

Table of Contents

Preface

Chapter 1: Friction Welding

Experimental Analysis of SA213 Tube to SA387 Tube Plate Welding by Using Close Fit Technique in Absence of Supporting Plate S.S. Kumaran, M. Sree Arravind, N. Srinivasan and D. Venkateswarlu	3
Microstructures and Mechanical Properties of Friction Welded Steel Tubes G.W. Kim, Y.K. Kim and K.H. Song	9
Metal Joining Technique of SA 213 Tube and SA 387 Tube Plate Grade Materials Using Backing Block by Clearance Fit Condition S.S. Kumaran, N. Srinivasan, S.R. Kumar, N. Sekarapandian and D. Venkateswarlu	13
Microstructure Characterization of Superalloy 718 during Dissimilar Rotary Friction Welding M. Cheepu, D. Venkateswarlu, P.N. Rao, V. Muthupandi, K. Sivaprasad and W.S. Che	19
Welding of Valve Steels of Different-Sized Cross Sections A.M. Osipov, Y.V. Bezgans and D.G. Lodkov	26

Chapter 2: Friction Stir Welding

General Aspects Concerning Possibilities of Joining by Friction Stir Welding for some of Couples of Materials Usable in the Automotive Industry R. Cojocaru, L.N. Boțilă, C. Ciucă, B. Radu, V. Verbițchi and I.A. Perianu	35
General Considerations Regarding Friction Stir Welding of some Steels Used in Important Industrial Fields C. Ciucă, R. Cojocaru, L.N. Boilă and I.A. Perianu	44
Considerations on the Ultimate Tensile Strength of Butt Welds of the EN AW 5754 Aluminium Alloy, Made by Friction Stir Welding (FSW) V. Verbițchi, R. Cojocaru, L.N. Boilă, C. Ciucă and I.A. Perianu	54
Research on the Welding Behavior for Alloy EN AW 5754 when Using FSW-US Hybrid Process O.V. Oancă, G.V. Mnerie, E.F. Binchiciu, R. Cojocaru, L.N. Boțilă and I. Duma	63
Study on the Precipitation Behavior of Precipitates of 7075 Aluminum Alloy Friction Stir Welding Joint H. Zhu, S.K. Dong, Z.M. Ma and J. Wang	69
Fatigue Property of Friction Stir Welded Butt Joints for 6156-T6 Aluminum Alloy A. Chen, J. Yang, X.M. Chen and D.K. Dong	79
Effect of Weld Zone Shape on Microstructure and Tensile Properties in Friction Stir Welding Process P. Prakash, R.S. Anand and S.K. Jha	85
Investigations on the Hardness Distribution and Microstructure of Friction-Stir-Welded 6082 Aluminum Alloy K.Y. Gao, B. Li, Y.S. Ding, H. Huang, S.P. Wen, X.L. Wu and Z. Nie	92
On FSW Keyhole Removal to Improve Volume Defect Using Pin Less Tool K.P. Mehta and R. Patel	99
Mechanical and Corrosion Behavior of Pure Aluminium Added Friction Stir Weld Joint of Aluminium Alloy S. Sinhmar and D.K. Dwivedi	106
Evaluation of Microstructure and Mechanical Properties for Friction Stir Welding of Aluminium HE-30 Plates A.K. Revely, B. Rajkumar and V. Swapna	113
Improvement in Mechanical and Metallurgical Properties of Friction Stir Welded 6061-T6 Aluminum Alloys through Cryogenic Treatment K.T. Babu, S. Muthukumaran, C.H.B. Kumar and C.S. Narayanan	120

