Dr. Rahul M R

Faculty at the Department of Fuel Minerals and Metallurgical Engineering
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EDUCATION

Program	Institution/University	%/CGPA
Ph.D. in Metallurgical and Materials Engineering	Indian Institute of Technology Madras, Chennai	9.5/10
M.S in Metallurgical and Materials Engineering	Indian Institute of Technology Madras, Chennai	8.8/10
B.Tech in Mechanical Engineering (stream production)	University of Kerala	8.8/10 (University first rank)
HSE (Class XII), Kerala	Board of Higher Secondary Examinations, Kerala	91%
SSLC	Board of Public Examinations, Kerala	90%

AREA OF RESEARCH

- Alloy design: Experimental and Simulation
- Welding and Solidification
- ICME and Materials Informatics
- Microstructure Informatics

RESEARCH AND TEACHING EXPERIENCE

- **Assistant Professor - (04/07/2020 to present)**
  Department of Fuel, Minerals and Metallurgical Engineering, IIT (ISM) Dhanbad
  - *Institute Coordinator, Research & Development (Administration) (2023-24)*
  - *M Tech course coordinator (2020-2023)*
  - *Member of the Institute Library Advisory Committee (2022-2023)*
  - *Member of DPGC (2023-2024)*
  - *Member of Faculty Selection Committee (AP) (2023-2024)*
  - *Member of Departmental Grievance Redressal Committees (DGRC) (2024- present)*
  - *Department Time Table Co-ordinator (2024-present)*

> *Member of PMRF students progress review committee (External: December 2023 and June 2024 section)*

- **Institute Pre-doctoral fellow (IIT Madras- 2/12/2019 to 02/06/2020)**

Area: Additive manufacturing of high-temperature materials by experimental and simulation methods

LIST OF ONGOING PROJECTS (from external funding)

1. Title: Design and development of high entropy shape memory alloys for actuators application in the defence sector
   Funding organisation- **DRDO (No: ARDB/M&M/4119/2144)**
   Amount: 29.6214 Lakhs Rupees
   Role: **Principal Investigator**
2. Title: Development of Microstructure-Property-Processing Correlations for nickel-based superalloys
   Amount: 28.36 Lakhs Rupees
   Funding organisation- **ISRO (No. ISRO/RES/3/909/21-22)**
   Role: **Co-PI**, PI (Dr. Sumanta Samal, IIT Indore)

3. Title: Development of single-phase BCC refractory high entropy alloys for high-temperature applications using machine learning (ML) and experimental approaches
   Funding organisation- **DRDO (No: ARDB/MM/4095/2145)**
   Amount: 88.996 Lakhs Rupees
   Role: **Co-PI,** PI (Dr. Sumanta Samal, IIT Indore)

LIST OF COMPLETED PROJECTS

1. Title: Machine learning-enabled framework for the design of new multicomponent alloys
   Amount: 30. 91 Lakhs Rupees
   Funding organisation- **DST (DST- SERB, SRG/2022/001943)**
   Role: **Principal Investigator** (Co-PI- Nil)
2. Title: Multiscale simulation of weld solidification cracking in Ni-based superalloys used in aerospace applications
   Amount: 19.74 Lakhs Rupees
   Funding organisation- **ISRO (No. ISRO/RES/3/880/21-22)**
   Role: **Principal Investigator** (Co-PI- Nil)
   Year of completion: 2024
3. Title: Rapid solidification studies for the design of alloys for additive manufacturing
   Amount: 16 Lakhs Rupees
   Funding organisation: **IIT (ISM) Dhanbad**
   Role: **Principal Investigator** (Co-PI- Nil)
   Year of completion: 2024

LIST OF COMPLETED CONSULTANCY PROJECT

1. Title: Training and understanding microstructure simulation tool (for ISRO, Trivandrum)
   Funding organization: project number CONS 7386 C (Bhanu Scientific Systems Pvt Ltd)
   Role: Consultant-in-Charge (given talk and training for VSSC, ISRO scientists)
   Year of completion: 2024

