

Programme for 4th International Friction Stir Welding Symposium
Prospector Lodge & Conference Center, Park City, Utah, USA - 14-16 May 2003

Wednesday 14 May 2003

Session 1	Process & Equipment - 1	Celebrity Theater - Chairman Peter Fielding (TWI)
0900-0930	J dos Santos - GKSS	Robotic friction stir welding of 7075 alloy (late substitution - manuscript not on CD)
0930-1000	C Chen, R Kovacevic, D Jandric - Southern Methodist University	Acoustic emission in monitoring quality of weld in friction stir welding
1000-1030	C D Sorensen, T W Nelson - Brigham Young University	Progress in polycrystalline cubic boron nitride FSW tooling
1030-1100	Break	
Session 2	Metallurgy/Performance - 1	Celebrity Theater - Chairman Jean-Claude Goussain (Institut de Soudure)
1100-1130	A J Leonard, S A Lockyer - TWI	Flaws in friction stir welds
1130-1200	S H C Park, Y S Sato, H Kokawa - Tohoku University	Texture effects on tensile properties in friction stir weld of a magnesium alloy AZ31
1200-1230	Kh A A Hassan ¹ , B P Wynne ² , P B Prangnell ¹ - ¹ Manchester Materials Science Centre, ² University of Sheffield	The simulation of nugget zone grain structures in high strength Al-alloy friction stir welds by high strain torsion testing
1230-1330	Lunch	
Session 3A	Metallurgy/Performance - 2	Celebrity Theater - Chairman Hiroyuki Kokawa (Tohoku University)
1330-1400	T J Lienert ¹ , W L Stellwag Jr ² , L R Lehman ² - ¹ Los Alamos National Laboratory, ² Edison Welding Institute	Heat inputs, peak temperatures and process efficiencies for FSW
1400-1430	D Allehaux ¹ , G Petit ² , M-H Campagnac ¹ , G Lapasset ² , A Denquin ² - ¹ EADS CCR, ² ONERA	Microstructure and properties of a friction stir welded 7349-T6 aluminium alloy
1430-1500	H J Liu ^{1,2} , H Fujii ¹ , M Maeda ¹ , K Nogi ¹ - ¹ JWRI, Osaka University, ² Harbin Institute of Technology	Comparative study on fracture locations of friction stir welded joints for different types of aluminium alloys
Session 3B	Dissimilar & Special Materials - 1	Silver King Room - Chairman Paul Konkol (CTC)
1330-1400	L Cederqvist ¹ , R E Andrews ² - ¹ SKB, ² TWI	A weld that lasts for 100,000 years: FSW of copper canisters
1400-1430	T Källgren, R Sandström - RIST	Microstructure and temperature development in copper welded by the FSW process
1430-1500	R Johnson - TWI Ltd	FSW of magnesium alloys
1500-1530	Break	
Session 4A	Aerospace - 1	Celebrity Theater - Chairman François Marie (EADS)
1530-1600	J A Baumann, R J Lederich, R Mishra - Boeing	Evolution of thick section friction stir welding of 7050 Al
1600-1630	R Talwar ¹ , R Lederich ¹ , D Bolser ¹ , A Garcia ² - ¹ Boeing –Phantom Works, St Louis, MO, ² Boeing-Phantom Works, Long Beach, CA	An innovative, low cost friction stir welded cargo handling solution for the C-17 Globemaster III for reducing manufacturing cost and logistics support
1630-1700	B Christner, J McCoury, S Higgins - Eclipse Aviation Corporation	Development and testing of friction stir welding as a joining method for primary aircraft structure
Session 4B	Modelling - 1	Silver King Room - Chairman Tony Reynolds (University of S. Carolina)
1530-1600	T Dickerson, H Shercliff - Cambridge University	Validation of friction stir welding process models
1600-1630	A Askari - Boeing	Modelling, analysis, and validation of FSW processes (manuscript not on CD)
1630-1700	P A Colegrove ^{1,2} , H R Shercliff ¹ , P L Threadgill ² - ¹ Cambridge University, ² TWI	Modelling and development of the Trivex™ friction stir welding tool

