

Siddaganga Institute of Technology, Tumkur 572103

An autonomous institute, Affiliated to VTU, Belagavi, Approved by AICTE, Programmes Accredited by NBA

Department of Mechanical Engineering

Name: **Dr. U.S.Mallik Designation:** Professor and

Co-Ordinator, SIT- AICTE IDEA Lab.

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Mob. No.: +91 9448166621 Address : Dr. U.S.Mallikarjun

Professor, Department of Mechanical Engineering



| Educational | Ph.D. Advanced Materials (Shape Memory Alloys), I.I.T.Madras, Chennai | | | |
|---|---|----------------------------------|--|--|
| Qualification | M.E., Dept. of Mechanical Engineering, U.V.C.E, Bangalore University | | | |
| Quanneation | B.E., in Mechanical Engineering, S.I.T., Tumkur, Bangalore University | | | |
| Experience | Teaching | 36 Years | | |
| | Shape Memory Alloys | Advanced Materials | | |
| A waas of | Smart Materials | Fatigue Failure of Materials | | |
| Areas of Research | Structure Property Correlations | Bio-Materials | | |
| Interest | Hybrid Composites | Shape Memory Polymers | | |
| Interest | Nano Materials | Corrosion of Materials | | |
| | Shape Memory Composites | Advanced Manufacturing Processes | | |
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List of Funded Projects

| Sl. No. | Title of Project | Sponsoring Organization | Amount in Lakhs | Duration | Present Status |
|------------|---|---|--------------------|----------------|-------------------|
| 1 | Corrosion Behavior of Turbine Blade Materials | GTRE, DRDO, Ministry of Defence Bangalore | 09.35 | Two Years | Completed |
| 2 | Synthesis and Characterization of Cu-Al-Mn shape memory alloys for its Damping characteristics in Superelastic range | Visvesvaraya Technological University, Belgaum | 12.00 | Two Years | Completed |
| 3 | Setting up of the state of the art material characterization lab for M.Tech(MSE) | K-FIST, Govt of Karnataka | 20.00 | Two Years | Completed |
| 4 | "High Temperature Superconducting Energy Storage technique for use in Distributed Generation System (Flywheel Energy Storage System)" | CPRI Bangalore | 09.50 | Two Years | Completed |
| 5 | Modernization and Removal of Obsolescence Scheme [MODROBS] | AICTE New Delhi | 08.00 | One Year | Completed |
| 6 | To develop the Innovative Product Solutions for common problems faced by common man. "Strengthening the R and D Centre in the Department of Mechanical Engineering" | Karnataka Council for Technological Upgradation, Govt. of Karnataka. | 76.00 | Two Years | Completed |
| 7 | Idea Development, Evaluation and Application Lab. [IDEA Lab.] | AICTE New Delhi | 109.64 | Three Years | Completed |

| Research | M.Tech | 25 | | |
|-------------------------------------|--|----------------|----------------------|----|
| Guidance | Ph.D | Awarded: 07 Pu | rrsuing: 03 | |
| | International Referee | d Journals | | 75 |
| Publications | International Conferences | | | 25 |
| | National Conferences | | 10 | |
| Professional Memberships | Life Member of Indian Society of Technical Education (M.I.S.T.E). Life Member of Indian Institute of Metals (M.I.I.M). Life Member of Institution of Smart Structures and Systems (M.I.S.S.S). Fellow of Institution of Engineers India (F.I.E). Life Member for Society for failure Analysis (M.S.F.A) | | | |
| Subjects Taught for UG and PG | 1. Computer Aided Engineering Drawing 2. Materials Science and Engineering 3. Engineering Materials 4. Metal Forming Processes 5. Advanced Engineering Materials 6. Measurements and Metrology 7. Manufacturing Process-I, II, III 8. Machine Drawing 9. Production and Operations Managements 10. Mechanical Engineering Science 11. Production Technology 12. Foundry Technology 13. Advanced Processing of Materials 14. Strength of Materials 15. Engineering Mechanics 16. Smart Materials and MEMS | | Science Materials | |