EDITORIAL ASSIGNMENT

- **Editor for** *Nature Scientific Reports*, *Mechanical Engineering section* (Q1 journal, Oct 2024-present)
- **Guest Editor** for a Special Issue on Advanced Functional Materials: Materials Performance and Characterization, ASTM International, (https://www.astm.org/materials-performance-and-characterization.html#about)
- **Editor for the Special Issue** "High-Entropy Alloys: From Fundamentals to Applications" in Crystals (ISSN 2073-4352) Jointly with Dr. Amalraj Marshal (Northwestern University), Dr. Jiří Zýka (Czech Republic), Prof. Dr. Jakub Čížek (Charles University, Czech Republic), Dr. Hany R. Ammar (Qassim University, Buraydah

LIST OF PUBLICATIONS

Citations (Google Scholar)	h-index	i10-index
931	19	28

Peer-Reviewed International Journals (* corresponding author)

1. Shit Sarita, M Agilan, **M R Rahul***, Gandham Phanikumar, Integrated macro-micro scale and physical simulation framework for optimising electron beam welds of Ni-based superalloy, Materials Characterization, 221 (2024), 114699, https://doi.org/10.1016/j.matchar.2024.114699, **(Q1, Impact factor: 4.8)**

2. Manish Kumar Singh, B. Nithin, Kesavan Ravi, **M.R. Rahul*,** Simulation-guided design of novel precipitation-strengthened eutectic high entropy alloy, *Intermetallics* 175 (2024), 108501, https://doi.org/10.1016/j.intermet.2024.108501, **(Q1, Impact factor: 4.4)**

3. Saswati Swateelagna, Manish Singh, **M.R. Rahul*,** Explainable Machine Learning based approach for the design of new refractory high entropy alloys, *Intermetallics* 167 (2024), 108198, https://doi.org/10.1016/j.intermet.2024.108198, **(Q1, Impact factor: 4.4)**

4. L Naveen, Umre Priyanka, Chakraborty Poulami, **M.R. Rahul**, Samal Sumanta, Raghvendra Tewari, Development of single-phase BCC refractory high entropy alloys using machine learning techniques, *Computational Materials Science*, 238 (2024), 112917, https://doi.org/10.1016/j.commatsci.2024.112917, **(Q2, Impact factor: 3.3)**

5. Vivek Sharma, **Rahul M R**, Ashis Mallick, Microstructural, mechanical, and tribological behaviors of Cu40Fe30Mn20Cr5Ti5 high entropy alloy via powder metallurgy route, *Materials Today Communications,* 38 (2024), 108313, https://doi.org/10.1016/j.mtcomm.2024.108313, **(Q2, Impact factor: 3.8)**

6. Surya Prakash Mishra, **M R Rahul***, A detailed study of convolutional neural networks for the identification of microstructure, *Materials Chemistry and Physics*, 308 (2023), 128275, https://doi.org/10.1016/j.matchemphys.2023.128275, **(Q2, Impact factor: 4.6)**

7. Shambhu Kushwaha, M Agilan, **Rahul M R***, Gandham Phanikumar, Study of TIG weld microstructure formation in Inconel 718 alloy using ICME approach, *Integrating Materials and Manufacturing Innovation*, (2023), https://doi.org/10.1007/s40192-023-00317-3, **(Q2, Impact factor: 3.3)**

8. Piyush Kumar, **M R Rahul**, Sumanta Samal, Abhijit Ghosh, Gandham Phanikumar, Constitutive Behavior With Microstructure and Texture Evolution During the High-Temperature Deformation of Fe11.5Co20.6Ni40.7Cr12.2Al7.8Ti7.2 High-Entropy Alloy, *Metallurgical and Materials Transactions A,* 54 (2023), 3249–3260, https://doi.org/10.1007/s11661-023-07093-x, **(Q1, Impact factor: 2.8)**

9. Reliance Jain, **M R Rahul**, Poulami Chakraborty, Rama Krushna Sabat, Sumanta Samal, Nokeun Park, Gandham Phanikumar, Raghvendra Tewari, Integrated experimental and modeling approach for hot deformation behavior of Co-Cr-Fe-Ni-V High Entropy Alloy, *Journal of Materials Research and Technology,* 25(2023), 840-854, https://doi.org/10.1016/j.jmrt.2023.05.257, **(Q1, Impact factor: 6.4)**

10. A Bansal, P Kumar, S Yadav, VS Hariharan, **M R Rahul***, G Phanikumar, Accelerated design of high entropy alloys by integrating high throughput calculation and machine learning, *Journal of Alloys and Compounds*, 960 (2023), 170543, https://doi.org/10.1016/j.jallcom.2023.170543, **(Q1, Impact factor: 6.2)**

