

# AJAY KUMAR CV

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**Name:** Dr. Ajay Kumar

**Designation:** Assistant Professor

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## About:

Ajay Kumar is the Assistant Professor of Mechanical Engineering at Indian Institute of Technology (IIT) Tirupati. Prior to joining IIT Tirupati 2019, he was a postdoctoral fellow at Washington State University (WSU) Pullman, USA and University of Wisconsin Milwaukee (UWM) USA.

Dr. Ajay Kumar's research interests encompass materials design, mechanical behavior of advanced materials at bulk and small length scales, including composite materials, Pb-free solder alloys, composite foams, shape memory materials, and metallic coatings. He also works in the area of Tribology and addresses problems related to friction, wear and lubrication of materials. He has published several papers in peer reviewed journals and book chapters. He has one patent on Polymer Derived Metal Matrix Composites using Friction Stir Processing.

His group is engaged in various aspects of materials processing, properties and characterization. Research programs in his group aim at constructing a quantitative and predictive understanding of the phenomena underlying the materials development for industrial applications. His group employs a variety of experimental and computational tools to establish process-structure-property relationships in materials.

## Education:

- Ph.D., Department of Mechanical Engineering, Indian Institute of Science (IISc), Bangalore India
- M.Tech, Department of Mechanical Engineering, Maulana Azad National Institute of Technology (MANIT), Bhopal (MP) India
- Bachelor of Engineering (Mechanical Engineering), Department of Mechanical Engineering, Madhav Institute of Technology and Science (MITS), Gwalior (MP) India

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## **Experience:**

- Research Associate, Department of Mechanical Engineering, Indian Institute of Science (IISc), Bangalore India (July 2015- March 2016).
- Post-doctoral Research Associate, School of Mechanical and Materials Engineering, Washington State University (WSU) USA (March, 2016 - March, 2017).
- Post-doctoral Research Associate, Department of Material Science Engineering, University of Wisconsin Milwaukee (UWM), USA (April 2017-November 2019).
- Assistant Professor, Department of Mechanical Engineering, Indian Institute of Technology (IIT), Tirupati A.P. India (December 2019-Present).

**Teaching:** Manufacturing Technology (ME2280); Manufacturing System (ME3214); Design for Manufacturing and Assembly (ME5103), Tribology and Surface Engineering (ME5033), Advanced Solidification Processes, Machine Design

## **Research Interests:**

1. Advanced Materials Manufacturing Processes, Joining, Development and Characterization
  - Friction Stir Welding and Processing, Friction Stir Compaction
2. Light Weight Metals, Nano-Composites, Syntactic composite foams, self-healing, self-lubricating and self-cleaning materials, Shape memory materials, High entropy materials, High temperature structure materials
3. Mechanics and materials related reliability issues in microelectronics packages
4. Predictive analysis in manufacturing
5. Additive Manufacturing
6. Tribology

## **Administration:**

- ♦ Cultural Advisor, IIT Tirupati (2020-Present)
- ♦ Coordinator, Fitness Club FIT India, IIT Tirupati (2020-Present)

## Publications:

## Patent:

1. Ajay Kumar, Satish V Kailas, and Rishi Raj, "METHOD OF PREPARING IN-SITU POLYMER DERIVED CERAMIC REINFORCED METAL MATRIX COMPOSITES BY FRICTION STIR PROCESSING" (Application No-4555/CHE/2014) (Patent Number-358638 Granted on 15/02/2021) (Publication Number 27/2016) (Publication date- 2016/07/01).

## Book Chapters:

- B1. Fundamentals of Solid Lubricants, **Ajay Kumar P.**, Vishnu Namboodiri.V, Emad Omrani, Pradeep L. Menezes, Pradeep Rohatgi. Springer 2017. Self-Lubricating Composites. Online ISBN 978-3-662-56527-8; Printed ISBN 978-3-662-56528-5 (eBook)  
[https://doi.org/10.1007/978-3-662-56528-5\\_1](https://doi.org/10.1007/978-3-662-56528-5_1)
- B2. Self-Lubricating Polymer Composites, **Ajay Kumar P.**, Vishnu Namboodiri.V, Emad Omrani, Pradeep L. Menezes, Pradeep Rohatgi. Springer 2017. Self-Lubricating Composites. Online ISBN 978-3-662-56527-8; Printed ISBN 978-3-662-56528-5 (eBook)  
[https://doi.org/10.1007/978-3-662-56528-5\\_3](https://doi.org/10.1007/978-3-662-56528-5_3)
- B3. Application of Metallic Foam in Solar Power System, **Ajay Kumar P.**, Vishnu Namboodiri.VCRC Press, Taylor & Francis Group, USA 2021.

