Successful Symposium highlights developments in friction stir welding

Over 150 international delegates from 24 countries gathered in the spectacular natural surroundings of Saguenay, Quebec, Canada for the 12th International Friction Stir Welding (FSW) Symposium.

The event, held from 26 to 28 June, was formally opened by the Mayoress of Saguenay, Josee Neron, followed by welcoming speeches from Yves Chiricoat, Dean of Research and Creation at the University of Quebec at Chicoutimi, who emphasised the importance of FSW to his organisation, and TWI's Director of Operations Mike Russell, who confirmed TWI's commitment to organising future Symposia.

The technical programme for the three days in plenary and parallel sessions contained 88 papers presented by specialists in all aspects of friction stir welding technology, as well as a poster display.

Particular highlights of the Symposium programme included:

- Applications: How FSW is being applied to aerospace structures, rail car body fabrication, automotive aluminium tailor-welded blanks and bridges.
- Techniques: Papers were given on stationary shoulder FSW, Friction Stir Shaping, dovetailing and friction stir channelling
- Robotics: Techniques for welding 3D components, high speed welding and tool path trajectory corrections.
- Inspection: In process/real-time assessment of the weld and also resulting forces as a means of prediction of weld quality was described
- Modelling: A variety of theoretical models were presented to aid the understanding of different FSW techniques and tooling

The second meeting of the FSW Users Group was held following the first day of presentations. This included updates of the friction standards.

The Symposium also included a social event, a well-attended evening cruise along the Saguenay River Fjord, the fourth largest fjord in the world and the southernmost navigable fjord in North America.

Sculpted by ancient glaciers, the 60-mile-long, one-mile-wide fjord is lined with towering cliffs up to 1,150 feet tall, and it plunges to depths of up to 900 feet. With near perfect weather conditions delegates had the opportunity to network in a relaxed atmosphere while sampling local cuisine, enjoying live music while attempting to play along using traditional wooden spoons.

Mike Russell, TWI Operations Director said, 'This biennial event helps connect the global FSW community by facilitating discussions and knowledge exchange.

'The wealth of discussion, quality of papers presented, excellent programme, superb organisation and liaison between TWI and local supporters of the event, the University of Quebec at Chicoutimi, all added up to an excellent well-supported event.

'We are now looking forward to the next Symposium which will be held 26-28 May 2020 in Kyoto supported by Osaka University.'

Following the Symposium, over 80 delegates had the opportunity to tour the Friction Stir Welding Center (CSFM-UQAC), National Research Council Canada - Aluminium Technology Center, Research Center on Aluminium (CURAL) to see a range of FSW machines and other cutting-edge aluminium-related technologies.

The 12th International Symposium on Friction Stir Welding took place on 26-28 June 2018 in Saguenay, Quebec, Canada. The Symposium is the world's largest FSW event and provides a unique opportunity for the FSW community to hear from top industrial experts and academics, and network with leading authorities on FSW including researchers, practitioners, customers and suppliers from around the world.

The 13th International Symposium will take place in Kyoto, Japan in 2020. Visit the **dedicated Symposium website** for more details.