11. K Saphal, P Hrutidipan, S Naishalkumar, **M R Rahul***, G Phanikumar, Machine learning enabled processing map generation for high-entropy alloy, *Scripta Materialia*, 234 (2023), 115543, https://doi.org/10.1016/j.scriptamat.2023.115543, **(Q1, Impact factor: 6)**

12. P Kumar, R Jain, **M R Rahul**, A Ghosh, S Samal, G Phanikumar, High Temperature Deformation Behavior and Processing Maps of FeCoNiCrAlTi Dual Phase High Entropy Alloy, *Metals and Materials International*, (2023), https://doi.org/10.1007/s12540-023-01399-6, **(Q1, Impact factor: 3.5)**

13. AS Bundela, **M R Rahul***, Application of Machine Learning Algorithms With and Without Principal Component Analysis for the Design of New Multiphase High Entropy Alloys, *Metallurgical and Materials Transactions A*, 53 (2022), 3512–3519, https://doi.org/10.1007/s11661-022-06764-5, **(Q1, Impact factor: 2.8)**

14. AS Bundela, **M R Rahul***, Machine learning-enabled framework for the prediction of mechanical properties in new high entropy alloys, *Journal of alloys and compounds*, 908 (2022) 164578, https://doi.org/10.1016/j.jallcom.2022.164578, **(Q1, Impact factor: 6.2)**

15. VS Goud, **Rahul M R***, G Phanikumar, Prediction of growth velocity of undercooled multicomponent metallic alloys using a machine learning approach, *Scripta Materialia*, 207 (2022), 114309, https://doi.org/10.1016/j.scriptamat.2021.114309, **(Q1, Impact factor: 6)**

16. AK Sah, Agilan, M, S Dinesh raj, **M R Rahul***, B Govind, Machine learning-enabled prediction of density and defects in additively manufactured Inconel 718 alloy, *Materials Today Communications*, 30 (2022), 103193, https://doi.org/10.1016/j.mtcomm.2022.103193, **(Q2, Impact factor: 3.8)**

17. **M R Rahul***, M Agilan, D Mohan, G Phanikumar, Integrated experimental and simulation approach to establish the effect of elemental segregation in Inconel 718 welds, *Materialia*, 26 (2022), 101593, https://doi.org/10.1016/j.mtla.2022.101593, **(Q2, Impact factor: 3.4)**

18. S Naishalkumar, DJ Mathew, **M R Rahul***, G Phanikumar, Microstructure prediction of eutectic high entropy alloy using physical and computer simulation for additive manufacturing condition, *Journal of alloys and compounds*, 929 (2022), 167268, https://doi.org/10.1016/j.jallcom.2022.167268, **(Q1, Impact factor: 6.2)**

19. Yegi Vamsi Krishna, Ujjawal Kumar Jaiswal, **Rahul M R***, Machine learning approach to predict new multiphase high entropy alloys, *Scripta Materialia*, 197 (2021), 113804, https://doi.org/10.1016/j.scriptamat.2021.113804, **(Q1, Impact factor: 6)**

20. Ujjawal Kumar Jaiswal, Yegi Vamsi Krishna, **Rahul M R***, Gandham Phanikumar, Machine learning-enabled identification of new medium to high entropy alloys with solid solution phases,

*Computational Materials Science,*197 (2021), 110623, https://doi.org/10.1016/j.commatsci.2021.110623, **(Q2, Impact factor: 3.3)**

21. Surya Prakash Mishra and **Rahul M R***, A comparative study and development of a novel deep learning architecture for accelerated identification of microstructure in material science, *Computational Materials Science*, 200 (2021), 110815, https://doi.org/10.1016/j.commatsci.2021.110815, **(Q2, Impact factor: 3.3)**

22. Naishalkumar Shah, **Rahul M R*****,** Sandip Bysakh, Gandham Phanikumar, Microstructure stability during high-temperature deformation of CoCrFeNiTa eutectic high entropy alloy through nano-scale precipitation, *Materials science and Engineering A*, 824 (2021), 141793, https://doi.org/10.1016/j.msea.2021.141793, **(Q1, Impact factor: 6.4)**

