

# **S.A. ENGINEERING COLLEGE**

**(An Autonomous Institution, Affiliated to Anna University)**

**CHENNAI – 600077**



**DEPARTMENT OF MECHANICAL ENGINEERING**

## **Centre of Excellence for Smart and Advanced Materials**

**Details of  
Equipment  
Available**

# Centre of Excellence for Smart and Advanced Manufacturing

**Name of the Machine:** ECO-FRIENDLY HIGH STRENGTH FRICTION STIR WELDING

**Details on Funding Agency:** File No: 8023/RID/RPS-37/2011-2012, AICTE, (RESEARCH PROMOTION SCHEME), New Delhi

**Sanctioned Amount:** Rs.13,00,000

**Description:** Friction Stir Welding is a completely innovative solid state joining process, in which the materials get welded together by the heat due to friction accomplished by the rotating tool. During this joining methodology, the tool was made to rotate and descend into the portion of contact between the two plates. Moreover, consumables are not required, as the heat created by friction plasticizes the materials together, thereby leading to the attainment of welded joints possessing excellent finish appearance, which cannot be found in majority of the joining techniques. Our FSW Machine is a specially fabricated, semi-automatic category of machine housed with a 416 X 815 mm work table, together with a 5kW capacity motor spindle and this table had the capability to traverse in multiple directions including a 410 mm distance of travel both vertically and horizontally, a 525 mm distance of travel longitudinally

## **Photographs:**



**Research  
Scholars  
using this  
Center of  
Excellence  
(CoE)**

**No of Research Scholars completed Ph.D. Degree using this Centre of Excellence  
in Anna University:**

<b>S.No</b>	<b>Registration Number</b>	<b>Name of the Research Scholar</b>	<b>Degree</b>	<b>Branch</b>	<b>Month &amp; Year of Registration</b>	<b>Date of Completion</b>
1.	1612219103	S.D. Dhanesh Babu	Ph.D.	Mech	Jan 2016	Viva Voce Completed on 09/12/2021
2.	17142997194	C. Satheesh	Ph.D.	Mech	Jul 2017	Viva Voce Completed on 12/01/2022
3.	1614299213	B. Yokesh Kumar	Ph.D.	Mech	Jan 2016	Viva Voce Completed on 22/07/2022
4	1613299209	K. Giridharan	Ph.D.	Mech	Jan 2016	Viva Voce Completed on 02/11/2022
5	18142997208	Lokesh Kumar P J	Ph.D.	Mech	Jan 2018	Viva Voce Completed on 27/10/2023
6	19142997217	I. John Solomon	Ph.D.	Mech	Jul 2019	Viva Voce Completed on 21/02/2024
7	20152991150	J. Gunasekaran	Ph.D.	Mech	Jan 2020	Viva Voce Completed on 25/04/2024

**Funds  
received  
using this  
Center of  
Excellence  
(CoE)**

**Details of Funds Received:-**

<b>S.No</b>	<b>Title of Project</b>	<b>Duration</b>	<b>Funds Received</b>	<b>Funding Agency</b>	<b>Other Details</b>
1.	Fabrication of Dissimilar high strength AA7075 A1& AZ80A Mg alloy joints using underwater Friction Stir Welding (UFSW) technique	5 <sup>th</sup> December 2019 to 4 <sup>th</sup> December 2021 (2 Years)	<b>Rs.</b> <b>4,12,900</b>	S&T Scheme, TNSCST, DOTE Campus, Sardar Patel Road, Chennai, Tamil Nadu 600025	TNSCST/S TP/AR/2018-2019 dated 04.11.2019