Work Experience:

| Sl. No. | Organisation | Designation | Duration | Years |
|---------|---------------|----------------------------------|---------------|---------|
| 1 | S.I.T, Tumkur | Lecturer | 1989 to 1997 | 8-Years |
| 2 | -do- | Senior Lecturer | 1997 to 2002 | 5-Years |
| 3 | -do- | Asst. Professor | 2002 to 2007 | 5-Years |
| 4 | -do- | Professor | From 2007 | Present |
| 5 | -do- | Professor and Dean (Academic) | 2007 to 2010 | 3-Years |
| 6 | -do- | Professor and Head of Department | 2010 to 2013 | 3-Years |
| 7 | -do- | Professor and Co-ordinator IQAC | 2018 to 2023 | 5-Years |
| 8 | -do- | Professor and Head of Department | 2023 to 2025 | 2-Years |
| | | | Superannuated | |
| 9 | -do- | Professor Emeritus | From 2025 | Present |

Personal Details:

Name : Dr. U.S.Mallik

Date of Birth : 01-05-1965

Religion : Hindu **Nationality** : Indian

Address

Permanent: Office:

Dr. U.S.Mallikarjun Professor and Head

"Shivakrupa" Dept. of Mechanical Engineering
II Main, II Cross Siddaganga Institute of Technology

Jayanagara East Tumkur – 572103

Tumkur-572102. Karnataka

Additional Activities:

<u>Conferences</u>, <u>Faculty Development Workshops organised and Member of other academic activities</u>:

- 1. **Organizing Committee Member** for organizing "International Symposium for Research Scholars (ISRS-2006)", December 18-20, 2006, I.I.T. Madras, Chennai.
- 2. **Organizing Committee Member** for organizing International Conference "FDM-NMD-ATM 2005", November 12-16, 2005, I.I.T. Madras, Chennai.
- 3. **Organized** AICTE sponsored staff development program on "Advanced Materials and Materials Processing" at SIT, Tumkur, Karnataka during 8th to 13th June, 2009.
- 4. **Organized** VTU, Belgaum sponsored staff development program on "Materials and Processing" at SIT, Tumkur, Karnataka during 14th to 18th Dec, 2009.
- Convener for International Conference on "Advanced Materials,
 Manufacturing, Management and Thermal Sciences [AMMMT-2010]"
 organized at SIT, Tumkur, Karnataka during 18th and 19th Nov 2010.
- 6. **Organized** AICTE sponsored staff development program on "The World Today and Tomorrow-The Energy Challenge" at SIT, Tumkur, Karnataka during 20th June to 2nd July, 2011.
- Chairman, Organizing Committee for International Conference on "Advanced Materials, Manufacturing, Management and Thermal Sciences [AMMMT-2013]" organized at SIT, Tumkur, Karnataka during 3rd and 4th May 2013.
- 8. **Convener**, Organizing Committee for International Conference on "**Advanced Materials**, **Manufacturing**, **Management and Thermal Sciences [AMMMT-2016]**" organized at SIT, Tumkur, Karnataka during 23rd and 24th Sep 2016.
- 9. **Elsevier Publications** has awarded as **Recognized Reviewer Status** on 27th Sep 2016.
- 10. **Guest Editor** for Materials Today, Elsevier Publications and International Journal of Business and Systems Research (IJBSR), Inderscience Publications.
- 11. National Board of Accreditation Expert Committee Member.
- 12. **BOS and BOE member** for UVCE, Bangalore University, BMSCE, Bangalore, MCE, Hassan, SIT, Tumkur, BOS VTU nominee for Dr. AIT, Bangalore and BoS member, GCE, Krishnagiri, Tamilnadu.
- 13. **Governing Council member** of GMIT, Davanagere and SIET, Tumkur for two years.
- 14. Member of LIC Committee, VTU Belgaum.
- 15. **Honorary Secretary**, Institution of Engineers (India), Tumkur Local Center,
- 16. **Co-ordinator, SIT-AICTE IDEA Lab,** organised various FDPs in Advanced Manufacturing related topics.
- 17. Chaired many sessions in International Conferences and delivered invited lectures.
- 18. Delivered Invited Lecture on NBA accreditation and carried out mock NBA accreditation audit in few institutions.
- 19. Member of Academic Council, Institute Research Committee, Industry-Institute-Interaction Committee etc.