FSW Symposium Delegates

12th International Symposium on Friction Stir Welding

	TUESDAY 26 June 2018 (Morning)					
8.00 onwards	**REGISTRATION**					
	Montagnaise 3					
Session 1	**Plenary** **Chairs: Lyne St George ❖ Jorge dos Santos**					
09.00➢09.20	**Welcome and Opening Remarks**					
	Author(s)		Affiliation	Paper title		
09.20➢09.50	Murray Mahoney		FSW Consultant	Learning from the past		
09.50➢10.20	Tony Reynolds[1] Mark Smitherman[2], Timothy Freidhoff[2]		University of South Carolina[1] Concurrent Technologies[2]	Development of a Man-Portable Friction Stir Welding System		
	Montagnaise 3			**Montagnaise 2**		
Session 2	**Applications I** **Chairs: John Baumann ❖ François Marie**			**High Temperature I** **Chairs: Bolyu Xiao ❖ Toshiaki Yasui**		
	Author(s)	Affiliation	Paper title	Author(s)	Affiliation	Paper title
10.40➢11.00	**Sebastian Schulze[1]** Andreas Grimm[1], René Eger[1], Jens Standfuss[1], Eckhard Beyer[1,2], Christoph Leyens[1,2]	Fraunhofer IWS[1] Institute of Surface and Manufacturing Technology[2]	Friction Stir Welding of Large Aircraft Demonstrators	Joao Gandra[3] M. Meisnar[1], S. Baker[1], J. Bennett[2], K. Nor[3], D. Andrews[3], S. Dodds[3], R.Freeman[3], R. Bellarosa[4], J. Kelleher[2], A. Graham[5], A.F. Norman[5]	ESA-RAL[1] Rutherford Appleton Laboratory[2] TWI Ltd[3] Airbus Defence and Space[4] ESA, ESTEC[5]	Comparative study of the residual stresses in a friction stir welded Ti-6Al-4V spacecraft propellant tank
11.00➢11.20	**Sofiene Amira[1]** Nicolas Giguère[1], Michel Toupin[2], Jean-Denis Toupin[2]	Quebec Metallurgy Center[1] Construction Proco inc[2]	The manufacturing of the new pedestrian walkway of the Petite Décharge river (Alma, Quebec, Canada). Implementation, lessons learnt and future perspectives	Hidetoshi Fujii Yasuhiro Aoki	Osaka University, JWRI	No-Transformation Welding of Steel - Friction Stir Welding and Linear Friction Welding
11.20➢11.40	Marc Douilly[1] David Chartier[1], Amarylis Ben-Attar[2]	STELIA Aerospace[1] Institut de Sodure[2]	Friction Stir Welded Longitudinal junction for Aircraft fuselage – Robustness Study	Matts Björck[1] Ragna Elger[2], Claes Taxen[2], Taina Vuoristo[2], Christina Lilja[1]	Swedish Nuclear Fuel and Waste Management Co (SKB)[1] Swerea KIMAB[2]	The effect of embedded oxide particles on creep and corrosion properties of friction stir welded copper
11.40➢12.00	Grzegorz Luty Agata Wrońska, Tomasz Gałaczyński, Jacek Andres	PZL Mielec / a Sikorsky Company	Advanced techniques for the fabrication of airframe structures using innovative friction stir welding technology	Marie-Noëlle Avettand-Fenoel[1] Toru Nagaoka[2], Hidetoshi Fujii[3], Roland Taillard[1]	UMET - Université de Lille 1[1] Osaka Research Institute of Industrial Science and Technology[2] Joining and Welding Research Institute, Osaka UniversityOEL[3]	Dissimilar lap friction stir welding of steel - WC/Co cermet

12th International Symposium on Friction Stir Welding

TUESDAY 26 June 2018 (Afternoon)

