

6th International Symposium on Friction Stir Welding, (6ISFSW) Saint-Sauveur, Quebec, Canada 10th-13th October 2006

This event attracted over 200 registrants, a record for the Symposium, and 88 papers were presented. The venue in Saint-Sauveur, about 50km from Montreal, proved to be of a very high standard and the location resulted in a favourable response from the delegates.

This event was run on behalf of the Friction Stir Welding Licensees Association by TWI, with a great deal of local assistance from the National Research Council's Aerospace Manufacturing Technology Center in Montreal.

Delegates from every continent attended, and most of the major users of the process were represented, thus the audiences included people from every industry sector, and from all parts of the supply chain for friction stir welded products.

As a whole, the papers presented a detailed overview of the current state of the art. Most of the papers presented novel work, some incremental, but some reporting significant advances in technology and applications. The papers are available on a CD issued to all registered delegates, but which can be purchased from TWI's library for £175 (+ VAT where applicable) by non delegates.

Plans for the 7th International Symposium on Friction Stir Welding were announced at the Licensees meeting. This will be held at the Awaji Yumebutai Conference Centre on Awaji Island, near Kobe, Japan, on Tuesday 20th-Thursday 22nd May 2008.

TUESDAY 10TH OCTOBER 2006

	0800-0845	Registration		
	0845-0900	Opening Formalities		
SESSION 1		FSW TOOLS I	Chairman: Ian Norris	
36	0900-0930	Burford D A, Tweedy B, Widener C A	National Institute for Aviation Research, Wichita State University (USA)	Influence of shoulder configuration and geometric features on FSW track properties
62	0930-1000	Dubourg L ¹ , Dacheux P ²	¹ Aerospace Manufacturing Technology Centre, National Research Council Canada, ² Aluminium Technology Centre, National Research Council (Canada)	Design and properties of FSW tools: a literature review
	1000-1030	Coffee Break		
SESSION 2A		FSW OF HIGH TEMP ALLOYS	Chairman: Tim Li	
2	1030-1100	Jun H J & Ayer R	ExxonMobil Research & Engineering (USA)	Precipitation behaviour of Ni base alloys during FSW.
4	1100-1130	Fujii H, Kato H, Nakata K, Nogi K	Osaka Uni/JWRI (Japan)	FSW of high temperature materials (Mo, Ti)
48	1130-1200	Mononen J T	Helsinki Uni (Finland)	FSW of PH 15-7 stainless steel sheet
104	1200-1230	Ishikawa T ¹ , Fuji H ² , Iwaki S ¹ , Matsuoka S ¹ , Nogi K ²	¹ Tokyu Car Corp. , ² Joining and Welding Research Institute (Japan)	High-speed friction stir welding of 304 stainless steel
SESSION 2B		MODELLING I	Chairman: Tashiaki Yasui	
22	1030-1100	Williams S W ¹ , Colegrove P A ¹ , Shercliff H ² , Pragnell P ³ , Robson J ³ , Withers P ³ , Richards D ³ , Sullivan A ³ , Kamp N ³ , Lohwasser D ⁴ , Poad M ⁵	¹ Cranfield University, ² Cambridge University, ³ University of Manchester, ⁴ Airbus (Germany), ⁵ Airbus UK (UK)	Integrated modelling of the FSW process
44	1100-1130	Tartakovsky A M	Pacific Northwest National Lab (USA)	Lagrangian particle model of friction stir welding
51	1130-1200	Schmidt H and Hattel J	Technical University of Denmark (Denmark)	Analysis of the velocity field in the shear layer in FSW - Experimental and numerical modelling
70	1200- 1230	Sato T, Otsuka D, Watanabe Y	Nippon Sharyo Ltd (Japan)	Designing of FSW parameters with finite element flow simulation
	1230-1330	Lunch Break		
SESSION 3A		FATIGUE I	Chairman: Danie Hattingh	
65	1330-1400	Jene T ^{1,2} , Dobmann G ¹ , Wagner G ² , Eifler D ² ,	¹ Fraunhofer Institute for Non-destructive Testing, ² Institute of Materials Science and Engineering, University of Kaiserslautern (Germany)	Oxide fragments in friction stir welds- distribution and effects on crack initiation