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Session 5A	Aerospace - 2	Celebrity Theater - Chairman Raj Talwar (Boeing)
0900-0930	G Shepherd - Airbus UK (presented by G Brown)	The evaluation of friction stir welded joints on airbus aircraft wing structure
0930-1000	D Lohwasser - Airbus Deutschland	Friction stir welding of aerospace alloys
1000-1030	B Christner ¹ , M Hansen ² , M Skinner ² , G Sylva ² - ¹ Eclipse Aviation Corporation, ² MTS Systems Corporation,	Friction stir welding system development for thin gauge aerospace structures
Session 5B	Metallurgy/Performance - 3	Silver King Room - Chairman Mike Santella (Oak Ridge National Lab)
0900-0930	T Nelson - Brigham Young University	(late substitution - manuscript not on CD)
0930-1000	H J Liu ^{1,2} , H Fujii ¹ , M Maeda ¹ , K Nogi ¹ - ¹ JWRI, Osaka University, ² Harbin Institute of Technology	Comparative study on friction stir weldability of different types of aluminum alloys
1000-1030	J Yan, B Yang, M A Sutton, A P Reynolds, J Ward - University of South Carolina	Meso-structural banding and FSW parameter effects on crack turning in mode I fracture of 2524 friction stir welds (manuscript not on CD)
1030-1100	Break	
Session 6A	Aerospace & Applications	Celebrity Theater - Chairman Kumar Jata (USAF)
1100-1130	M Santella ¹ , S Babu ¹ , S David ¹ , D Storjohann ² , T Engstrom ² , T-Y Pan ³ - ¹ Oak Ridge National Laboratory, ² South Dakota School of Mines & Technology, ³ Ford Research Laboratory	Friction stir welding and surface modification of aluminum alloys (late substitution - manuscript not on CD)
1130-1200	J Hootman, S Simmons - Tower Automotive	Friction stir welded aluminium suspension links (manuscript not on CD)
1200-1230	A von Strombeck, J F dos Santos, C Schilling, S Sheikhi - GKSS	Effect of welding speed on the properties of friction stir welded tailored blanks.
Session 6B	Process & Equipment - 2	Silver King Room - Chairman Jorge dos Santos (GKSS)
1100-1130	K Lahti, R Larsson - ESAB AB (presented by J Defalco)	Thicker, faster and easier friction stir welding
1130-1200	M Skinner ¹ , R L Edwards ¹ , G Adams ² , Z Li ³ - ¹ MTS Systems Corporation, ² Lockheed Martin/Michoud Operations, ³ Edison Welding Institute	Improvements to the FSW process using the self reacting technology
1200-1230	J Thompson - General Tool Company	Space Shuttle ET FSW machines
1230-1330	Lunch	
Session 7	Process & Equipment - 3	Celebrity Theater - Chairman Masaki Kumagai (Sumitomo Light Metals)
1330-1400	O K Mishina, A Norlin - SAPA Technology	Lap joints produced by FSW on flat aluminium EN AW-6082 profiles
1400-1430	H Steiger, M Schwalm, F Palm - EADS	Highest FSW joint properties versus FSW process stability - the role of surface preparation, FSW tool geometry and FSW process parameters
1430-1500	C Fuller, M Mahoney, W Bingel - Rockwell Scientific	Friction stir processing of aluminum fusion welds
1500-1530	Break	
Session 8	Dissimilar & Special Materials - 2	Celebrity Theater - Chairman Murray Mahoney (Rockwell Scientific Co)
1530-1600	K Yoshikawa - Anan National College of Technology	A joining criterion for lap joining of dissimilar metal materials of aluminium and stainless steel by friction stir
1600-1630	P Nerman, J Andersson - Swedish Institute for Metals Research	Fatigue strength of mixed Al joints performed with FSW
1630-1700	M Santella ¹ , G J Grant ² , W Arbogast ³ - ¹ Oak Ridge National Laboratory, ² Pacific Northwest National Laboratory, ³ South Dakota School of Mines	Plunge testing to evaluate tool materials for friction stir welding of 6061 + 20wt%Al ₂ O ₃ composite