A Study on Influence of Underwater Friction Stir Welding on Microstructural, Mechanical Properties and Formability in 5052-O Aluminium Alloys K.T. Babu, S. Muthukumaran, C.H.B. Kumar and C.S. Narayanan	126
Studies on Friction Stir Welding of AA2014, AA6082 and AA7075 Similar and Dissimilar Joints P. Gunasekaran, K.T. Thilagham and D. Noorullah	133
Residual Stresses in Similar and Dissimilar Friction Stir Welds of AA5083 and AA6061 H.G. Svoboda, L.N. Tufaro and F.J.B. Varela	143
Characterization of Microstructure and Mechanical Properties of AA2219-O and T6 Friction Stir Welds D. Venkateswarlu, M. Cheepu, P.N. Rao, S.S. Kumaran and N. Srinivasan	149
Optimization of Process Parameters for Improved Corrosion Resistance and Microstructural Exploration in Friction Stir Welding of AA2024 - AA6061 R.D. Kumar, D. Srija, P. Suresh and S. Muthukumaran	155
Multi Objective Optimization of Joining Dissimilar AA5083& AA6061 Alloys Using Friction Stir Welding- Integrated Taguchi and Grey Systems Approach B. Ravi Sankar, P. Umamaheswarrao, K. Rajasekhara Babu and M. Pardhasaradhi	161
Mechanical Properties Evaluation of Friction Stir Welded AA6061-AA7075 Alloys for Different Tool pin Geometries R.R. Raghavendra, N. Bharath, S. Pradeep and C.K. Yogisha	168
Microstructures and Properties of Friction Stir Welded Al-Cu Lap Joints W.J. Liu, W.Q. Wang and F. Jiang	174
Temperature Influence on Microstructure and Properties Evolution of Friction Stir Welded Al-Mg-Si Alloy A. Naumov, I. Morozova, F.Y. Isupov, I. Golubev and V. Mikhailov	180
Joining of Titanium and its Alloys with Aluminum Alloys by Friction Stir Welding R. Rzaev, A. Chularis and A. Rybakov	187
Characterization and Evaluation of Mechanical Properties and Residual Stress in Aluminum-Magnesium Alloys Welded by the FSW Process D.B. Colaço, M.A. Ribeiro, T.M. Maciel and R.H.F. de Melo	195
Investigating the Effect of Friction Stir Welding on Microstructure and Corrosion Behaviour of Al-Zn-Mg Alloy C. Sharma and V. Upadhyay	200
Microstructure and Impact Load Performance of Friction Stir Welded Joint of AZ31B Magnesium Alloy H.F. Wang, S.R. Liu, X.L. Ge, J.F. Pu, L. Bao and L. Tian	207
On the Local Constitutive Behavior of Friction Stir Welded AISI 304 Stainless Steel Joints V.K. Srinivas and A.K. Lakshminarayanan	216
Optimization of Welding Process Parameters in Novel Friction Stir Welding of Polyamide 66 Joints R. Nandhini, R.D. Kumar, S. Muthukumaran and S. Kumaran	223

Chapter 3: Friction Stir Spot Welding

The Effect of Rotation Speed and Dwell Time on the Zn Distribution of the Dissimilar Metals Friction Stir Spot Welded between Aluminum Alloy and Galvanized Steel Z. Nurisna, A.W. Nugroho, N. Muhayat and Triyono	231
Multi-Objective Optimization of Friction Stir Spot Welds of Aluminum Alloy Using Entropy Measurement O.O. Ojo	237
Investigation on Parameter Contribution to the Property of Weld Joint AA5052-H112 Sheets in Friction Stir Spot Welding under Fatigue Load and Failure Mode Armansyah, J. Saedon, H.C. Ho and S. Adenan	251
Friction Stir Spot Welding of AA2024-T3 with Modified Refill Technique M.H. Fahmy, H.A. Abdel-Aleem, N.A. Abdel-Elraheem and M.R. El-Kousy	260