80	1400-1430	<u>Ali A¹</u> , Brown M <u>W²</u> , Rodopoulos C A ³	¹ University of Putra (Malaysia), ² University of Sheffield (UK), ³ Sheffield Hallam University (UK)	Crack coalescence and growth in aircraft friction stir welded joints
109	1430-1500	<u>Uematsu Y</u> , <u>Tokaji K</u> , <u>Murata S</u>	Gifu University (Japan)	Fatigue behaviour of FSSW joints in Al-Mg-Si alloy
SESSION 3B		FRICITION STIR PROCESSING	Chairman: Murray Mahoney	
97	1330-1400	<u>Nguyen J</u>	U S Navy (NSWC) (USA)	Corrosion evaluation of friction stir processed NAB
47	1400-1430	<u>Chung S W¹</u> , <u>Morishige T²</u> , <u>Tsujikawa M²</u> , <u>Takigawa Y²</u> , <u>Oki S³</u> , <u>Higashi K²</u>	¹ Osaka Industrial Promotion Organization, ² Osaka Prefecture University, ³ Kin-Ki University (Japan)	High strength Mg-Y-Zn alloy by FS processing
102	1430-1500	<u>Posada M</u>	U S Navy (NSWC) (USA)	Variable ductility evaluation of FSP'd NAB castings
	1500-1530	Coffee Break		
SESSION 4A		QUALITY I	Chairman: Philip Threadgill	
12	1530-1600	<u>Beamish K¹</u> , <u>Ezeilo A¹</u> , <u>Smith S¹</u> , <u>Lewis P²</u> , <u>Cheetham P³</u> (Presented by <u>Blignault C¹</u>)	¹ TWI Ltd., ² Applied Measurements Ltd., ³ Sigmapi Systems Ltd (UK)	Development of a low cost FSW monitoring system
21	1600-1630	<u>Boldsai Khan E</u> , <u>Corwin E M C</u> , <u>Logar A</u> , <u>Arbegast W</u>	SDSMT (USA)	Neural network evaluation of weld quality using FSW feedback data
95	1630-1700	<u>Barnes J E¹</u> , <u>McMichael J²</u> , <u>Reynolds A³</u>	¹ Lockheed Martin Aeronautics, ² Alcoa Technical Center, ³ University of South Carolina (USA)	Effects of FSW defects on 7075 joint strength and fatigue life
SESSION 4B		AEROSPACE I	Chairman: John Baumann	
27	1530-1600	<u>Lohwasser D</u>	Airbus Deutschland (Germany)	FSW for A350 aircraft
82	1600-1630	<u>Luan G</u> , <u>Ji Y</u> , <u>Jian B</u>	China FSW Center of BAMTRI and TWI (China)	Primary study on FSW of the lightweight aircraft structures
	1715-1830	LICENCEES MEETING		
WEDNESDAY 11TH OCTOBER 2006				
SESSION 5A		PROCESS I	Chairman: Gil Sylva	
3	0800-0830	<u>Nishida H¹</u> , <u>Inuzuka M¹</u> , <u>Koga S¹</u> , <u>Nishiyama G²</u> and <u>Yamazaki K²</u>	¹ Kawasaki Heavy Industries, ² Kawasaki Ship Building Corporation (Japan)	Development of a new FSW machine for large Al alloy structures
50	0830-0900	<u>Baumann J A</u>	Boeing (USA)	FS process capabilities for highly contoured applications.
84	0900-0930	<u>Liu H</u> , <u>Guo N</u> , <u>Feng J</u>	Harbin University (China)	FSW assisted by micro-plasma arc
86	0930-1000	<u>Smith C B</u> and <u>Hinrichs J</u>	Friction Stir Link (USA)	Deeper FSW penetration expands use of robotic FSW and processing