## Journal Papers:

1. Kaustubh Rane; Michael Beining; Swaroop Behera; Amir Kordijazi; **Ajay Kumar**; Pradeep Rohatgi, **Sand casting of surface-alloyed Butterfly Valve with improved hardness and corrosion resistance by incorporating metal powders in-mold coatings**, International Journal of Metal casting 2021.
2. **Ajay Kumar**, Vishnu Namboodiri, Gaurang Joshi, and Kush P. Mehta. "Fabrication and applications of fullerene-based metal nanocomposites: A review" Journal of Materials Research (2021): 1-15.
3. **Ajay Kumar P.**, Pradeep Rohatgi, David Weiss, T D P Rajan, B.C. Pai, D.P. Mondal, S. Das, **Cast metal matrix composites over last 50 years and future opportunities in India**, Indian Foundry Journal, Vol 66, 10, 2020, page 17-27.
4. Prabu, SS Mani, Chandra S. Perugu, Ashutosh Jangde, H. C. Madhu, M. Manikandan, Manoj D. Joshi, Santosh S. Hosmani, **Ajay Kumar P.**, Satish V. Kailas, and I. A. Palani. "Investigations on the influence of surface mechanical attrition treatment on the corrosion behaviour of friction stir welded NiTi shape memory alloy." Surface and Coatings Technology 402 (2020): 126495.
5. Pradeep K. Rohatgi, **Ajay Kumar P.**, Nagaraj M. Chelliah, T.P.D. Rajan, **Solidification Processing of Cast Metal Matrix Composites Over Last 50 Years and Future Opportunities**, JOM, The Journal of The Minerals, Metals & Materials Society (TMS) 2020.
6. Meysam Tabandeh-Khorshid, **Ajay Kumar P.**, Emad Omrani, Pradeep Rohatgi, Changsoo Kim,