Chapter 4: Friction Stir Processing

Mechanical Characterization of Aluminium Alloy 6061 Powder Deposit Made by Friction Stir Based Additive Manufacturing A. Mukhopadhyay and P. Saha	277
Surface Smoothing of A5083 Aluminum Alloy Plate by Friction Stir Forming T. Ohashi, K. Okuda, H.M. Tabatabaei and T. Nishihara	284
Analysis of Friction and Wear Properties of 7075 Aluminum Alloy Modified by FSP S.R. Liu, J.L. Wang, H.F. Wang, X.L. Ge and J.F. Pu	289
Effect of Tool Rotation Speed on the Microstructure and Mechanical Properties of Al-12.7 % Si Alloy by Friction Stir Processing C.X. Wang, S. Chang, G.C. Sun and Z.Q. Zhang	297
Effect of Multi Pass Friction Stir Processing on Surface Modification and Properties of Aluminum Alloy 6061 H. Vyas and K.P. Mehta	303
Stationary Shoulder Friction Stir Processing: Influence of Tool Wear on Surface Properties F. Impero, F. Scherillo, A.T. Silvestri, R. Casarin, A. Astarita and A. Squillace	310
Effect of Friction Stir Forming Process Parameters on Mechanical Interlock between A5083 Alloy and Ultra-Thin Stainless Steel Strands H.M. Tabatabaei, K. Kobayashi, T. Ohashi and T. Nishihara	316
Effect of Friction Stir Processing Parameters on the Properties of AA7075-T73/Al2O3 Surface Metal Matrix Composite A.H. Al-Helli, A.R. Alhamaoy and A.M. Takhakh	322
The Obtaining Layered Composite Materials that Contain Rare Earth Element A.N. Burlova, F.Y. Isupov, S.A. Kotov and M.G. Livintsova	333
Optimization of Friction Stir Processing Parameters for the Development of Cu-W Surface Composite R.B. Naik, G.M. Reddy, S.K. Subbu and R.A. Kumar	338
A Review on the Fabrication of <i>In Situ</i> Metal Matrix Composite during Friction Stir Welding A. Sharma and J. Paul	344
Role of Overlap Ratio on the Microstructure of Friction Stir Multiseam Cladded Copper-Stainless Steel Lap Joints A.K. Lakshminarayanan and K.L. Harikrishna	355
A Review on Fabrication of Surface Composites on Magnesium Alloys by Friction Stir Processing P.R. Surya, P. Ram, M. Arivarasu, P.L. Rozario and R.K. Mishra	360

Chapter 5: Tools and Technological Equipment

Technical Characteristics of the Equipment for Friction Stir Welding (FSW), Depending on the Base Metals V. Verbičchi, R. Cojocaru and L.N. Boțilă	369
Method and Technologies Functional Constructive Configuration Concept of a Flexible Unconventional Hybrid FSW-US Welding Process O.V. Oancă, N. ȘIRBU, E.F. Binchiciu, G.V. Mnerie and I.A. Perianu	378
A Novel Tool Path Strategy for Modelling Complicated Perpendicular Curved Movements B. Meyghani and M. Awang	385
Friction Stir Welding in the Aircraft Production D.N. Kuritsyn, M.V. Siluyanova and V.V. Kuritsyna	396
Utilization of XSYTIN-1 Tool in Electrically-Assisted Friction Stir Welding of Dissimilar Metals - Al 6061-T651 to Mild Steel D. Shaffer, T.J. Grimm, I. Ragai and J. Roth	402

Chapter 6: Analytical and Computational Modelling

Analytical Modeling and Analysis of the Matter Flow during Friction Stir Welding Z. Harchouche, M. Zemri and A. Lousdad	415
Development of a Friction Welded Joint for Future Industrial Application N. Schubert, A. Sterzig, R. Mauermann, S. Hilbers, P. Kolbe and C. Kuhn	431

Numerical Simulation of the Effect of Shoulder Rotation on the Tensile Strength of FSW Dissimilar Joints of Aluminum Alloy Riswanda, Akhyar, Sugianto, H. Kadir and S. Rizal	437
A New Thermal Model in SAE-AISI 1524 Friction Stir Welding E.A. Bonifaz	447
Analysis of Thermal Processes during Friction Stir Welding of Metals A. Maystrenko, V. Nesterenkov, V. Dutka, V. Lukash and S. Zabolotny	458
Finite Element Simulation of Temperature Field during Friction Surfacing of Al-5Mg Consumable Rod F.Y. Isupov, O. Panchenko, L. Zhabrev, I. Mushnikov, E.N. Rylkov and A.A. Popovich	470
Finite Difference Model of Temperature Fields in Linear Friction Welding A.U. Medvedev, V.R. Galimov, I.M. Gatiyatullin and O.V. Murugova	478
Heat Transfer Simulations and Analysis of Joint Cross-Sectional Microstructure on Friction Stir Welding between Steel and Aluminium T.M. Nhat, T.Q. Thanh, T.V. Thong, T.T. Quyet and L.P. Minh	484
Preliminary Studies on Molecular Dynamics Simulation of Friction Stir Processing of Aluminium Alloys O. Kayode, O.A. Olufayo and E.T. Akinlabi	495