SESSION 5B		RESIDUAL STRESSES	Chairman: Jorge dos Santos	
23	0800-0830	<u>Williams S W</u>	Cranfield University (UK)	Control of residual stresses and distortion in FSW
53	0830-0900	<u>Lombard H¹</u> , <u>Hattingh D G¹</u> , James M N ² , Steuwer A ³ .	¹ Nelson Mandela Metropolitan University (South Africa), ² Plymouth University (UK), ³ ESRF (France)	Synchrotron Diffraction residual strain scanning in FSW as a function of process conditions
49	0900-0930	<u>Blanchard S B¹</u> , Langrand B ¹ , Fabis J ¹ , Denquin A ²	¹ ONERA Structures and Damage Mechanics Dept. ² ONERA Metallic Materials and Processing Dept (France)	Arcan test and strain field measurement to study material behaviour in 6056T78 FSW specimens.
24	0930-1000	<u>Williams S W¹</u> , Price D A ² , Wescott A ² , Steuwer A ³ , Peel M ³ , Altenkirch J ⁴ , Withers P J ⁴ , Poad M ⁵	¹ Cranfield University, ² BAE Systems, ³ ILL-ESRF (France), ⁴ University of Manchester and UMIST, ⁵ Airbus UK (UK)	Distortion control in welding by mechanical testing
	1000-1030	Coffee Break		
SESSION 6A		AEROSPACE II	Chairman: Daniela Lohwasser	
5	1030-1100	<u>Marie F and Allehaux F</u>	EADS (France)	Development of FSW for optimum run-out performance
	1100-1130	<u>Lohwasser D</u>	Airbus Deutschland (Germany)	Video presentation to infill 'no show' slot
110	1130-1200	<u>Sylva G¹</u> , <u>Moore G²</u> , Thomas B ² , Kok L ²	¹ MTS (USA) ² Bombardier Aerospace (Canada/UK)	Advances in FSW for commercial aircraft applications
75	1200-1230	<u>Cao X</u>	NRC Montreal (Canada)	FSW of aerospace Mg alloy
SESSION 6B		FRICTION STIR SPOT WELDING	Chairman: John Hinrichs	
17	1030-1100	<u>Pan T Y¹</u> , <u>Schwartz W J¹</u> , <u>Lazarz K A¹</u> , <u>Santella M L²</u> (Presented by <u>Grant G J³</u>)	¹ Ford USA, ² Oak Ridge National Laboratory, ³ Pacific Northwest National Laboratory (USA)	'Spot friction weldbonding' for sheet Al joining
13	1100-1130	<u>Kyffin W J¹</u> , <u>Threadgill P L²</u> , Lalvani H ³ , Wynne B P ³	¹ TWI Technology Centre (Yorkshire) Ltd., ² TWI Ltd., ³ University of Sheffield (UK)	Progress in FSSW of DP800 high strength automotive steel
35	1130-1200	<u>Badarinarayan H</u>	Hitachi America (USA)	Process development and material property evaluation of FS stitch welded sheet metal (Al)
107	1200-1230	<u>Tozaki Y</u> , <u>Uematsu Y</u> , <u>Tokaji K</u>	Gifu University (Japan)	Effect of welding condition on tensile strength of dissimilar FS spot welds between different Al alloys.
	1230-1330	Lunch Break		
SESSION 7A		APPLICATIONS	Chairman: Tadashi Nishihara	
67	1330-1400	<u>Gerçekioğlu E¹</u> , Eren T ² , Yildizli K ¹ , Salamci E ³	¹ Erciyes Uni, ² Military Main Repairment Factory, ³ Zonguldak Karaelmas University (Turkey)	The application of FSW method to the Al alloy of AA 6063-T6 pipe using milling machine