- Synthesis, Characterization, and Properties of Graphene Reinforced Metal-Matrix Nanocomposites**, Composites Part B: Engineering (2019): 107664.
7. Yeasir Arafat, Bibekananda Datta, Ajay Kumar P., Hanry Yang, Indranath Dutta, **A Model for Intermetallic Growth Kinetics in Thin Sn Joints between Cu Substrates: Application to Solder Microbumps**, Journal of Electronic Materials (2020): 1-16.
  8. Swaroop K Behera, Ajay Kumar P., Neil Dogra, Michael Nosonovsky, Pradeep Rohatgi, **Effect of microstructure on contact angle and corrosion of ductile iron: Iron-Graphite Composite**, Langmuir 35, no. 49 (2019): 16120-16129.
  9. S. S. Mani Prabhu, Chandra S Perugu, Madhu H. C., Ashutosh Jangde, Soheli Khan, Jayachandran S, Manikandan M, Ajay Kumar P., Satish V Kailas, Palani I.A, **Exploring the Functional and Corrosion Behavior of Friction Stir Welded NiTi Shape Memory Alloy**, Journal of Manufacturing Processes Volume 47, November 2019, Pages 119-128.
  10. Ajay Kumar P., Madhu H C, Abhishek Pariyar, Chandra S. Perugu., Satish V. Kailas, Uma Garg, Pradeep Rohatgi, **Friction stir processing of squeeze cast A356 with surface compacted graphene nanoplatelets (GNPs) for the synthesis of metal matrix composites**, Materials Science and Engineering: A 769 (2020): 138517.
  11. Ajay Kumar P., Pradeep Rohatgi, David Weiss, **50 Years of Foundry Produced Metal Matrix Composites, and Future Opportunities**, International Journal of Metalcasting (2019): 1-27.
  12. Pradeep Rohatgi, David Weiss, Ajay Kumar P., **50 Years of Foundry Produced Metal Matrix Composites, and Future Opportunities**; American Foundry Society Modern Casting 2019.
  13. Mani Prabhu S.S, Madhu H C, Chandra S Perugu, Akash K, Ajay Kumar P., Satish V Kailas, Anbarasu Manivannan, Palani I A, **Shape memory effect, temperature distribution and mechanical properties of friction stir welded nitinol**, Journal of Alloys and Compounds 2018 (Impact Factor- 3.779)
  14. Liwen Pan, Yi Yang, Muhammad U Ahsan, Dung D Luong, Ajay Kumar P., Pradeep K Rohatgi, Nikhil Gupta, Zn-Matrix Syntactic Foams: **Effect of Heat Treatment on Microstructure and Compressive Properties**, Materials Science & Engineering A 731 (2018) 413–422. (Impact Factor- 3.414).
  15. Ajay Kumar P., I Dutta, **Effect of intermetallic content on shear deformation properties of thin Sn-3.0Ag-0.5Cu solder micro-joints between copper substrates**, Journal of Electronic Materials 2018, 47: 5488. (Impact Factor- 1.579)
  16. Vishnu Namboodiri V., Anirudhan Pottirayil, Ajay Kumar P., Satish V. Kailas, **Wear behavior of friction stir processed NAB alloys in marine environment**, Tribology Online, Japanese Society of Tribologists, 2018 Volume 13 Issue 3 Pages 75-80. (Impact Factor- 2.259)
  17. Ajay Kumar P., Perugu C.S. (2018) **Synthesis of FeCrVNbMn High Entropy Alloy by Mechanical Alloying and Study of their Microstructure and Mechanical Properties**. In: & Materials Society T. (eds) TMS 2018 147th Annual Meeting & Exhibition Supplemental Proceedings. TMS 2018 pp 669-675. The Minerals, Metals & Materials Series. Springer, Cham.
  18. Madhu H C, Ajay Kumar P., Chandra S Perugu, Satish V. Kailas, **Microstructural and Mechanical Behaviour of an In-Situ Reactive Al-TiO<sub>2</sub> Composite by FSP**, ASM International, Journal of Materials Engineering and Performance (2018), 27: 1318. (Impact Factor- 1.340)

19. **Ajay Kumar P.**, Satish V. Kailas, **Evolution of In-Situ Nano-Pores During Friction Stir Processing of Polymer Derived Ceramic Reinforced Metal Matrix Composites**, Research and Reports on Metals, Issue 4, Vol 1, 2018.
20. Mani Prabhu S.S, Madhu H C, Chandra S Perugu, Akash K, **Ajay Kumar P.**, Satish V Kailas, AnbarasuManivannan, Palani I A, **Microstructure, mechanical properties and shape memory behaviour of friction stir welded nitinol**, Materials Science and Engineering: A, 2017; 693: 233–236. (Impact Factor- 3.414)
21. **Ajay Kumar P.**, Devinder Yadav, Chandra S. Perugu., Satish V. Kailas, **Influence of particulate reinforcement on microstructure evolution and tensile properties of in situ polymer derived MMC by friction stir processing**, Materials and Design 2017; 113: 99–108 (Impact Factor- 4.525).
22. **Ajay Kumar P.**, Rishi Raj and Satish V. Kailas, **A novel in-situ polymer derived nano ceramic MMC by friction stir processing**, Materials and Design 2015; 85: 626-634. (Impact Factor- 4.525).
23. **Ajay Kumar P.**, Satish Kailas, **Tribological Performance of a Copper Based Composite Produced by Friction Stir Processing**. Technology Letters CP0001 2014; 371 p.

