y. Takashima
Controlling Factors for Roughness Increases on Cleavage Fracture Surfaces and Crack Branching in Polycrystalline Steel

Y. Takashima, T. Kawabata, R. Deguchi, S. Yamada and F. Minami
Increase in Micro-Cracks Beneath Cleavage Fracture Surface in Carbon Steel ESSO Specimens

Relationship between Grain Size and Cleavage Crack Propagation Resistance in Ferrite-Pearlite Steels
13th Int. Conf. on Mechanical Behaviour of Materials (ICM13), (2019).

Y. Takashima, Y. Ito, F. Lu and F. Minami
Fracture Toughness Evaluation for Dissimilar Steel Joints by Charpy Impact Test

N. Nakamura, T. Kawabata, Y. Takashima, Y. Nishizono and F. Yanagimoto
Effect of Triaxial Stress Distribution upon Roughness of Brittle Fracture Surface
12th Int. Conf. on Multiaxial Fatigue and Fracture (ICMFF12), (2019).

Y. Takashima, T. Kawabata and F. Minami
Numerical Investigation of Temperature Rise Near Crack-Tip in Steel Plate During Brittle Crack Propagation
10th Int. Conf. on Impact Fracture (ISIE2019), (2019), 174-180.
F. Yanagimoto, T. Hemmi, Y. Suzuki, Y. Takashima, T. Kawabata and K. Shibanuma

T. Kawabata, K. Shibanuma, Y. Takashima and M. Ohata

Y. Takashima, T. Handa, T. Sakimoto, R. Deguchi and F. Minami

S. Tsutsumi, R. Fincato and H. Momii

T. Nakagomi, H. Kanko, S. Tsutsumi, S. Kanezaki and K. Kishi


K. Morita, M. Mouri, S. Tsutsumi and R. Fincato

K. Soejima, Y. Shintaku, S. Tsutsumi and K. Terada

S. Ishibashi, Y. Shintaku, S. Tsutsumi and K. Terada

K. Morita, M. Mouri, S. Tsutsumi and R. Fincato

R. Gadallah and S. Tsutsumi

T. Ohta, S. Tsutsumi and N. Ma

S. Fukuma, Y. Sakino, N. Matsumoto, K. Inose and S. Tsutsumi

T. Nakagomi, H. Kaneko, S. Tsutsumi, R. Horiba and T. Kasuga

J. Tamari, T. Ishikawa, M. Hirohata and S. Tsutsumi
Y. KIYOKAWA, S. TSUTSUMI and R. FINCATO  
Prediction of Cyclic Softening and Crack Initiation Life  
Using Accelerated Fatigue SS Model  
Proc. National Symp. on Welding Mechanics and  

G. DAIMON, S. TSUTSUMI and R. FINCATO  
Study on the Thickness Effect to Joint Fatigue Strength  
Proc. National Symp. on Welding Mechanics and  

S. ISHIBASHI, Y. SHINTAKU, K. TERADA and S. TSUTSUMI  
Numerical Analysis of Crack Propagation with  
Cleavage Fracture and Dependence of Toughness on  
Hydrogen Concentration  
Proc. National Symp. on Welding Mechanics and  

S. TSUTSUMI, H. NAGAHAMA and R. FINCATO  
Development of Fatigue Crack Initiation and  
Propagation Life Assessment Considering Hydrogen Effect  
Proc. National Symp. on Welding Mechanics and  

K. TAKATA, S. TSUTSUMI, R. FINCATO and M. OGAWA  
Fatigue Life Assessment of Butt Weld Joint with  
Backing Plate  
Proc. National Symp. on Welding Mechanics and  

Y. KURIHARA, Y. SAKINO and S. TSUTSUMI  
Effect for the Residual Stress and Fatigue Strength by  
Hammer Peening on High-Strength Base Metal  
Proc. National Symp. on Welding Mechanics and  

S. TSUTSUMI, H. SHIBATA, R. FINCATO, H. AKEBONO and  
M. YAMAMOTO  
Fatigue Strength Assessment of Lap Fillet Welded Joint for High-Tensile Steel Sheets Using Hot-Wire Laser Welding Process  
Proc. National Symp. on Welding Mechanics and  

R. FINCATO and S. TSUTSUMI  
Coupled Damage-Viscoplasticity Model for Metals under Cyclic Loading Conditions  
Proc. 25th Int. Conf. on Fracture and Structural Integrity, (2019), 1-11.

R. FINCATO, S. TSUTSUMI, T. SAKAI and K. TERADA  
Influence of Hard and Soft Inclusions inside a Ferritic Matrix  

R. FINCATO and S. TSUTSUMI  
Coupled Damage-Viscoplasticity Model for Metals under Cyclic Loading Conditions  

Y. X. LUO, R. MA, M. HE, R. FINCATO and S. TSUTSUMI  
Experimental Research and Parametric Study on the Fatigue Performance of Slotted Tubular Connection Based on the Effective Notch Stress Approach  

M. SHIBAHARA, A. KAWAHARA, M. NAKATANI, Y. YAMAZAKI,  
K. ODA, S. TADANO, Y. NAKATANI, D. TAKAKURA,  
H. FUKAZAWA, A. KUNUGI, S. NARITA, N. YANAGIDA,  
H. MURAKAMI, T. ONOZATO, T. NOTO, N. OTANI, H.UEDA,  
H. NAGAKI, S. MAEDA, H. SERIZAWA, N. MA and  
H. MURAKAWA  
Objectives and Activities of Research Grope for Practical Use of Welding Mechanics Simulation  
Proc. National Symp. on Welding Mechanics and  

[General Welding]

H. XIA, W. TAO, L. LI, C. TAN, K. ZHANG and N. MA  
Effect of Laser Beam Models on Laser Welding–Brazing Al to Steel  