39	1400-1430	<u>Grant G J</u>	Pacific Northwest National Lab (USA)	Superplastic forming of Al multi-sheet structures fabricated using FSW and refill FSSW
68	1430-1500	<u>Cederqvist L</u>	SKB (Sweden)	FSW to manufacture and seal 5cm Cu canisters for Sweden's nuclear waste
SESSION 7B		FATIGUE II	Chairman: Dwight Burford	
1	1330-1400	<u>Tsujikawa M</u> ¹ , <u>Koizumi S</u> ¹ , <u>Oguri T</u> ² , <u>Oki S</u> ³ , <u>Chung S W</u> ⁴ , <u>Higashi K</u> ¹	¹ Osaka Prefecture University, ² Technology Research Institute of Prefecture, ³ Kinki University, ⁴ Osaka Technology Licensing Organization (Japan)	Fatigue crack growth in Mg alloy FSW joints
96	1400-1430	<u>Yang X</u> ¹ , <u>Fang D</u> ¹ , <u>Luan G</u> ² , <u>Jian B</u> ²	¹ Tianjin University, ² Beijing FSW Technology Co Ltd. (China)	Experimental investigation on fatigue properties of FSW in aircraft Al alloys
61	1430-1500	<u>Vugrin T</u> , <u>Biallas G</u> , <u>Ghidini T</u>	DLR (Germany)	Influence of root and nugget flaws on static and fatigue properties of FSW
	1500-1530	Coffee break		
SESSION 8A		QUALITY II	Chairman: Jean-Pierre Immarigeon	
30	1530-1600	<u>Lamarre A</u>	Olympus NDT (Canada)	Eddy current array and ultrasonic phased array technologies as reliable tools for FSW inspection.
74	1600-1630	<u>Dubourg L</u> ¹ , <u>Gagnon F O</u> ² , <u>Nadeau F</u> ² , <u>St-Georges L</u> ³ , <u>Jahazi M</u> ¹	¹ Aerospace Manufacturing Technology Centre, NRC Canada, ² Aluminium Technology Centre, NRC Canada, ³ REMAC Industrial Innovators (Canada)	Process window optimization for FSW of thin and thick sheet Al alloys using statistical methods
6	1630-1700	<u>Okada T</u> , <u>Kida K</u> , <u>Iwaki S</u> , <u>Eguchi N</u> , <u>Ishikawa T</u> , <u>Oiwa N</u> , <u>Namba K</u>	The Japan Light Metal Assoc Welding & Construction Association Inc (Japan)	Studies on Characteristics of FSW joints in structural Al alloys - Part 1
SESSION 8B		FSW TOOLS II	Chairman: François Marie	
38	1530-1600	<u>Widener C</u> ¹ , <u>Talia J E</u> ² , <u>Tweedy B M</u> ¹ , <u>Burford D A</u> ¹	¹ National Institute for Aviation Research Wichita State University ² Mechanical Engineering Department Wichita State University (USA)	High-rotational speed FSW with a fixed shoulder
99	1600-1630	<u>Nishihara T</u>	Kokushikan University (Japan)	Development of simplified FSW tool
	1800-2300	Social Event		
THURSDAY 12TH OCTOBER				
SESSION 9A		PROPERTIES	Chairman: Luan Guohong	
7	0830-0900	<u>Hori H</u> , <u>Tanikawa H</u> , <u>Seo N</u> , <u>Namba K</u>	The Japan Light Metal Assoc Welding & Construction Association Inc (Japan)	Studies on Characteristics of FSW joints in structural Al alloys - Part 2
43	0900-0930	<u>Shukla A K</u> ¹ , <u>Baeslack III W A</u> ²	¹ Rensselaer Polytechnic Institute, ² The Ohio State University (USA)	Effect of process conditions on microstructure evolution and mechanical properties of FSW thin sheet 2024-T3

42	0930-1000	Steuer A ^{1,2} , Peel M J ^{1,2} , Withers P J ²	¹ University of Manchester (UK) ² ESRF-ILL (France)	Influence of welding speed on the properties of AA5083-AA6082 dissimilar FSWs
SESSION 9B		MODELLING II	Chairman: Stewart Williams	
63	0830-0900	St-Georges L ¹ , Dasyuva-Raymond V ² , Kiss L I ² , Perron A L ²	¹ REMAC, ² Université du Quebec á Chicoutimi (Canada)	Prediction of optimal parameters of FSW
89	0900-0930	De Vuyst T ¹ , Magotte O ^{1,2} , Robineau A ² , Goussain J-C ² , D'Alvise L ¹	¹ CENAERO (Belgium) ² Institut de Soudure (France)	Multi-physics simulation of the material flow and temperature field around FSW tool
	0930-1000	<u>Meyer A</u>	RIFTEC GmbH (Germany)	Tailored welded blanks in the new Audi R8 (presentation to infill 'no show' slot.
	1000-1030	Coffee Break		
SESSION 10A		FSW OF STEELS	Chairman: Philip Threadgill	
11	1030-1100	Cui L ¹ , Fujii H ¹ , Tsuji N ² , Nakata K ¹ , Nogi K ¹	¹ Joining & Welding Research Institute, Osaka University ² Department of Adaptive Machine Systems, Osaka University (Japan)	Mechanical properties of FSW of carbon steel joints – FSW with transformation
73	1100-1130	Li T, Gan W, Khurana S	EWI (USA)	FSW of L80 and X70 steels
15	1130-1200	Mahawish S ¹ , Fox M ¹ , Barnes S J ¹ , Johnson R ² and Withers P J ¹ (Presented by Threadgill P ¹)	¹ Manchester University, ² TWI (UK)	Residual stress and microstructural analysis of single and multi-pass FSWs in HSLA-65 steel
112	1200-1230	Nelson T, Sorensen C (Presented by Mahoney M ²)	¹ Brigham Young University, ² Rockwell Scientific Company (USA)	Advances in PCBN tooling for friction stirring of high temperature alloys
SESSION 10B		METALLURGY I	Chairman: Maria Posada	
71	1030-1100	Sato Y S, Kurihara Y, Kokawa H	Tohoku University (Japan)	Microstructural characteristics of dissimilar butt friction stir welds of AA7075 and AA2024
28	1100-1130	Simar A ¹ , de Meester B ¹ , Brechet Y ² , Pardoën T ¹	¹ Université Catholique de Louvain (Belgium), ² Domaine Universitaire (France)	Microstructural evolution and local mechanical properties evolution throughout FSW in Al 6005A
41	1130-1200	Fonda R W ¹ , Wert J A ² , Reynolds A P ³ , Tang W ³	¹ Naval Research Laboratory (USA), ² Center for Fundamental Research: Metal Structures in Four Dimension, Risø National Laboratory (Denmark) ³ University of South Carolina (USA)	Grain and texture development in single crystal FSWs
78	1200-1230	Attallah M M, Davis C L, Strangwood M	University of Birmingham (UK)	The influence of intermetallic particles on the formation of the 'onion rings' structure in Al-based alloys FSW welds