23. Naishalkumar Shah, **Rahul M R*** and Gandham Phanikumar, Accelerated design of eutectic high entropy alloy by ICME approach, *Metallurgical and Materials Transactions A***,** (2021), 52 (5), 1574-1580, https://doi.org/10.1007/s11661-021-06218-4, **(Q1, Impact factor: 2.8)**

24. Reliance Jain, **Rahul M R**, Poulami Chakraborty, Rama Krushna Sabat, Sumanta Samal, Gandham Phanikumar, Raghvendra Tewari, Design and deformation characteristics of single-phase Co-Cr-Fe-Ni-V high entropy alloy, *Journal of Alloys and Compounds,* 888 (2021), 161579, https://doi.org/10.1016/j.jallcom.2021.161579, **(Q1, Impact factor: 6.2)**

25. **Rahul M R**, G. Phanikumar, Solidification behaviour of undercooled equiatomic FeCuNi alloy, *Journal of Alloys and Compounds*, 815 (2020) 152334, https://doi.org/10.1016/j.jallcom.2019.152334, **(Q1, Impact factor: 6.2)**

26. **Rahul M R**, G Phanikumar, Growth kinetics, microhardness and microstructure evolution of undercooled FeCoNiCuSn high entropy alloy, *Material science and Engineering A*, 777 (2020) 139022, https://doi.org/10.1016/j.msea.2020.139022, **(Q1, Impact factor: 6.4)**

27. **Rahul M R**, Sumanta Samal, A. Marshal, V I Nithin Balaji, K. G. Pradeep, Gandham Phanikumar, Nano-sized Cu clusters in deeply undercooled CoCuFeNiTa high entropy alloy, *Scripta Materialia*, 177 (2020), 58-64, https://doi.org/10.1016/j.scriptamat.2019.10.006, **(Q1, Impact factor: 6)**

28. Rajeev G.P., **Rahul. M. R.,** Kamaraj M., Srinivasa Rao Bakshi, Microstructure and high-temperature mechanical properties of wire arc additively deposited Stellite 6 alloy using cold metal transfer process, *Materialia,* 12 (2020) 100724*,* https://doi.org/10.1016/j.mtla.2020.100724, **(Q2, Impact factor: 3.4)**

29. Reliance Jain, Avi Jain, **Rahul M R**, Ashok Kumar, Mrigendra Dubey, Rama Krushna Sabat, Sumanta Samal, Gandham Phanikumar, Development of ultrahigh strength novel Co-Cr-Fe-Ni-Zr quasi-peritectic high entropy alloy by an integrated approach using experiment and simulation, *Materialia*, 2020, 100896, https://doi.org/10.1016/j.mtla.2020.100896, **(Q2, Impact factor: 3.4)**

30. Jinu Kurian, **Rahul M R**, J. Arout Chelvane, A. V. Morozkin, A. K. Nigam, Gandham Phanikumar and R. Nirmala, Enhanced Magnetocaloric effect in Undercooled Rare earth intermetallic compounds RNi (R = Gd, Ho and Er), *Journal of Magnetism and Magnetic Materials,* 499 (2020) 166302, https://doi.org/10.1016/j.jmmm.2019.166302, **(Q2, Impact factor: 2.7)**

31. **Rahul M R,** Sumanta Samal, Gandham Phanikumar, Metastable microstructures in the solidification of undercooled high entropy alloys, *Journal of Alloys and Compounds,* 821 (2020), 153488, https://doi.org/10.1016/j.jallcom.2019.153488, **(Q1, Impact factor: 6.2)**

32. Reliance Jain, **Rahul M R**, Sumanta Samal, Vinod Kumar, Gandham Phanikumar, Hot workability of Co-Fe-Mn-Ni-Ti eutectic high entropy alloys, *Journal of Alloys and Compounds*, 822 (2020), 153609, https://doi.org/10.1016/j.jallcom.2019.153609, **(Q1, Impact factor: 6.2)**

33. **Rahul M R**, G. Phanikumar, Design of a Seven-Component Eutectic High-Entropy Alloy, *Metallurgical and Materials Transactions A*, 50 (2019), 2594-2598, https://doi.org/10.1007/s11661-019-05210-3, **(Q1, Impact factor: 2.8)**