### Conference Paper:

1. Ajay Kumar P., Swaroop K. Behera, Amir Kordijazi, Uma Garg, David Weiss, Pradeep K. Rohatgi, Predictive analysis of tribological behaviour of nickel-coated graphite (NiGr) reinforced aluminum A206 metal matrix composites produced by stir casting, WTC 2021
2. Kaustubh Rane, Michael Beining, Ajay Kumar P., Amir Kordijazi, Pradeep Rohatgi, Sand casting of surface-alloyed Butterfly Valve with improved hardness and corrosion resistance by incorporating metal powders in-mold coatings, AFS Metal Casting Congress AFS Transactions 2021.
3. Ajay Kumar; Madhu H C; Abhishek Pariyar; Laszlo S Toth; Satish Vasu Kailas, The Quest for High-Strength, High-Ductility Materials, THERMEC'2020 - International Conference on PROCESSING & MANUFACTURING OF ADVANCED MATERIALS: Processing, Fabrication, Properties, Applications: May 31st - June 5th, 2020 in Vienna, Austria THERMEC'2020.
4. Mani Prabu S. S., Madhu H C, Chandra S. Perugu, Ajay Kumar P, Satish V. Kailas, Palani I A, Friction Stir Welding of NiTi Shape Memory Alloy and Realization of Actuation Behaviour, 16th International Conference on Martensitic Transformation (ICOMAT), Jeju, Korea, July 5-10, 2020.
5. Ajay Kumar P, Satish Kailas, Friction Stir Processing of Polymer Derived Nano Ceramics Metal Matrix Composites, 13<sup>th</sup> International Symposium on Friction Stir Welding and 3<sup>rd</sup> International Joint Symposium on Joining and Welding, Kyoto International Conference Centre, Kyoto, Japan on 26 - 28 May 2020.
6. S.S. Mani Prabu, H.C. Madhu, Chandra S. Perugu, K. Akash, Ajay Kumar P., Satish V. Kailas, Manivannan Anbarasu, I.A. Palani, Microstructure, mechanical and shape memory behaviour of

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- friction stir welded shape memory alloy, 5th International Congress 6<sup>th</sup> – 8<sup>th</sup> February 2020 Weld India Mumbai.
7. Vishnu Namboodiri V., Anirudhan Pottirayil, Ajay Kumar P., Satish V. Kailas, A case study showing particulate addition may not be effective for a functional performance like wear resistance, National Conference on Nanomaterials for Energy, Environment and Health care (NEEHCON'19) Dec-27 and 28, 2019 School of Materials Science and Engineering, NIT Calicut.
  8. Ajay Kumar, Pradeep K. Rohatgi, Friction stir processing of squeeze cast A356 with surface compacted graphene nanoplatelets (GNPs) for the synthesis of metal matrix composites, NMD 14-15 November 2019 Thiruvananthapuram Kerala India.
  9. Pradeep Rohatgi, Ajay Kumar, T.P.D. Rajan, B.C. Pai, Cast metal matrix composites over last 50 years and future opportunities in India, NMD 14-15 November 2019 Thiruvananthapuram Kerala India.
  10. Ajay Kumar, Nikhil Gupta, Metal matrix syntactic foams for military submarine applications, International Conference on Advanced Materials and Processes for Defence Application, 23-25 September 2019.
  11. S.S. Mani Prabu, H.C. Madhu, Chandra S. Perugu, K. Akash, Ajay Kumar, Satish V. Kailas, Manivannan Anbarasu, I.A. Palani, Realization of Friction Stir Welding of NiTi Shape Memory Alloy towards Functional Applications, at Shape Memory and Superelastic Technology Conference and Exposition (SMST), (May 13-17, 2019) at The Bodenseeforum in Konstanz, Germany.
  12. Ajay Kumar P., Gajendra Dixit, Aruna Patel, Satyabrata Das, Rolling behaviour of aluminum alloy 2014-10wt% SiCp composites, MS&T 2018 October 14-18, 2018 Columbus, Ohio USA.DOI 10.7449/2018/MST\_2018\_1296\_1303
  13. Ajay Kumar P., Chandrasekhar P, Synthesis of FeCrVNbMn high entropy alloy by mechanical alloying and study of their microstructure and mechanical properties, In: & Materials Society T. (eds) TMS 2018 147th Annual Meeting & Exhibition Supplemental Proceedings. TMS 2018 pp 669-675. The Minerals, Metals & Materials Series. Springer, Cham.
  14. Meysam Khorshid, Ajay Kumar P., Emad Omrani, Pradeep Rohatgi, Synthesis, Characterization, and Properties of Graphene Reinforced Metal-Matrix Nano Composites using Powder Metallurgy, TMS 2018 March 11-15, 2018 Phoenix, Arizona.
  15. S.S. Mani Prabu, H.C. Madhu, Chandra S. Perugu, K. Akash, Ajay Kumar, Satish V. Kailas, Manivannan Anbarasu, I.A. Palani, Friction Stir Welding of Nitinol: Microstructure, Mechanical and Shape Memory Properties, International Conference on Advanced Materials and processes (ADMAT) 14-16 December 2017 ISRO Thiruvananthapuram, Kerala, India. (ADMAT)