	1230-1330	Lunch break
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SESSION 11A		PROCESS II	Chairman: Lyne St Georges	
108	1330-1400	<u>Völlner G</u> ¹ , <u>Zaeh M F</u> ¹ , <u>Kellenberger O</u> ² , <u>Lohwasser D</u> ³ , <u>Silvanus J</u> ⁴	¹ Technical University, Munich, ² KUKA Roboter GmbH, ³ Airbus Deutschland GmbH, ⁴ EADS Deutschland GmbH (Germany)	3-D FSW using a modified high payload robot
113	1400-1430	<u>Tuck J R</u> ¹ , <u>Rowe C E D</u> ² , <u>Thomas W</u> ³ , <u>Staines D G</u> ³ , <u>Shields J</u> ¹	¹ H C Starck, ² Cedar Metals Ltd., ³ TWI Ltd.	Refractory Metal Tooling for FSW of Hard Aluminium and Steel
45	1430-1500	<u>Oki S</u> ¹ , <u>Tsujikawa M</u> ² , <u>Okawa Y</u> ³ , <u>Chung S W</u> ³ , <u>Higashi K</u> ²	¹ Kinki University, ² Osaka Prefecture University, ³ Technical Research Institute of Osaka Prefecture, ⁴ Osaka TLO (Japan)	Tolerance of tool position and posture in FSW

SESSION 11B		AEROSPACE III	Chairman: Zach Loftus	
37	1330-1400	<u>Tweedy B</u>	Wichita State University (USA)	Fundamental properties of FSW Al 7136 including effects of post-weld artificial ageing.
59	1400-1430	<u>Martin W</u> , <u>Anderson B</u> , <u>Jones R</u> , <u>Loftus Z</u>	Lockheed Martin Space Systems (USA)	FS lap welding methods for manufacturing large scale space- flight vehicles
8	1430-1500	<u>Hashimoto T</u> , <u>Takeda J</u> , <u>Miyamichi T</u> , <u>Namba K</u>	The Japan Light Metal Welding & Construction Association Inc (Japan)	Studies on characteristics of FSW joints in structural aluminium alloys – Part 3

	1500-1530	Coffee Break
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SESSION 12A		FUNDAMENTALS	Chairman: Dick Fonda	
29	1530-1600	<u>R Zettler</u> ¹ , <u>dos Santos J</u> ¹ , <u>Donath T</u> ¹ , <u>Beckmann F</u> ¹ <u>Lohwasser D</u> ²	¹ GKSS ² Airbus Deutschland GmbH (Germany)	Material flow in FS butt welded Al alloys
106	1600-1630	<u>Crawford R</u> ¹ , <u>Bloodworth T</u> ¹ , <u>Cook G E</u> ¹ , <u>Strauss A M</u> ¹ , <u>Hartman D A</u> ²	¹ Vanderbilt University, ² Los Alamos National Laboratory (USA)	High speed FSW process modeling
100	1630-1700	<u>Reynolds A P</u> , <u>Pouget G</u> , <u>Tang W</u> <u>Khandkar Z</u>	University of South Carolina (USA)	General features of RPM, torque and process force relationships in Al alloy FSW