**No of  
Research  
Papers  
published  
using this  
CoE**



**No of Research papers published using this CoE in SCIE Journals (past 3 years alone):**

- [1] Bindhushree, BS, **Sevvel, P**, Shanmuganatan, SP, Saravanabavan, D and Madhusudan, M. Influence of tool geometry on mechanical and microstructural characteristics of friction stir welded cast alloys, Practical Metallography, 2024, Vol. 61, No. 1, pp. 292-318 <https://doi.org/10.1515/pm-2023-1055> (**SCI Indexed Journal**)
- [2] Srinivasan D, **Sevvel P**, Dhanesh Babu SD, Vasanthe Roy, V. Optimization of parameters and formulation of numerical model employing GRA-PCA and RSM approach for friction stir welded Ti-6Al-4V alloy joints, Materials Research Express, 2024, Vol. 11, No. 5, 056511. <https://doi.org/10.1088/2053-1591/ad48e3> (**SCI Indexed Journal**)
- [3] Srinivasan D, **Sevvel P**, Gunasekaran J. Impact of process parameters on transitions in the microstructural characteristics and mechanical attributes of Ti-6Al-4V alloy joints during FSW, Practical Metallography, 2024, Vol. 61, No. 1, pp. 28-58. <https://doi.org/10.1515/pm-2023-1039> (**SCI Indexed Journal**)
- [4] John Solomon I, **Sevvel P**, Gunasekaran J and Vasanthe Roy J. Parametric based optimization of friction stir welded wrought AZ80A Mg alloy employing response surface methodology, Materials Research Express, 2023, Vol. 10, No.11, 116514 <https://doi.org/10.1088/2053-1591/ad0ac4> (**SCI Indexed Journal**)
- [5] John Solomon I, **Sevvel P**, Gunasekaran J and Rajarajan SJ, Establishment of empirical relations amidst mechanical attributes of friction stir welded distinctive alloys of Mg and optimized process parameters”, Materials Research Express, 2023, Vol. 10, No.6, 066502 <https://doi.org/10.1088/2053-1591/acd5ae> (**SCI Indexed Journal**)
- [6] Gunasekaran J, **Sevvel P**, J Vasanthe Roy, A Sivaramakrishnan, “Analysis of sensitivity and formulation of empirical relationship between parameters of FSW process and tensile strength of AZ80A Mg alloy joints”, Materials Research Express, 2023, Vol. 10, No.5, 056513 <https://doi.org/10.1088/2053-1591/acd98f>
- [7] Lokesh Kumar, PJ, Sevvel, P, Loganathan, TG, “Impact of tool rotational speed on the microstructural transitions and tensile properties of the dissimilar AZ80A-Mg - AA6061-Al joints fabricated by friction stir welding”, Praktische Metallographie/Practical Metallography, 2023, 60(5), pp. 289–318. <https://doi.org/10.1515/pm-2022-1029> (**SCI Indexed Journal**)
- [8] Yaknesh S, **Sevvel P**, Sampathkumar K, John Solomon I and Rajamurugu N, “Tilt angle impact on strength, microstructure of friction stir welded AZ91CMg plates”, Materials Science and Technology, 39(5), pp. 613–622 2023 <https://doi.org/10.1080/02670836.2022.2130525> (**SCI Indexed Journal**)
- [9] Lokesh Kumar, PJ, **Sevvel, P**, Loganathan, TG and Prakash, D 2023, ‘Investigation on the distribution and role of intermetallic aggregates in influencing the mechanical strength of the friction stir welded AZ91C Mg – AA6061 Al alloy joints’, Materials Research Express, Vol. 10, 026516. <https://doi.org/10.1088/2053-1591/acbbbb> (**SCI Indexed Journal**)