16. Ajay Kumar P., Vishnu Namboodiri V, Anirudhan Pottirayil, Satish V. Kailas, Wear behaviour of friction stir processed NAB alloys in marine environment, WTC2017, 17-22 Sept 2017 Beijing China. (Presented)
17. Ajay Kumar P., Chandrasekhar P, Synthesis of AlTiCuCoZnMn high entropy alloy by mechanical alloying and their microstructure, mechanical behaviour, ICAPIE 2016 DTU Delhi, 9-10 Dec 2016. (Published in Proceedings of International Conference on Advanced Production and Industrial Engineering-2016, p57).
18. Ajay Kumar P., Satish Kailas, Tribological Performance of In-Situ PD-MMC Produced by Friction Stir Processing presented at National Tribology Conference held at AMPRI CSIR Bhopal, 21-22 Jan 2016.
19. Ajay Kumar P., Rishi Raj, Satish Kailas, Polymer Derived In-Situ Nano Metal Matrix Composites Obtained by Friction Stir Processing presented at American Society for Composites 30th Annual Technical Conference held at Michigan State University USA, September 28-30, 2015.
20. Ajay Kumar P., Nithant Sourya, Satish Kailas, Use of Image Processing to Estimate Area Fraction of Reinforcement Particles in Composite Fabricated via Friction Stir Processing presented at International Conference on Friction Based Processing at IISc Bangalore India during 3-5 September, 2014.
21. Ajay Kumar P., Satish Kailas, Fabrication and Property of In-situ Cross-linked Polymer Derived Ceramics Reinforced Cu Matrix Composites by High Shear Powder Consolidation Process presented at ASIATRIB-2014 International Conference held at Agra, India during 17<sup>th</sup> - 20<sup>th</sup> February, 2014.
22. Ajay Kumar P., Satish Kailas, In-situ Dispersion of Ceramic Phase in Cu Matrix by High Shear Powder Consolidation Process presented at IUMRS-ICA 2013 conference held at IISc, Bangalore during 16<sup>th</sup> - 20<sup>th</sup> December 2013.
23. Ajay Kumar, Aruna Patel, S. Das, Rolling behaviour of Al alloy 2014-10wt. % SiC<sub>p</sub> composite, 22nd AGM, Materials Research Society of India, Feb. 14-16, 2011, Bhopal, India: pp-47.
24. Ajay Kumar, H.S. Chandra, Seasonal Variation of Pollutant Dispersion around Coal Based Thermal Power Plant: a case study presented at International Conference on Environmental Strategies-2020 held in Ujjain Engineering College MP during 26th – 27th Dec 2007.

### Awards & Achievements:

- Got certificate of appreciation by collector for being topper in 10th & 12th Standards.
- Tribology Society of India Best Paper Award (Academic Research) in National Tribology Conference 2014.
- International Travel Grant from DST (SERB) for presenting a paper in the “30th Technical Conference of American Society for Composites” at Michigan State University, USA, September 27-30, 2015.
- Session chair to the Foam and Sandwich Composites at the 30th American Society for Composites Annual Conference at Michigan State University USA, East Lansing, MI during September 28-30, 2015.
- Conference Chair at International Conference on Nanomaterials and Nano chemistry 2017 at Atlanta, Georgia, USA November 29-30, 2017.
- Invited speaker, Young Investigator Meeting 2018 at Massachusetts Institute of Technology (MIT), Cambridge, MA, USA.