	Montagnaise 3			Montagnaise 2		
Session 3	**Techniques I** **Chairs: Murray Mahoney ❖ Pedro Vilaça**			**Modelling I** **Chairs: Max Hossfeld ❖ Alan Smith**		
	Author(s	Affiliation	Paper title	Author(s)	Affiliation	Paper title
13.00➢13.20	**Marcus Weigl**	Grenzebach Maschinenbau GmbH	Stationary shoulder tools for long-term loading under industrial conditions	**Kirk Fraser**[1] Francois Nadeau[1], Saleema Noormohammed[1], Laszlo Kiss[2], Lyne St-Georges[2]	NRC[1] UQAC[2]	Meshfree Numerical Simulation of Hybrid FSW-Adhesive Joints
13.20➢13.40	**Francois Nadeau,** Saleema Noormohammed	Aluminium Technology Centre (NRC)	Hybrid joining of FSW lap joints: Thermal degradation of adhesive and its influence on mechanical properties	**Florian Panzer**[1] Martin Werz[2], Stefan Weihe[2]	Institute for Materials Testing, Materials Science and Strength of Materials (IMWF) of the University of Stuttgart[1] Materials Testing Institute (MPA) University of Stuttgart[2]	Analysis of the oscillating process forces of friction stir welding using finite elements
13.40➢14.00	**William Evans** Al Strauss, George Cook	Vanderbilt University	Friction Stir Shaping	Henrik Schmidt	HBS Engineering ApS	Scanstir – A web-based framework for modelling of Friction Stir Welding
14.00➢14.20	Joao Gandra	TWI Ltd	Developing friction stir channelling to manufacture leaner heat exchangers	Martin Werz	MPA Universität Stuttgart	Development of a new material model for the continuum mechanical simulation of the friction stir welding process
Session 4	**FSW Tools** **Chairs: Dale Flack ❖ Mike Russell**			**Performance I** **Chairs: Yuri Hovanski ❖ Jesus Mendoza**		
14.40➢15.00	**Murray Mahoney**[4] Brian Martinek[2], Scott Rose[2], Anthony Reynolds[3], John Baumann[1]	Retired from Boeing[1] Boeing[2] University of South Carolina[3] Consultant[4]	Improving the Efficiency of Rolling and Equal Channel Angle Extrusion for Ausforming of H13 Tool Steel for Long Life FSW Tools	Bolyu Xiao	Institute of Metal Research, Chinese Academy of Sciences	Study of fatigue behavior of aluminum matrix composite by high welding speed friction stir welding (FSW)
15.20➢15.20	**Jan Ansgar Gerken** Anna Regensburg, Michael Grätzel	Department of Production Technology, Technische Universität Ilmenau	Investigation of the material flow by multiaxial high resolution process force analysis	Kun Zhang Guohong Luan, Qiang Meng, Weibing Wang	Beijing CFSWT Company China Aviation Company	Microstructure and mechanical property of robotic friction stir welding 2198 Al-Li alloys
15.20➢15.40	**George Stubblefield**[1] Kirk Fraser[2], Paul Allison[1], Brian Jordon[1]	University of Alabama[1] National Research Council Canada[2]	Meshfree Simulation of Additive Friction Stir Manufacturing of Aluminum Alloy 6061	**Adam Jarrell** Alvin Strauss, George Cook	Vanderbilt University	Joining of Electron Beam FreeForm Fabricated Aluminum 2219 by Friction Stir Welding
15.40➢16.00	**Sven Schüddekopf** Gabriel Mienert Stefan Böhm	University of Kassel	Effects on the Friction Stir Welding process by laser implanting ceramics particles into the boundary layer of the tool	**Xiaoqing Jiang** Shujun Chen, Xiaoxu Li	Beijing University of Technology	Effect of precipitation behaviour on mechanical properties of friction stir welded 5A06 aluminium alloy
16.00➢16.20	**Francis Tremblay** Lyne St-Georges François Nadeau	1UQAC et CNRC-NRC	FSW tool wear characterization and prediction in dissimilar material Al-steel lap joining	**Shuja Ahmed**[1] Probir Saha[2]	IIT Patna[1] Department of Mechanical Engineering, IIT Patna[2]	The demands of ultra-thin workpieces for obtaining a sound friction stir weld

POSTER SESSION & USER GROUP MEETING

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WEDNESDAY 27 June 2018 (Morning)