- [10] K. Giridharan, **P. Sevvel**, R. Ramadoss and B. Stalin: “Friction stir processing of nanofiller assisted AISI 1010 steel-CDA 101 copper dissimilar welds: a strength factor approach”, *Metallurgical Research & Technology*, 119, 505 (2022) <https://doi.org/10.1051/metal/2022065> (**SCI Indexed Journal**)
- [11] Yaknesh S, Sampathkumar K, **Sevvel P** and John Solomon I: “Generation of force and torque during joining of AZ91C plates by FSW under distinctive tool tilt angle and their impact on mechanical strength and micro-structure”, *Journal of Adhesion Science and Technology*, Vol. 37, Issue 6, 1071– 1090, 2022. <https://doi.org/10.1080/01694243.2022.2057763> (**SCI Indexed Journal**)
- [12] Yokesh Kumar B and **Sevvel P**: “Impact of speed of traverse during joining of CDA101 plates by FSW process”, *Scientia Iranica*, 29 (4), 1817-1827 2022 <https://doi.org/10.24200/sci.2022.58185.5612> (**SCI Indexed Journal**)
- [13] Yaknesh S, Sampathkumar K and **Sevvel P**: “Effect of Tool Pin Geometry and Process Parameters During FSW of Dissimilar Alloys of Mg”, *Materials Research–Ibero–American Journal of Materials*, Vol. 25. e20210508, 2022 <https://doi.org/10.1590/1980-5373-MR-2021-0508> (**SCI Indexed Journal**)
- [14] Giridharan K, **Sevvel P**, Stalin B, Ravichandran M & Sureshkumar P: “Microstructural Analysis and Mechanical Behaviour of Copper CDA 101/AISI-SAE 1010 Dissimilar Metal Welds Processed by Friction Stir Welding”, *Materials Research Ibero-american Journal of Materials*, 25, 2022, e20210430. <https://doi.org/10.1590/1980-5373-MR-2021-0430> (**SCI Indexed Journal**)
- [15] Giridharan, K., **Sevvel, P**, Gurijala, C, &Yokesh Kumar B: “Biochar-assisted copper-steel dissimilar friction stir welding: mechanical, fatigue, and microstructure properties”, *Biomass Conversion and Biorefinery*, Vol. 12, pp. 4021–4031, 2023. <https://doi.org/10.1007/s13399-021-01514-w>. (**SCI Indexed Journal**)
- [16] Dhanesh Babu, S.D., **Sevvel, P**, Senthil Kumar, R, Vijayan, V &Subramani, J: “Development of Thermo Mechanical Model for Prediction of Temperature Diffusion in Different FSW Tool Pin Geometries During Joining of AZ80A Mg Alloys”, *Journal of Inorganic and Organometallic Polymers and Materials*, 31 (7), 2021, 3196–3212. <https://doi.org/10.1007/s10904-021-01931-4> (**SCI Indexed Journal**)
- [17] Satheesh C, **Sevvel P** andSenthil Kumar R: “Experimental Identification of Optimized Process Parameters for FSW of AZ91C Mg Alloy Using Quadratic Regression Models”, *Strojniski Vestnik / Journal of Mechanical Engineering*, Vol. 66 (12), 2020, pp. 736 – 751. <https://doi.org/10.5545/sv-jme.2020.6929>(**SCI Indexed Journal**)
- [18] Dhanesh Babu SD, **Sevvel P** & Senthil Kumar R: “Simulation of heat transfer and analysis of impact of tool pin geometry and tool speed during friction stir welding ofAZ80A Mg alloy plates”, *Journal of Mechanical Science and Technology*, Vol. 34 (10), 2020, pp. 4239 – 4250. <https://doi.org/10.1007/s12206-020-0916-7>(**SCI Indexed Journal**)
- [19] **Sevvel P**, Dhanesh Babu SD &Senthil Kumar R: “Peak Temperature Correlation and Temperature Distribution during Joining of AZ80A Mg Alloy by FSW – A Numerical and Experimental Investigation”,

Strojnikivestnik - Journal of Mechanical Engineering, Vol. 66 (6), 2020, pp. 395-407.  
<https://doi.org/10.5545/sv-jme.2020.6566>(**SCI Indexed Journal**)