34. **Rahul M R**, S. Samal, G. Phanikumar, Effect of niobium addition in FeCoNiCuNbx high-entropy alloys, *Journal of Materials Research*, 34 (2019), 700–708. https://doi.org/10.1557/jmr.2019.36, **(Q3, Impact factor: 3)**

35. **Rahul M R**, S. Samal, G. Phanikumar, Hot Deformation Behavior and Microstructural Characterization of CoCrFeNiNb$_{0.45}$ Eutectic High Entropy Alloy, *Materials Performance and Characterization*, 8 (2019) 1062-1075, DOI: 10.1520/MPC20190014, **(Q4, Impact factor: 1.1)**

36. **Rahul M R**, G Phanikumar, Experimental and simulation studies of solidification behaviour in undercooled CuCoNi equiatomic medium entropy alloy, *European Physical Journal (EPJ- Special Topics)*, 229 (2020) 145-155, https://doi.org/10.1140/epjst/e2019-900111-5, **(Q2, Impact factor: 2.8)**

37. R. Sonkusare, A. Swain, **Rahul M R**, S. Samal, N.P. Gurao, K. Biswas, et al., Establishing processing-microstructure-property paradigm in complex concentrated equiatomic CoCuFeMnNi alloy, *Materials Science and Engineering A*, 759 (2019), 415-429, https://doi.org/10.1016/j.msea.2019.04.096, **(Q1, Impact factor: 6.4)**

38. **Rahul M R**, S. Samal, S. Venugopal, G. Phanikumar, Experimental and finite element simulation studies on hot deformation behaviour of AlCoCrFeNi$_{2.1}$ eutectic high entropy alloy, *Journal of Alloys and Compounds*, 749 (2018), 1115–1127, https://doi.org/10.1016/j.jallcom.2018.03.262, **(Q1, Impact factor: 6.2)**

39. R. Jain, **Rahul M R**, S. Jain, S. Samal, V. Kumar, Phase Evolution and Mechanical Behaviour of Co–Fe–Mn–Ni–Ti Eutectic High Entropy Alloys, *Transactions of the Indian Institute of Metals*, 71 (2018) 2795–2799, https://doi.org/10.1007/s12666-018-1437-2, **(Q2, Impact factor: 1.6)**

40. S. Jain, R. Jain, **Rahul M R**, S. Samal, V. Kumar, Phase Equilibria and Mechanical Properties in Multicomponent Al–Ni–X (X = Fe, Cr) Alloys, *Transactions of the Indian Institute of Metals*, 71 (2018) 2819–2825, https://doi.org/10.1007/s12666-018-1420-y, **(Q2, Impact factor: 1.6)**

41. Sumanta Samal, **Rahul M R**, Ravi Sankar Kottada and Gandham Phanikumar., Hot deformation behaviour and processing map of Co-Cu-Fe-Ni-Ti eutectic high entropy alloy, *Materials Science and Engineering A*, 664 (2016), 227-235, https://doi.org/10.1016/j.msea.2016.04.006, **(Q1, Impact factor: 6.4)**

42. **Rahul M R** and Phanikumar, G., Correlation of Microstructure With HAZ Welding Cycles Simulated in Ti-15-3 Alloy Using Gleeble® 3800 and SYSWELD®, *Materials Performance and Characterization*, 4 (2015), 381-398, doi:10.1520/MPC20140065, **(Q4, Impact factor: 1.1)**

Conference Proceedings

1. Garima Jain, Avadhut Sardeshmukh, Gerald Tennyson, Shalini Koneru, **Rahul M R**, Microstructure modeling of deformed alloys using contrastive conditional generative adversarial networks, *AI for Accelerated Materials Design-NeurIPS 2024*

2. **Rahul M R**, Sumanta Samal, Gandham Phanikumar, Undercooling studies and growth velocity measurements on multi-component FeCuNi{X} alloys. *Solidification and Gravity VII*, Edited by: A. Roósz, Zs. Veres, M. Svéda, G. Karacs, Hungarian Academy of Sciences – University of Miskolc, Materials Science Research Group (2018) pages 250-254 ISBN: 978-963-508-889-8

3. **Rahul M R**, Reliance Jain, Sumanta Samal, Gandham Phanikumar, Microstructure evolution and mechanical properties of Co-Fe-Ni-Ti-V eutectic high entropy alloy, *Solidification and Gravity VII*, Edited by: A. Roósz, Zs. Veres, M. Svéda, G. Karacs, Hungarian Academy of Sciences - University of Miskolc, Materials Science Research Group (2018) pages 313-318. ISBN: 978-963-508-889-8

List of paper/posters and invited talks in international/national conferences

1. Delivered **invited talk**: "ICME and Microstructure Informatics framework for the alloy design" at the International Conference on Materials for Energy, Environment, and Healthcare, December 20th and 21st, 2024, at the Department of Materials Science and Engineering, **National Institute of Technology Calicut**.

