1st International Symposium on Friction Stir Welding, (1ISFSW)
Thousand Oaks, California
14-16 June 1999

TWI's FSW Symposium at the Rockwell Science Centre

Outstanding success for 1st International Symposium on Friction Stir Welding. More than 140 delegates met at the Rockwell Science Center in California for three days in June to attend the world's first symposium devoted exclusively to Friction Stir Welding (FSW).

Delegates to the event, organised by TWI on behalf of the FSW Licensees Association with the tremendous support of Rockwell, heard over 30 presentations from commercial users and researchers drawn from Europe, Japan, and USA. FSW has revolutionised the welding of aluminium alloys and achieved a high level of commercial maturity for such materials. Delegates were told that some 100 miles (160km) of production butt welding has been done in Scandinavia by one company alone, mainly for marine and land transport applications.

The delegates used the breaks for intensive discussion

Doug Waldron of Boeing described his company's $15million investment in the use of FSW to weld the booster core tanks for the Delta range of space launch vehicles. Production welding started on 19 February 1999. This was the first production FSW in the USA and to date 10 tanks have been made, all defect free. The astonishing reproducibility of FSW was echoed by other speakers. Doug also made the astounding revelation that two scrap tanks with defective arc welds had been recovered by friction stir welding over the arc welds. The result was sufficient to allow the tanks to be used. This alone saved the cost of one of their FSW machines. Dick Andrews (TWI) on behalf of SKB, the Swedish nuclear company, was able to disclose and describe the first potential commercial use of friction stir welding of copper with up to 50mm thickness. Meanwhile speakers from TWI, EWI, and the wider research community were able to provide information on the extensive worldwide activity on the welding by friction stir of the higher softening temperature materials such as steels, as well as developments in the wider theoretical analysis of the process and the evaluation of mechanical and other properties. There seems little doubt that commercial FSW of steels and similar materials will be accomplished.

The excellent Californian weather conditions made tents unnecessary

But apart from the technical presentations, all the feed back from delegates to TWI rated the opportunity to meet with so many experts, and fellow interested persons, in informal and social discussions, as the major benefit of being there. Inspired by this enthusiasm TWI and the Friction Stir Welding Association plan to hold a similar event in Summer 2000 in Europe. At least one industrial user with an exciting story to tell has already offered a paper for the next symposium.

The papers presented provided an overview of the current state of the art., presenting novel work, some incremental, but some reporting significant advances in technology and applications.

1ST INTERNATIONAL SYMPOSIUM ON FSW - USA (14-16 JUNE 1999)

Session	Author	Paper
Process Developments		
	R J Ding and P A Oelgoetz	'Mechanical property analysis in the retracted pin-tool (RPT) region of friction stir welded (FSW) aluminium-lithium 2195'
	Z Loftus, R Venable and G Adams	'Development and implementation of a load controlled friction stir welder'
Applications 1		
	S W Kallee and A Mistry	'Friction stir welding in the automotive body in white production'
	O T Midling , J S Kvåle and O Dahl	'Industrialisation of the friction stir welding technology in panels production for the maritime sector'
	J Przydatek	A ship classification view on friction stir welding'
Weld Performance 1		
	G Bussu and P E Irving	'Static and fatigue performance of friction stir welded 2024-T351 aluminium joints'
	M Kumagai and S Tanaka	'Properties of aluminium wide panels by friction stir welding'
	G Biallas, R Braun, C Dalle Donne, G Staniek and W A Kaysser	'Mechanical properties and corrosion behaviour of friction stir welded 2024-T3'
Modelling 1		
	A P Reynolds, T U Seidel and M Simonsen	'Visualisation of Material Flow in an Autogenous Friction Stir Weld'
	B Yuh J Chao and X Qi	'Heat transfer and thermo-mechanical analysis of friction stir joining of AA6061-T6 plates'
	P Dong, F Lu, J K Hong and Z Cao	'Analysis of weld formation process in friction stir welding'
Microstructure and Corrosion 1		
	L-E Svensson and L Karlsson	'Microstructure, hardness and fracture in friction stir welded AA6082'
	K Colligan	'Material flow behaviour during friction stir welding of aluminium'
	J Lumsden III, M Mahoney, G Pollock, D Waldron and A Guinasso	'Stress corrosion susceptibility in 7075 T7541 aluminium following friction stir welding'

Applications 2		
	M James and M W Mahoney	'Residual stress measurements in friction stir welded aluminium alloys'
	C Jones and G Adams	'Assembly of a full scale external tank barrel section using friction stir welding'
	R Pedwell, H Davies and A Jefferson	'Application of friction stir welding to aircraft wing structures'
	H Hori, S Makita and H Hino	'Friction stir welding of rolling stock for subway'
Process Developments 2		
	T W Nelson, B Hunsaker and D Field	'Micro-texture characterization of friction stir welds in 1100-0 aluminium'
	O T Midling and G Rørvik	'Effect of tool shoulder material on heat input during friction stir welding'
	C J Dawes, and W M Thomas	'Development of improved tool designs for friction stir welding of aluminium'
Modelling 2		
	A P Reynolds and W D Lockwood	'Digital image correlation for determination of weld and base metal constitutive behavior'
	O Frigaard, Ø Grong, B Bjorneklett and O T Midling	'Modelling of the thermal and microstructural fields during friction stir welding of aluminium alloys'
	M J Russell and H R Shercliff	'Analytical modelling of microstructure development in friction stir welding'
Weld Performance 2		
	A von Strombeck, J F Dos Santos, F Torster and M Koçak	'Fracture toughness behaviour of FSW joints in aluminium alloys'
	D Kinchen, Z Li and G Adams	'Mechanical properties of friction stir welds in Al-Li 2195-T8'
	T. Hashimoto, S Jyogan, K Nakata, Y G Kin and M Ushio	'FSW Joints of High Strength Aluminium Alloy'
Friction Stir Welding of Steel and Copper		
	D J Waldron	'Application of friction stir welding for Delta rocket fuel tanks'
	W M Thomas	'Friction stir welding of ferrous materials; A feasibility study'
	T J Lienert and J E Gould	'Friction stir welding of mild steel'
	C-G Andersson and R E Andrews	'Fabrication of containment canisters for nuclear waste by friction stir welding'
Microstructures 2		
	T J Lienert, R J Grylls, J E Gould and H L Fraser	'Microstructural evolution in friction stir welds'
	O Frigaard, Ø Grong, H Hjelen, S Gulbrandsen-Dahl and O T Midling	'Characterisation of the subgrain structure in friction stir welded aluminium alloys using the SEM-EBSD technique'
	M Strangwood, J E Berry, D M Cleugh, A J Leonard and P L Threadgill	'Characterisation of the thermo-mechanical effects on microstructural develop-ment in friction stir welded age hardening aluminium based alloys'

Proceedings

The proceedings of this highly successful symposium are available on CD-ROM. The papers presented provided an overview of the current state of the art., presenting novel work, some incremental, but some reporting significant advances in technology and applications.

The CD is also available from the Library at TWI Ltd. Please contact library@twi.co.uk (Tel: +44 (0)1223 899000, Fax: +44 (0)1223 892588).

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