- [20] **Sevvel P**, Satheesh C &Senthil Kumar R: “Generation of regression models and multi-response optimization of friction stir welding technique parameters during the fabrication of AZ80A Mg alloy joints”, Transactions of the Canadian Society for Mechanical Engineering, Vol. 44(2), 2020, pp.311-324.  
<https://doi.org/10.1139/tcsme-2019-0162>(**SCI Indexed Journal**)
- [21] **Sevvel P**, Satheesh C &Jaiganesh V: “Influence of tool rotational speed on microstructural characteristics of dissimilar Mg alloys during friction stir welding”, Transactions of the Canadian Society for Mechanical Engineering, Vol. 43(1), 2019, pp.132-141. <https://doi.org/10.1139/tcsme-2018-0037>(**SCI Indexed Journal**)
- [22] **Sevvel, P** & Satheesh C: “Role of tool rotational speed in influencing microstructural evolution, residual-stress formation and tensile properties of friction-stir welded AZ80A Mg alloy”, Materiali In Tehnologije, Vol. 52 (5), 2018, pp.607 – 614. <https://doi.org/10.17222/MIT.2017.213> (**SCI Indexed Journal**)

### **No of Research papers published using this CoE in SCOPUS Journals (past 3 years alone):**

- [1] Srinivasan D, **Sevvel P**, John Solomon I & Tanushkumaar P: “A review on Cold Metal Transfer (CMT) technology of welding”, Materials Today Proceedings, Vol. 64, Part 1, 2022, pp. 104–115.<https://doi.org/10.1016/j.matpr.2022.04.016> (**Scopus Indexed Journal**)
- [2] Sathish T, Sevvel P, Sudharsan, P and Vijayan V: “Investigation and optimization of laser welding process parameters for AA7068 aluminium alloy butt joint”, Materials Today: Proceedings, Vol.37, Part 2, 2021,1672-1677.<https://doi.org/10.1016/j.matpr.2020.07.196>(**Scopus Indexed Journal**)
- [3] Giridharan K, **Sevvel P**, Senthilnathan K, Muthukumaran S &Padmanabhan S: “Experimental Study on Mechanical Properties of Friction Stir Welded Dissimilar Joints of Aluminium Alloys AA8011-AA6082”, International Journal of Vehicle Structures & Systems, Vol. 11 (2), 2019, pp.135 – 139.<https://doi.org/10.4273/ijvss.11.2.04>(**SCOPUS Indexed Journal**)
- [4] Sevvel P, Mahadevan S, Satheesh C, Srinivasan D &Jaiganesh, V:“Experimental Investigation on the Improvement of the Properties of the AZ80A Mg Alloy Joints Using FrictionStir Welding process”, FME Transactions, Vol. 47, No.3, 452 – 463, 2019. <https://doi.org/10.5937/fmet1903452S>(**SCOPUS Indexed Journal**)

**Details of  
Patents filed,  
published &  
Granted  
using this  
Centre of  
Excellence**

**Details of Patents filed, published & Granted using this Centre of Excellence (past 3 years alone):**

<b>S.No.</b>	<b>Application No</b>	<b>Title of the Patent</b>	<b>Status</b>
1.	335844-001	Disinfectant spraying robot	Filed on 03/12/2020 and <b>GRANTED on 05/02/2021</b>
2.	350259-001	Height adjustable Wheel Chair	Filed on 28/09/2021 & <b>GRANTED on 10/11/2021</b>
3.	201741012731	A Portable Hybrid Powered Intelligent Special Multiplex Prospect Machine	Filed on 10/04/2017 and Published on 14/12/2018
4.	201741025414	IOT based solar powered drainage channels and water bodies cleaning device	Published on 22/03/2019
5.	320629-001	Friction stir welding tool	Filed on 13/08/2019

**No of  
Workshops  
organized as  
a part of this  
Centre of  
Excellence**

**No of Workshops organized as a part of this Centre of Excellence:**

<b>S.No</b>	<b>Title of Project</b>	<b>Duration</b>	<b>Sponsoring Agency</b>	<b>Other Details</b>
1.	1 Days Online Workshop on Challenges and Opportunities in FSW of Mg alloys	13 <sup>th</sup> June 2020	S.A Engineering College	234 External Participants
2.	1 Week Online Workshop on Research Scopes in Advanced Manufacturing Processes	4 <sup>th</sup> to 9 <sup>th</sup> April 2022	S.A Engineering College	134 External Participants