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Session 9A	Metallurgy/Performance - 4	Celebrity Theater - Chairman Phil Prangnell (UMIST)
0900-0930	C Bird - TWI Ltd	Quality control of friction stir welds by the application of non-destructive testing
0930-1000	K Lindner, Z Khandkar, J Khan, W Tang, A P Reynolds - University of South Carolina	Rationalization of hardness distributions in alloy 7050 friction stir welds based on weld energy, weld power, and time/temperature history
1000-1030	J F Bingert ¹ R W Fonda ² - ¹ Los Alamos National Laboratory, ² Naval Research Laboratory	Transverse texture and microstructure gradients in friction stir welded 2519 aluminium
Session 9B	Steels - 1	Silver King Room - Chairman Maria Posada (US Navy)
0900-0930	Richard Johnson ¹ , J F dos Santos ² , - ¹ TWI, ² GKSS	Mechanical properties of friction stir welded S355 C-Mn steel plates
0930-1000	T Lienert ¹ , W Tang ² , J A Hogeboom ² , L G Kvidahl ³ - ¹ Los Alamos National Laboratory, ² University of South Carolina, ³ Northrup Grumman Ship Systems	Friction stir welding of DH-36 steel
1000-1030	S Packer ¹ , T Nelson ² , C Sorensen ² , R Steel ³ , M Matsunaga ⁴ - ¹ ADVMP, ² Brigham Young University, ³ Sii Megadiamond, ⁴ Tecnara	Tool and equipment requirements for friction stir welding ferrous and other high melting temperature alloys
1030-1100	Break	
Session 10A	Steels - 2	Celebrity Theater - Chairman John Hinrichs (Friction Stir Link)
1100-1130	K Okamoto ¹ , S Hirano ¹ , M Inagaki ¹ , S C Park ² , Y S Sato ² , H Kokawa ² , T W Nelson ³ , C D Sorensen ³ - ¹ Hitachi Research Laboratory, ² Tohoku University, ³ Brigham Young University (presented by Y S Sato)	Metallurgical and mechanical properties of friction stir welded stainless steels
1130-1200	P Konkol - Concurrent Technologies Corporation	Characterization of friction stir weldments in 500 Brinell hardness quenched and tempered steel
1200-1230	M Posada ¹ , J DeLoach ¹ , A P Reynolds ² , R W Fonda ³ , J P Halpin ⁴ - ¹ Naval Surface Warfare Center, ² University of South Carolina, ³ Naval Research Laboratory, ⁴ MTS Systems Corporation	Evaluation of friction stir welded HSLA-65
Session 10B	Modelling - 2	Silver King Room - Chairman Tom Lienert (Los Alamos National Lab)
1100-1130	S Xu, X Deng - University of South Carolina	Two and three dimensional finite element models for the friction stir welding process
1130-1200	Q-Y Shi, T L Dickerson, H R Shercliff - Cambridge University Engineering Department	Thermomechanical FE modelling of friction stir welding of Al-2024 including tool loads
1200-1230	C Chen, R Kovacevic - Southern Methodist University	Finite element modeling of thermomechanical performance of friction stir welding
1230-1330	Lunch	
Session 11	Process & Equipment - 4	Celebrity Theater - Chairman Ian Norris (TWI)
1330-1400	M McLane, P Carter - Brigham Young University	Free-form friction stir welding
1400-1430	C B Smith, J F Hinrichs, W A Crusan - Friction Stir Link	Robotic friction welding - the state of the art
1430-1500	T Nishihara, Y Nagasaka - Kokushikan University	Measurement of tool temperature during friction stir welding

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Poster Presentations	
U Henneboehle, F Palm, H Steiger - EADS CRC Germany	The origin of particle (oxide) traces in friction stir welds
T L Dickerson, Q-Y Shi, H R Shercliff - Cambridge University	Heat flow into friction stir welding tools
T L Dickerson ^{1,2} , H R Shercliff ¹ , H Schmidt ^{3,4} - ¹ Cambridge University, ² University of Manchester and UMIST, ³ Technical University of Denmark, ⁴ Risø National Laboratory	A weld marker technique for flow visualization in friction stir welding
G Grant ¹ , M Khaleel ¹ , R Johnson ¹ , M Santella ² , W J Arbogast ³ - ¹ Pacific Northwest National Laboratory, ² Oak Ridge National Laboratory, ³ South Dakota School of Mines	Protecting the surface of tooling during friction stir joining of aluminum MMCs (manuscript not on CD)
D Jandric, C Chen, M Valant, R Kovacevic - Southern Methodist University	Characterization of weld quality by different sensing techniques in friction stir welding of lap joints
Y S Sato, Y Sugiura, H Kokawa - Tohoku University	Hardness distribution and microstructure in friction stir welding of aluminum alloy 5052
M Song, R Kovacevic - Southern Methodist University	A coupled heat transfer model for workpiece and tool in friction stir welding
P S Pao ¹ , E Lee ² , C R Feng ¹ , H N Jones ¹ , D W Moon ¹ - ¹ Naval Research Laboratory, ² Naval Air Warfare Center	Corrosion fatigue in FSW and GMA welded Al 2519
R L Johnson - TWI Ltd	An assessment of the friction stir welding of magnesium alloys
T Ghidini, C Dalle-Donne - German Aerospace Center	Prediction of fatigue crack propagation in friction stir welds
W M Thomas, I J Smith, D G Staines - TWI Ltd	Reversal stir welding - Re-stir TM - Feasibility study
M Moles, H Cook - R/D Tech	Friction stir, laser and electron beam welding