Research Papers published in international refereed journals:

| Sl.No. | Particulars of the Paper and Journal | National/ |
|--------|--|---------------|
| | | International |
| 1. | "Influence of aluminum and manganese concentration on the shape memory characteristics of Cu-Al-Mn shape memory alloys", U.S.Mallik and V.Sampath, Journal of Alloys and Compounds, Volume 459, Issue 1-2, 14 July 2008, Pages 142-147. | International |
| 2. | "Effect of composition and ageing on damping characteristics of Cu-Al-Mn shape memory alloys", U.S.Mallik and V.Sampath, Materials Science and Engineering: A, Volume 478, Issues 1-2, 15 April 2008, Pages 48-55 | International |
| 3. | "Effect of Alloying on Microstructure and Shape Memory Characteristics of Cu-Al-Mn Shape Memory Alloys", U.S.Mallik and V.Sampath, Materials Science and Engineering A, Vol. 481-482, 25 May 2008, pp 680-683. | International |
| 4. | "Influence of Quaternary Alloying additions on Transformation Temperatures and Shape Memory Properties of Cu-Al-Mn Shape Memory Alloy", U.S.Mallik and V.Sampath, Journal of Alloys and Compounds, Volume 469, Issues 1-2, 5 February 2009, Pages 156-163. | International |
| 5. | "Evaluation of grain refinement and variation in mechanical properties of equal- channel angular pressed 2014 aluminum alloy", C. Mallikarjuna, S.M. Shashidhara, U.S. Mallik, .Materials & Design, <i>Volume 30</i> , Issue 5, May 2009, Pages 1638-1642. | International |
| 6. | "Effect of Small Additions of Boron on Shape Memory Properties and Grain Refinement of Cu-Al-Mn SMAs", Sampath.V and Mallik U S , TMS Annual Meeting, Vol. 3, Year 2009, 181-188. | International |
| 7. | "Grain refinement and wear properties evaluation of aluminum alloy 2014 matrix- TiB ₂ in-situ composites", C. Mallikarjuna, S.M. Shashidhara, U.S. Mallik , K.I.Parashivamurthy, Materials & Design, Volume 32, Issue 6, June 2011, Pages 3554-3559 | International |
| 8. | "CFD Analysis for design optimization of reverse flow type cyclone separator", International Journal of Mechanical and Production Engineering Research and Development (IJMPERD), K.V.Sreenivasa Rao, R.Suresh and U.S.Mallikarjun Vol.1, Issue 2, Dec 2011, 111-124. | International |
| 9. | "An investigation into use of Sodium Chloride crystals as an electrolytic medium in a Dye sensitized Solar Cell", International Journal of Emerging Technology and Advanced Engineering (IJETAE), Anupama .R.Hiremath and U.S.Mallikarjun , Vol. 2, Issue 6, June 2012. | International |
| 10. | "An experimentation into the utilization of different materials for the purpose of dye absorption in a dye sensitized solar cells", International Journal of Emerging Technology and Advanced Engineering (IJETAE), Anupama .R.Hiremath and U.S.Mallikarjun , Vol. 2, Issue 6, June 2012. | International |
| 11. | "Corrosion behavior of Cu-Zn-Ni Shape Memory Alloys", Journal of Minerals and Materials Characterization and Engineering", S.Satish and Dr. U S Mallik , 2013,1,49-54. | International |
| 12. | "Characterization of Cu-Al-Be Shape Memory Alloys", IOSR Journal of Mechanical and Civil Engineering, S. Prashant & Dr. U S Mallikarjun ISSN: 2278-1684, PP.01-06,Feb 2013. | International |
| 13. | Synthesis of Cu-Al-Be Shape Memory Alloys", BONFRING JOURNAL, S.Prashant & Dr. U S Mallikarjun ISBN 978-93-82338-03-1 Pg.No 01-05, July2012. | International |
| 14. | "Validation of NiTinol SMA Characteristics using Finite Element Analysis and Closed Form Solutions", Adarsh.S.H & Dr. U.S.Mallikarjun , Journal of Advanced Materials Research, Vol.856 (2014) pp 147-152, Online available since 2013/Dec/06 at www.scientific.net,© (2014) Trans Tech Publications, Switzerland doi:10.4028/www.scientific.net/AMR.856.147. | International |
| 15. | "Corrosion Behavior of Cu-Zn-Ni Shape Memory Alloys" S.Satish and Dr. U S Mallik , Journal of Minerals and Materials Characterization and Engineering, 2013, 1, 49-54, published online in Sci Res, http://www.scirp.org/journal/jmmce | International |
| 16. | "Microstructure and Shape Memory Effect of Cu-Zn-Ni Shape Memory Alloys", Journal of Minerals and Materials Characterization and Engineering, S.Satish and Dr. U S Mallik , 2014, 2,71-77, published online March 2014 in Sci Res, | International |