	Montagnaise 3			Montagnaise 2		
Session 5	**Quality** **Chairs: Dwight Burford ❖ Yutaka Sato**			**Joint Interfaces** **Chairs: John Baumann ❖ Maria Posada**		
	Author(s)	Affiliation	Paper title	Author(s)	Affiliation	Paper title
08.40➢09.00	**Daniel Franke** Frank Pefferkorn, Woongjo Choi, Michael Zinn	University of Wisconsin-Madison	Advances in Force Measurement based Discontinuity Detection during Friction Stir Welding of Aluminum Alloys	Huaxia Zhao	AVIC Manufacturing Technology Institute	Interface defect and mechanical properties of friction stir lap welded 2A12-T4
09.00➢09.20	**Marvin Klein**[1] Wojciech Osikowicz[2], Johann Fremling[2], Eva Lindh-Ulmgren[3], Martin Engman[3], Magnus Falkenstrom[3]	Intelligent Optical Systems Inc[1] Hydro Extruded Solutions[2] Swerea KIMAB[3]	In-Line Inspection of Friction Stir Welds Using Laser Ultrasonic Testing	**Egoitz Aldanondo**[1] Ekaitz Arruti[1], Ion Quintana[1], Juana Valer[2]	IK4-LORTEK[1] Aernnova Engineering[2]	Developments in stringer-skin lap joints by FSW
09.20➢09.40	François Vicat André Lamarre, Etienne Grondin	Olympus NDT	Ultrasonic phased-array technologies as reliable tools for FSW inspection	**Alexandre Gariépy** Axel Gambou-Bosca, Hélène Grégoire, François Nadeau	National Research Council Canada	Investigation on the fatigue fracture characteristics between friction-stir welded overlap joints with different alloys and tools
09.40➢10.00	**Elizabeth Hoyos** Santiago Escobar, Juan Esteban Guzmán	Universidad EIA	FSW process map development for aluminum alloys: nondestructive testing and model based approach	**Morgane Geyer**[1] Vanessa Vidal[2], Christine Boher[2], Fabien Castanié[3], Laurent Dubourg[4], Mario Guillo[4], Farhad Reraï-Aria[2]	Institut Clément Ader, IMT Mines Albi[1] Institut Clément Ader[2] Avantis Project[3] Institut Maupertuis[4]	Influence of process parameters on dissimilar Al 2024-T3 to Ti-6Al-4V friction stir welding overlap joints
10.00➢10.20	Hugo Robe[2] Jean-Pierre Bonnafe[1]	ARIANE Group[1] Institut de Soudure[2]	Defects in Friction Stir Welded Joint: Analysis and consequences for the assembly	**Luqman Hakim Ahmad Shah** Shi Guo, Scott Walbridge, Adrian Gerlich	University of Waterloo	Evaluation of tool eccentricity on material flow and mechanical properties in friction stir welded AA6061 aluminum alloy
Session 6	**Applications II** **Chairs: Dave Hofferbert ❖ Thomas Weinberger**			**FSSW I** **Chairs: Necdet Çapar ❖ Jorge Dos Santos**		
10.40➢11.00	Xinmeng Zhang	Changchun Railway Vehicles Co Ltd	Application of friction stir welding on aluminum alloy railway vehicles	**Enkhsaikhan Boldsaikhan**[1] Shintaro Fukada[2], Mitsuo Fujimoto[2], Kenichi Kamimuki[2], Hideki Okada[2], Brian Brown[1]	Wichita State University[1] Kawasaki Heavy Industries[2]	Refill Friction Stir Spot Welding of Surface-Treated Aerospace Aluminum Alloys with Faying-Surface Sealant
11.00➢11.20	Michael Grätzel Michael Hasieber, Torsten Löhn, Anna Regensburg, Jean Pierre Bergmann	Technische Universität Ilmenau	Process force reduction for advanced FSW applications	**Egoitz Aldanondo**[1] Ekaitz Arruti[1], Ion Quintana[1], Pedro Alvarez[1], Eber Arregi[2]	IK4-LORTEK[1] Edertek Technology Center[2]	Friction stir spot welding of dissimilar AlSi10MgMn Aluminium alloy and 22MnB5 hot-stamped boron steel
11.20➢11.40	Martin Werz	MPA Universität Stuttgart	A new heat treatment sequence for friction stir welded hybrid tailor welded blanks	S.M. Goushegir[1] K. Schricker[2], J.P. Bergmann[2], J.F. dos Santos[1], S.T. Amancio-Filho[3]	Helmholtz-Zentrum Geesthacht[1] Technische Universität Ilmenau [2] Graz University of Technology[3]	Influence of the Aluminum Pretreatment on the Mechanical Performance of Metal-Polymer Friction Spot Joints
11.40➢12.00	S Larose[1] P Wanjara[1], G Comeau[2], J Gholipour[1]	National Research Council of Canada[1] Groupe Tremblay[2]	Development of friction stir lap welding of AA6061 to commercially pure copper with a view towards industrialization	Yuri Hovanski[1] Brigham Larsen[1], Blair Carlson[2], Robert Szymanski[2]	Brigham Young University[1] General Motors[2]	Friction Stir Spot Welding of Ultra-Thin Steel Sheet