SESSION 12B		MMCs/Properties	Chairman: Jukka Mononen	
9	1530-1600	<u>Kamioka M</u> , <u>Okubo K</u> , <u>Namba K</u>	The Japan Light Metal Welding & Construction Association Inc. (Japan)	Studies on characteristics of FSW joints in structural aluminium alloys – Part 4
66	1600-1630	<u>Dalkilic S D</u> , <u>Biallas G</u>	DLR-German Aerospace Center, Institute of Materials Research (Germany)	FSW joints of an Al MMC and a monolithic Al alloy
34	1630-1700	<u>Yasui T</u> ¹ , <u>Tsubaki M</u> ¹ , <u>Fukumoto M</u> ¹ , <u>Takahashi H</u> ² ,	¹ Toyohashi University of Technology, ² Taiheiyo Cement, ³ NIHON CERATEC Co Ltd (Japan)	Butt welding between Al alloy and Al- based MMC by friction stirring

		Sasaki S-i ³		
FRIDAY 13TH OCTOBER 2006				
SESSION 13A		FSW Al-steel/Cu	Chairman: Patrick Gougeon	
31	0800-0830	Fukumoto M, Miyagawa K, Yasui T, Tsubaki M	Toyohashi University (Japan)	Spot welding between Al alloy and carbon steel by friction stirring
79	0830-0900	Savolainen K, Mononen J, Saukkonen T, Hänninen H	Helsinki University of Technology (Finland)	A preliminary study on FSW of dissimilar metal joints of Cu and Al
111	0900-0930	Bozzi S ¹ , Etter A L ¹ , Baudin T ¹ , Robineau A ² , Goussain J C ²	¹ Université de Paris-Sud, ² Institut de Soudure (France)	Influence of the dwell time on spot welding between 6008 Al alloy and steel by FSW
SESSION 13B		FSW OF Ti ALLOYS	Chairman: Tony Reynolds	
40	0800-0830	Bernath J J, Krem S, Li T	EWI (USA)	FSW of Ti-6Al-4V structural components
58	0830-0900	Ronald E Jones, Loftus Z	Lockheed Martin Space Systems Co (USA)	FSW of 5mmTi-6Al-4V
105	0900-0930	Ikeda M ¹ , Hasegawa S ¹ , Wook C S ² , Higashi K ³	¹ Kansai University, ² Osaka Industrial Promotion Organization, ³ Osaka Prefecture University (Japan)	Fundamental study for development of new tool for Ti and its alloys
14	0930-1000	Russell M J, (Presented by Blignault C)	TWI (UK)	Recent developments in FSW of Ti alloys
	1000-1030	Coffee break		
SESSION 14A		MODELLING III	Chairman: Laszlo Kiss	
93	1030-1100	Buffa G, Fratini L F, Hua J, Micari R and Shivpuri R	Palermo University (Italy)	FSW research activity at OSU and UNIPA
101	1100-1130	Chen Z, Pasang T, Qi Y and Perris R	Auckland University of Technology (New Zealand)	Tool-workpiece interface and shear layer formed during FSW
103	1130-1200	Gebhard G P, Zaeh M F	Institute for Machine Tools and Industrial Management (Germany)	Empirical model for the tool shoulder temperature during FSW
SESSION 14B		DISSIMILAR & METALLURGY II	Chairman: Mohammad Jahazi	
56	1030-1100	Soundararajan V, Kovacevic R	Research Center for Advanced Manufacturing (RCAM), Southern Methodist University (USA)	FSW of steel to Al alloy
33	1100-1130	Yasui T, Ishii T, Tsubaki M and Fukumoto M	Toyohashi University (Japan)	Microstructure of butt welding between Al and steel by FSW
54	1130-1200	Mahoney M ¹ Fuller C ² DeWald A ³ Hill M ³	¹ Rockwell Scientific Co., ² GE Healthcare, ³ University of California (USA)	Residual stresses in multi-pass friction stir processed NiAl bronze using the contour method
	1200	END OF SYMPOSIUM		
	pm	VISIT TO NRC		