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- Certificate of Appreciation for outstanding contribution, coordination and participation during the Global Students Solar Ambassador Workshop October 2nd 2019 GGSY.
- Organizer Symposium on Solid State Processing of Metals and Composites in Materials Science & Technology 2020, October 4-8, 2020 – Pittsburgh, Pa. USA

### Professional Affiliations

#### **Name of the Professional Body**

- International Association of Engineers (IAENG)
- Tribology Society of India (TSI)
- Society for Failure Analysis (SMA)
- American Society for Composites (ASC)
- Material Advantage (MA)
- Association for Iron and Steel (AIST)
- American Foundry Society (AFS)
- The Minerals, Metals & Materials Society (TMS)
- Institute of Engineers India (IEI)
- Indian Institute of Welding (IIW)
- Indian Institute of Metals (IIM)
- Indian Science Congress Association (ISCA)
- Indian Institute of Foundrymen (IIF)



## Invited Expert Talks:

- 18/11/2020 Friction Stir Processing of Nano Metal Matrix Composites and opportunities for Next Generation Composites in India  
5 days AICTE ATAL Academy Sponsored Online FDP On Green Technology & Sustainability Engineering, **GITAM School of Technology, Bengaluru Campus**
- 16/10/2020 Advance Solid State Welding Process: Friction Stir Welding and Its Applications, Guest Lecture based on Subject Syllabus of Mechanical Engineering at G.H. Raison College of Engg., Nagpur
- 14/10/2020 Friction Stir Processing of Nano Metal Matrix Composites and opportunities for Next Generation Composites in India  
Expert lecture for STTP, RECENT ADVANCES IN TRIBOLOGY AND SURFACE ENGINEERING" sponsored by AICTE at SAINTGITS COLLEGE OF ENGINEERING, Kottayam, Kerala, INDIA
- 13/10/2020 Modern Materials Welding and Processing Technologies, Faculty Development Program at Department of Mechanical Engineering, National Institute of Technology (NIT) Surat Gujarat
- 09/10/2020 Tribology of Metal Matrix Composites, Faculty Development Program on "Tribology for Reliability-2020" at Department of Mechanical Engineering, GITAM School of Technology, Bangalore/SRM Institute of Science and Technology, Kattankulathur, Chennai
- 26/09/2020 The role and impact of 3D printing technologies in casting, Faculty Development Program on 3d Printing Technology & Its Application In Engineering Education, Mechanical Engineering Jaipur Engineering College, Kukas, Jaipur
- 09/09/2020 Functional Materials, AICTE sponsored Short Term Training Program on "Recent Advances in Materials and Manufacturing" (RAMM2020) at Department of Mechanical Engineering, Gayatri Vidya Parishad College of Engineering (A) located at Visakhapatnam, Andhra Pradesh
- 12/08/2020 Friction Stir Processing of Nano Metal Matrix Composites and opportunities for Next Generation Composites in India  
@Faculty Development Program on Advances in Materials Engineering and Sustainable Manufacturing, Mechanical Engineering Department, Federal Institute of Science and Technology, Angamaly, Ernakulam, Kerala (FISAT)
- 04/07/2020 Metal casting advanced materials, AICTE sponsored Short Term Training Program on "Recent Advances in Materials and Manufacturing" (RAMM2020) at Department of Mechanical Engineering, Gayatri Vidya Parishad College of Engineering (A) located at Visakhapatnam, Andhra Pradesh
- 06/07/2020 Metal forming advanced materials, AICTE sponsored Short Term Training Program on "Recent Advances in Materials and Manufacturing" (RAMM2020) at Department of Mechanical Engineering, Gayatri Vidya Parishad College of Engineering (A) located at Visakhapatnam, Andhra Pradesh
- 13/06/2020 Friction Stir Processing of Nano Metal Matrix Composites and opportunities for Next Generation Composites in India  
@Faculty Development Program, on Nanocomposites and Nanomaterials & it's Characterization, Department of Mechanical Engineering, Vimal Jyothi Engineering College, Chemperi, Kannur, Kerala