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WEDNESDAY 27 June 2018 (Afternoon)

	Montagnaise 3			Montagnaise 2		
Session 7	**Techniques II** **Chairs: Joao Gandra ❖ Stephan Kallee**			**High Temperature II** **Chairs: Matts Björck ❖ Marie-Noëlle Avettand-Fenoel**		
	Author(s)	Affiliation	Paper title	Author(s)	Affiliation	Paper title
13.00➢13.20	**Guntram Wagner[1],** Marco Thomä[1], Bernd Wolter[2], Benjamin Strass[2], Sigrid Benfer[3], Wolfram Fürbeth[3]	Chemnitz University of Technology[1] Fraunhofer Institute for Nondestructive Testing IZFP[2] DECHEMA-Forschungsinstitut[3]	New developments in the field of ultrasound enhanced friction stir welding of dissimilar materials	**Huihong Liu** Hidetoshi Fujii, Kohsuke Ushioda	Joining and Welding Research Institute, Osaka University	Clarification of Interface Joining Mechanism of Friction Stir Welding by Cu/Cu-10Zn Interfacial Observation
13.20➢13.40	**Wang Tao** Feng Xingmei, Lv Xiaowei, Feng Zhanying	Nanjing Research Institute of Electronics Technology	Study on the Friction Stir Welding Technology of Aluminum honeycomb sandwich plate (AHS) and 5A05 Aluminum	**Bolyu Xiao** Zongyi Ma	Institute of Metal Research, Chinese Academy of Sciences	Improving comprehensive properties of high nitrogen stainless steel by friction stir processing with forced cooling
13.40➢14.00	**Pedro Vilaça** Daniel Nordal, Heikki Karvinen	Aalto University	Microstructural characterization of the processed zones of Al-Al and Cu-Al plate systems manufactured by Hybrid Friction Stir Channeling	**Murray Mahoney** Russell Steel, Dale Fleck, Trever Davis, Steve Larsen, Bill Johnson	MegaStir	Friction Stir Welding of 4340 Steel and 4340 Steel to Inconel 718
14.00➢14.20	**Kenneth Ross[1]** Md. Reza-E-Rabby[1], Nicole Overman[1], Scott Whalen[1], Martin McDonnel[2]	Pacific Northwest National Laboratory[1] US Army TARDEC[2]	Friction Stir Dovetailing - A New Process for Joining Thick Section Aluminum to Steel	**Pedro Vilaça[2]** Sergio Duarte Brandi[1], Jaime Soeiro Jr[1], Gonçalo Sorger[2]	University of Sao Paulo[1] Aalto University[2]	Friction Stir Welding of 9% Nickel Steel
Session 8	**Robotic & Non linear** **Chairs: Jeroen De Backer ❖ Sebastian Schulze**			**Dissimilar** **Chairs: Masatoshi Enomoto ❖ Guntram Wagner**		
14.40➢15.00	**David Hofferbert[1]** Max Hossfeld[2]	Bond Technologies Inc[1] fsw.expert[2]	Pushing the Limits of FSW by High Speed Welding of Complex 3D Contours	**Krzysztof Mroczka[1]** Adam Pietras[2], Stanisław Dymek[3]	Pedagogical University of Cracow[1] Institute of Welding in Gliwice[2] AGH University of Science and Technology in Krakow3	Dissimilar FSW welds of light alloys – microstructure and mechanical properties
15.00➢15.20	**Sandra Zimmer-Chevret[3]** Ives Kolegain[1], François Leonard[2], Amarilys Ben Attar[1], Gabriel Abba[2]	Institut de Soudure[1] ENIM[2] Arts et Métiers ParisTech[3]	Continuous path generation for 3D Robotic Friction Stir Welding based on Bézier curves	**Toshiaki Yasui[1]** Tian Wu-Bian[2], Atsuhiro Hanai[3], Tatsuya Mori[4], Katashi Hirosawa[5], Masahiro Fukumoto[1]	Toyohashi University of Technology[1] Toyohashi University of Technology (former)[2] Aichi Center for Industry and Science Technology[3] NT Tool Corporation[4] OSG Corporation[5]	Friction stir girth welding of dissimilar metals and its application
15.20➢15.40	**Laurent Dubourg** Mario Guillo	Institut MAUPERTUIS	Dual encoder robot for accurate robotic FSW	**Thomas Weinberger** Martin Zubcak	Stirtec GmbH	Development of friction stir welded Al-Cu components for industrial applications
15.40➢16.00	**Tianbo Zhao[1]** Yutaka Sato[1], Hiroyuki Kokawa[1], Kazuhiro Ito[2]	Tohoku University[1] Joining and Welding Research Institute, Osaka University[2]	Experimental measurement of Welding Heat-input and its Responses to Mechanical Properties during Friction Stir Welding of Aluminum Alloy 6063	**Masatoshi Enomoto[1]** Koji Gotoh[2], Hideki Yamagishi,[3] Shogo Tomida[3]	WISE Planning Corporation1 Kyushu University[2] Toyama Industrial Research and Development Center[3]	High cycle fatigue properties of SZ, TMAZ, HAZ of friction stir welded joints with cantilever type bending fatigue testing equipment up to ten million cycle.