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| 17. | "Effect of Ageing on Shape Memory Effect and Transformation Temperature in Cu- | International |
| • | Al-Be Shape Memory Alloy", S.Prashanth, U.S.Mallik , Journal of Procedia | |
| | Materials Science 5 (2014) 567 – 574, Elsevier Publications. | |
| 18. | "Preparation and Characterization of Cu-Al-Be Shape Memory Alloys with Cr as | International |
| 10. | | International |
| | grain refining additive", S.Prashanth, U.S.Mallik , Journal of Applied Mechanics | |
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| 19. | "Effect of variation in Applied Force on Transformation Temperatures of NiTinol | International |
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| 20. | "Synthesis of Cu-Al-Be-Mn Shape Memory Alloys", A.G.Shivasiddaramaiah and | International |
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| 22. | "Microstructure and Shape Memory Effect of Cu-Al-Be-Mn Quaternary Shape | International |
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| | Publications, Sdoi: 10.4028/www.scientific.net/AMM.813-814.23, Switzerland | |
| 23. | "Synthesis and Characterization of Cu-Al-Be-Mn Quaternary Shape | International |
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| | Memory Alloys Prepared by Induction Melting Technique", | |
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| 24. | "SYNTHESIS AND EVALUATION OF MECHANICAL PROPERTIES OF Cu-Al-Be- | International |
| | Mn QUATERNARY SHAPE MEMORY ALLOYS", Shivasiddaramaiah.A.G, | |
| | Manjunath.S.Y, Prashant Singh, U.S.Mallikarjun, International Journal of Applied | |
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| 25 | "Study on Corrosion Behaviour of Cu-Al-Be-Mn Quaternary Shape Memory Alloy At | International |
| 25. | | International |
| | Room Temperature", Shivasiddaramaiah.A.G, Ravi Das B.R.D, Prashant Singh, | |
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| 26. | "Determination of transformation temperatures of SMAs by varying the force using | International |
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| 27. | "Mechanical and Morphological Studies of Al6061- Gr- SiC Hybrid Metal | International |
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| 28. | "Variation in Transformation Temperature and Shape Memory Effect in | International |
| | Cu-Al-Be Shape Memory Alloys with the Effect of Quaternary Elements", | |
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| 30. | "Experimental Investigation on Fracture Toughness of Cu-Al-Be Shape | International |
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| 31. | "Mechanical and Morphological Studies of Al6o61- Gr- SiC Hybrid Metal Matrix Composites", Lokesh T, U. S. Mallikarjun, Applied Mechanics and Materials Vols. 813-814 (2015) pp 195-202, © (2015) Trans Tech Publications, Switzerland, doi:10.4028/www.scientific.net/AMM.813-814.195. | International |
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| 32. | "Synthesis and evaluation of ageing effect on Cu—Al—Be—Mn | International |
| 32. | quaternary Shape MemoryAlloys" , A.G. Shivasiddaramiah, U.S. Mallik , S. Devaraju, S. Prashantha, <i>Department of Mechanical Engineering, Siddaganga Institute of Technology, Tumakuru 572-103, Karnataka,India</i> , Perspectives in Science (2016) 8 , 113—116,Elsevier Publications. | momuni |
| 33. | "Evaluation of shape memory effect anddamping characteristics of Cu— | International |