Social Event

12th International Symposium on Friction Stir Welding

THURSDAY 28 June 2018 (Morning)

Montagnaise 3

Session 9 — Process & Equipment
Chairs: Tim Haynie ❖ Mr Julien Laye

	Author(s)	Affiliation	Paper title
08.40➢09.00	**Masatoshi Enomoto**[1] Shigeki Kakiuch[2], Masaru Sato[2]	WISE Planning Corporation[1] Toyama Industrial Research and Development Center[2]	Effect of tool temperature on FSW dissimilar metals between Aluminium alloy and Magnesium alloy
09.00➢09.20	**Anthony Fleury** Lyne St-Georges, Ahmed Rahem	Université du Québec à Chicoutimi	Effect of welding equipment rigidity on mechanical and physical properties of friction stir welded aluminum 6061-T6
09.20➢09.40	**David Hofferbert** Tim Haynie, John Bosker	Bond Technologies Inc	Retrofitting Milling Machines To Perform Force-controlled Friction Stir Welds
09.40➢10.00	Laurent Dubourg[1] Yann Mace[2]	Institut MAUPERTUIS[1] ENS Rennes[2]	FSW head for NC machine tool: case studies and applications
10.00➢10.20	Jeroen De Backer[1,2] Ana Silva-Magalhães[1], Jonathan Martin[2], Gunnar Bolmsjö[1]	University West[1] TWI Technology Centre (Yorkshire)[2]	Welding Temperature effects on mechanical properties of FSW 5 mm AA6082