| | Al—Be—Mnshape memory alloys" , A.G. Shivasiddaramaiah, U.S. Mallik , L. Shivaramu,S. Prashantha, <i>Department of Mechanical Engineering, Siddaganga Institute of Technology, Tumakuru 572-103, Karnataka,India</i> , Perspectives in Science (2016) 8 , 244—246, Elsevier Publications. | |
| 34. | "Effect of Equal Channel Angular Pressing on the Microstructure and | International |
| | Mechanical Properties of Al6061-SiCp Composites", T Lokesh and U S Mallik, Materials Science and Engineering, 149 (2016) 012119 doi:10.1088/1757-899X/149/1/012119, IOP Publications. | |
| 35. | "Effect of Equal Channel Angular Pressing on the Microstructure and Mechanical Properties of Hybrid Metal Matrix Composites", T. Lokesh and U. S. Mallik, Indian Journal of Science and Technology, Vol 9(35), DOI: 10.17485/ijst/2016/v9i35/88443, September 2016. | International |
| 36. | "Shape Memory Polymers Synthesised For Controllable Switching Temperatures", Ranganatha Swamy MK, U S Mallikarjun, V Udayakumar, Materials Today: Proceedings 4 (2017) 4 (2017) 11148–11153. | International |
| 37. | "Effect Of Ageing On Damping Characteristics Of Cu-Al-Be-Mn | International |
| 3/. | Quaternary Shape Memory Alloys", Shivaramu L, A.G Shivasiddaramaiah, U.S Mallik, Prashantha S, Materials Today: Proceedings 4 (2017) 11314–11317. | |
| 38. | "Damping Characteristics of Cu-Al-Be-Mn Quaternary Shape Memory Alloys", A.G Shivasiddaramaiah., U.S.Mallikarjun, Shivaramu L, Prashantha S, Materials Today: Proceedings 4 (2017) 8948–8953. | International |
| 39. | "EVALUATION OF CORROSION BEHAVIOUR OF Cu-Al-Be-Mn QUATERNARY SHAPE MEMORY ALLOYS", A.G Shivasiddaramiah, U.S Mallik, Ranjit Mahato, C. Shashishekar, Materials Today: Proceedings 4 (2017) 10971–10977. | International |
| 40. | "Wear Behaviour of Cu-Al-Be-Mn Shape Memory Alloys by Using Taguchi Technique", A.G Shivasiddaramiah, U.S Mallik, Krishnakanth C, Prashanth S, Materials Today: Proceedings 4 (2017) 11168–11174. | International |
| 41. | "A Study on Machining Characteristics of Al6061-Sic Metal Matrix | International |
| | Composite through Wire – Cut Electro Discharge Machining", Prashantha S, Veeresha R B, S M Shashidhara, Mallikarjun.U.S , Shivasiddaramaiah.A.G, Materials Today: Proceedings 4 (2017) 10779–10785. | |
| 42. | "Evaluation of Shape memory effect and Pseudo elastic effect of Cu-Al-Be-Mn Quaternary shape memory alloys", A.G Shivasiddaramaiah, U.S Mallik, Jayanth V,Prashanth S, Materials Today: Proceedings 4 (2017) 10109–10112. | International |
| 43. | "Evaluation of Shape Memory Effect and Wear Characteristics of Cu-Al-Be-Mn Quaternary Shape Memory Alloys", A.G Shivasiddaramaiah, U.S Mallik, Krishnakanth C, Prashantha S, Materials Today: Proceedings 4 (2017) 10099–10103. | International |
| 44. | "Evaluation of Shape Memory Effect and Wear Properties of Cu-Al-Be Shape Memory Alloys", S. Prashantha, S. M. Shashidhara, U. S. Mallikarjun, Shivasiddaramaiah.A.G, Materials Today: Proceedings 4 (2017) 10123–10127. | International |
| 45. | "Dry sliding wear behavior of Al/Gr/SiC hybrid metal matrix composites by Taguchi techniques", Lokesh T, U. S. Mallik, Materials Today: Proceedings 4 (2017) 11175–11180. | International |
| 46. | "Effect of ECAP Process on the Microstructure and Mechanical Properties of Al6o61-Gr Composite", T.Lokesh and U S Mallik, Materials Today Proceedings, Vol 5, Issue 1, Part 3, 2018, pp 2453 – 2461. | International |
| | | |

| 47. | "Preparation and Evaluation of ageing effect of Cu-Al-Be-Mn Shape Memory Alloys", A.G.Shivasiddaramaiah, U.S.Mallikarjun, Ranjit Mahato and C Shashishekar, AIP Conference Proceedings 1943, 020081 (2018); https://doi.org/10.1063/1.5029657 | International |
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| 48. | "Evaluation of Bio Compatibility of Cu-Al-Be-Mn Quaternary Shape Memory Alloy", A.G.Shivasiddaramaiah, U.S.Mallikarjun, N.Praveen, S.Prashantha, C.Anupama, Materials Today: Proceedings, Volume 5, Issue 11, Part 3, 2018, Pages 24799-24808. | International |
| 49. | "Synthesis and Evaluation of Fracture Behavior of Cu-Al-Be-Mn Quaternary SMA", A.G.Shivasiddaramaiah, U.S.Mallikarjun, Jeevan, S.Prashantha, Materials Today: Proceedings, Volume 5, Issue 11, Part 3, 2018, Pages | International |
| 50. | 24457-24465. "Corrosion Behavior of Cu-Al-Be Based Shape memory Alloy with and | International |
| _ | without coating", Prashanth S, Shivasiddaramaiah. A.G, U S Mallikarjun, Materials Today: Proceedings, Volume17, part 1, 2019, Pages 147-154, https://doi.org/10.1016/j.matpr.2019.06.412 | |
| 51. | "Synthesis and Characterization of Shape Memory Polymers" , M K Ranganatha Swamy, U S Mallikarjun , V Udayakumar, IOP Conference Series: Materials Science and Engineering, 577 (2019)012095 | International |
| 52. | "Evaluation of Biocompatibility of Cu-Al-Be-Mn Quaternary Shape Memory Alloys Using Antibacterial Test by AGARWELL Diffusion Method", A.G.Shivasiddaramaiah, U. S. Mallik, Ranjith Mahato, C.Shashishekar, Shivaramu L and Prashantha S, Materials Today: Proceedings, Volume 17, 2019, Pages 61-69. https://doi.org/10.1016/j.matpr.2019.06.401, ISSN: 2214-7853 | International |
| 53. | "Synthesis and Evaluation of Biocompatibility of Cu-Al-Mn Shape Memory Alloy", Arunabha Majumder, Vybhavi Shivakumar, A.G. Shivasiddaramaiah, C. Shashishekar, U.S. Mallikarjuna, K.B. Roopa, Materials Science Forum, ISSN: 1662-9752, Vol. 969, pp 380-385, © 2019 Trans Tech Publications Ltd, SwitzerlandOnline: 2019-08-30, https://doi.org/10.4028/www.scientific.net/MSF.969.380, ISSN: 1662-9752 | International |
| 54. | "Synthesis and evaluation of shape memory effect of Cu-Al-Ni shape memory alloys", AIP Conference Proceedings 2274, 030017 (2020); https://doi.org/10.1063/5.0022458, N. Lokesh, U. S. Mallikarjun and A. G. Shivasiddaramaiah, Volume 2274, Issue 1 > 10.1063/5.0022458 | International |
| 55. | "Synthesis and evaluation of machining characteristics of Cu-Al-Mn ternary shape memory alloys using CNC wire electric discharge machining", N. Praveen, U. S. Mallik, L. Shivaramu, A. G. Shivasiddaramaiah, R. Suresh, and S. Prashantha, AIP Conference Proceedings, Volume 2247, Issue 1, 10.1063/5.0003846, https://doi.org/10.1063/5.0003846, Published Online: 16 July 2020 | International |
| 56. | "Effect of PP and PP/MWCNT-COOH nano-composites on mechanical properties", C. Poornima, C. E. Pavan Sheshadri, and U. S. Mallik, AIP Conference Proceedings 2204, 040018 (2020); https://doi.org/10.1063/1.5141591, Published Online: 10 January 2020 | International |
| 57. | "A study on material removal rate of Cu-Al-Mn shape memory alloys in WEDM", N.Praveen, U.S.Mallik, A.G.Shivasiddaramaiah, G.N.Narendra Reddy, Materials Today: Proceedings, Volume 46, Part 7, 2021, Pages 2770-2774, June 2021, https://doi.org/10.1016/j.matpr.2021.02.555. | International |
| 58. | "Evaluation of wear characteristics of PP/MWCNT nanocomposites" C.Poornima, U.S.Mallik, A.G.Shivasiddaramaiah, N.Pushpalakshmi, B.S.Puneeth, Materials Today: Proceedings, Volume 46, Part7, 2021, Pages 2477-2482, https://doi.org/10.1016/j.matpr.2021.01.404 | International |
| 59. | "Synthesis and characterzation of graphite based shape memory polymers", MK Ranganatha Swamy, U S Mallik and V Udayakumar Published by IOP Publishing Ltd, IOP Conference Series: Materials Science and Engineering, Volume 1091, 3rd International Conference on Inventive Research in Material Science and Technology (ICIRMCT 2021) 22nd-23rd January 2021, Coimbatore, India, Citation MK Ranganatha Swamy et al 2021 IOP Conf. Ser.: | International |

| | Mater. Sci. Eng. 1091 012073 | |
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