Session 10 — Techniques III
Chairs: Laurent Dubourg ❖ Kenneth Ross

10.40➢11.00	Martin Reimann Jorge dos Santos	Helmholtz-Zentrum Geesthacht GmbH	Keyhole repair in precipitation hardening aluminum alloys using refill friction stir spot welding
11.00➢11.20	Steve Dodds[1] J. Gandra[1], D. Szegda[2], P. Santos[1], J. Liu[3], L. Wang[3], A. Malone[4], G. Chapman[5]	TWI[1] Impression Technologies Ltd[2] Imperial College London[3] PAB Coventry Ltd[4] Morgan Motor Company5	Making it lighter - for less. Combining FSW tailor-welded blanks with HFQ forming.
11.20➢11.40	Takuya Miura	University of Fukui	Deformation of friction stir welded 5052 Al alloy sheet in friction stir incremental forming
11.40➢12.00	**Mariko Ochi** Yoshiaki Morisada, Hidetoshi Fujii	Joining and Welding Research Institute, Osaka University	Inversion Friction Stir Welding of Steel

Montagnaise 2

Modelling II
Chairs: Kirk Fraser ❖ Henrik Schmidt

Author(s)	Affiliation	Paper title
Gaoqiang Chen Han Li, Qingyu Shi, Shuai Zhang	Tsinghua University	Numerical simulation for predicting the root flaw in friction stir welding of AA6082
Konrad Adamus Piotr Lacki, Julita Winowiecka	Politechnika Czestochowska	Modelling of deformations caused by FSW process in aluminum panels
Professor Alan J Smith[1] Montadhar Al-moussawi[2]	Sheffield Hallam University/MERI[1] Sheffield Hallam University[2]	An Experimental and Numerical Analysis of Wear of a Poly Crystalline Boron Nitride Friction Stir Welding Tool
Amanda Zens Andreas Bachmann, Roman Hartl Michael Zaeh	Institute for Machine Tools and Industrial Management	Modelling of the Friction Stir Welding Process for torque-based temperature control
Robert Escobar, Jr[1] Kirk Fraser[2], JB Jordon[1], Paul Allison[1]	University of Alabama[1], National Research Council Canada[2]	Meshfree Simulation of Oxide Dispersion in Additive Friction Stir Deposition of Aluminum Alloy 5083

FSP
Chairs: Max Hossfeld ❖ Tony Reynolds

Amir Abdollah-zadeh[1] Amir Rahbar-kelishami[1], Firooz Kargar[1], Adrin Gerlich[2], Mostafa Hajian[3]	Tarbiat Modares University[1] University of Waterloo[2] University of Shahrood[3]	A comparison of FSP effects on wear properties of two different sprayed layers on 52100 steel
Amanda Zens Maximilian Gnedel, Lars Nyga, Michael F. Zaeh, Ferdinand Haider	Institute for Machine Tools and Industrial Management	Effect of the tool geometry and processing parameters on the resulting nugget zone during Friction Stir Processing
Michael Eff Kate Namola	EWI	FSW Repair of 7075 Aluminum
Jong-Ning Aoh Chi-Wei Huang	National Chung Cheng University	Friction Stir Processing on Aluminum Matrix Composites (AMC) Containing Multiscaled Graphene/Nickel Coated SiC Particles and Graphene Flakes

12th International Symposium on Friction Stir Welding

THURSDAY 28 June 2018 (Afternoon)

	Montagnaise 3			Montagnaise 2		
Session 11	**Performance II** **Chairs: Steve Dodds ❖ Krzysztof Mroczka**			**FSSW II** **Chairs: Egoitz Aldanondo ❖ Enkhsaikhan Boldsaikhan**		
	Author(s)	Affiliation	Paper title	Author(s)	Affiliation	Paper title
13.00➢13.20	**Jesus Mendoza** Wojciech Osikowicz, Henrik NyströmFraser	Hydro Extruded Solutions, Innovation & Technology	Comparison of fatigue strength of MIG and FS half-overlap welds in AA6082-T6 aluminium extrusions	**Banglong Fu**[1] Fabio Rodrigues[1], Junjun Shen[1], Uceu F.H. Suhuddin[1], Hao Su[1], Jorge F. dos Santos[1], Michael Rethmeier[2]	Helmholtz-Zentrum Geesthacht GmbH[1] BAM Federal Institute for Materials Research and Testing[2]	Microstructure and mechanical properties of a modified refill friction stir spot welds of AM50 magnesium alloy
13.20➢13.40	**Dulce Rodrigues**[1] Inês Costa[2], Carlos Leitão[2]	ISISE-University of Coimbra[1] CEMMPRE-University of Coimbra[2]	Influence of FSW process parameters and procedures on welding distortion	**Necdet Çapar**[1] Metin Calli[2], Gokhan Tekin[2], Mesut Kaya[2], Orkun Tekelioglu[2]	Coskunoz Die & Machinery[1] Coskunoz Kalip Makina[2]	Friction Stir Spot Welding Development For Dissimilar Automotive Metals Through Investigation Of The Correlation Between FEA With Practical Applications
13.40➢14.00	**P Wanjara**[1] S Larose[1] X Cao[1], C Munro[2], A Nolting[2]	National Research Council of Canada[1] Defence R&D Canada[2]	Manufacturing of Alumina Particle Reinforced Composite on the surface of AA5083 by Friction Stir Processing	**Carlos Leitão** David Andrade, Dulce Rodrigues	University of Coimbra	Analysis of thermomechanical conditions in FSSW of steels
14.00➢14.20	**Scott Walbridge**	University of Waterloo	Fatigue Tests on Structural Friction Stir Welded Joints with Various Common Defect Types Present	**Anna Derlatka** Piotr Lacki	Czestochowa University of Technology	Impact of sleeve depth on quality of RFSSW joints made of thin 2xxx aluminum alloy sheets

	Montagnaise 3		
Session 12	**Plenary** **Chairs: Hidetoshi Fujii ❖ Axel Meyer**		
	Author(s)	Affiliation	Paper title
14.40➢15.10	**Jorge Dos Santos**	Helmholtz-Zentrum Geesthacht GmbH	The role of Friction Stir based Processes on future Rivetless Aircraft Structures
15.10➢15.40	**Yuri Hovanski**[1] Thomas Luzanski[2] ,Dustin Marshall[2] , Piyush Upadhyay[3]	Brigham Young University[1] TWB Company[2] Pacific Northwest National Laboratory[3]	Automated Production of Aluminum Tailor-Welded Blanks
15.40➢15.50	**Closing**		

*Please note: Presentations in grey are Abstract only. Select few unavailable.

12th International Symposium on Friction Stir Welding

FRIDAY 29 June 2018 (Morning)

OPTIONAL INDUSTRIAL VISIT

POSTERS

Author(s)	Affiliation	Paper title
Janina Adamus Julita Winowiecka	Czestochowa University of Technology	Impact of the selected FSW process parameters on strength and structure of overlap joints
Yukio Miyashita[1] Takuma Maeda[1], Yuichi Otsuka[1], Nobushiro Seo[2], Hisashi Hori[2]	Nagaoka University of Technology[1] Nippon Light Metal, Co. Ltd.[2]	Formation behavior of microstructure around interface in FSWed dissimilar materials lap joint between A1100 and Zn plated steel by using shoulder less tool
Masaki Okane[1] Yuki Ogura[1], Toshimasa Chaki[1], Hisahiro Sakai[2], Toshiaki Yasui[3], Masahiro Fukumoto[3]	National Institute of Technology, Toyama College[1] Kyoshin Heat Treatment Co Ltd[2] Toyohashi University of Technology[3]	Fatigue Properties of Die-cast Aluminum Alloy and Carbon Steel Dissimilar Joints by Friction Stir Welding
Gnofam Jacques Tchein[1] Dimitri Jacquin[1] Dominique Coupard[1], Eric Lacoste[2],Franck Girot[3]	University of Bordeaux[1] ENSAM – Bordeaux[2] University of the Basque Country[3]	Study of genesis of microstructure during Friction Stir Welding of Ti-6Al-4V alloy
Tomoya Nagira Shuo Wu, Zexi Wu, Hidetoshi Fujii	Joining and Welding Research Institute, Osaka University	Friction stir welding of developed high tensile strength steel with reduced rare metal