2. Delivered **invited talk** on " ICME framework for the design and development of new materials", at the Five-Day Workshop on "Computational Materials Engineering" organized by **MNIT Jaipur** on 22 - 27 January 2024.

3. Delivered **invited talk** on "ICME and physical simulation approach for manufacturing process optimisation", at the Five-Day Workshop on "Computational Materials Engineering", organized by **MNIT Jaipur** on 22 - 27 January 2024.

4. Delivered **invited talk** on "Microstructure simulation using phase field method" at the Five-Day Workshop on "Computational Materials Engineering" organized by **MNIT Jaipur** on 22 - 27 January 2024.

5. Delivered **invited talk** on "Machine learning enabled phase prediction in HEAs" at the Five-Day Workshop on "Computational Materials Engineering", organized by **MNIT Jaipur** on 22 - 27 January 2024.

6. Delivered **invited talk** on "ML-based alloy design and development", at the workshop on AI &ML applications with Thermo-Calc software, organized by **Thermo-Calc** on 26th January 2024.

7. Delivered **invited talk** on "ICME + Machine Learning based framework for understanding solidification behaviour of high entropy alloys", at the International Conference on Solidification Science and Processing (ICSSP 2023), organized by **IIT Jodhpur** and **IIT Hyderabad** on December 11-14, 2023.

8. Delivered **invited talk** on "ICME and machine learning framework for the design and development of materials" at the five-day Winter School on ICME at **IIT Gandhinagar** on December 8th, 2022

9. Given **invited training** on "Microstructure simulation by integrating Thermo-Calc and Micress" on five day Winter School on ICME at **IIT Gandhinagar** on December 8th, 2022

10. Delivered **invited talk** on "ICME and machine learning framework for the design and development of new materials" in the workshop on "Computational Techniques in Metallurgical and Materials Engineering (CTiMME-2022)" Organized by: Department of Metallurgical & Materials Engineering, **NIT Srinagar**, 17-21 October 2022

11. Delivered **invited talk** on "ICME and physical simulation approach for manufacturing process optimization" in the workshop on "Computational Techniques in Metallurgical and Materials Engineering (CTiMME-2022)" Organized by: Department of Metallurgical & Materials Engineering, **NIT Srinagar**, 17-21 October 2022

12. Given training on "Microstructure simulation during welding and casting processes" in the workshop on "Computational Techniques in Metallurgical and Materials Engineering (CTiMME-2022)" Organized by: Department of Metallurgical & Materials Engineering, **NIT Srinagar**, 17-21 October 2022

13. *Amit Bundela,* **Rahul M R,** "Machine Learning-enabled Framework for the Screening of Hydrogen Storage Materials**,** Feb 27 – Mar 3, 2022, **TMS 2022** (virtual), California USA.

14. *Gandham Phanikumar*, Dasari Mohan, **M R Rahul**, V.S. Hariharan, "High Performance Computing for Microstructure prediction via Process Parametric Space", NMD ATM 2022

15. **Technical section chair** for International Conference on Advances in Mechanical and Aerospace Engineering, TKM college of Engineering Kerala, India, 16-18 December 2021.

16. **Organized (Convenor)** Webinar on "Metallurgy and Material Science in the Era of Artificial Intelligence (MMSEAI 2021)", Department of Fuel Minerals and Metallurgical Engineering (27-28 February 2021), sponsored by TEQIP III, IIT (ISM) Dhanbad

17. **Coordinated** the Expert lecture series of "**Materials Informatics**" by **Prof. Krishna Rajan**, Erich Bloch Chair, Empire Innovation Professor, Department of Materials Design and Innovation, University at Buffalo, Date (25-29/10/2021), conducted by IIT (ISM) Dhanbad.

18. Delivered an **invited talk** on the topic "Materials Characterization using Thermo-mechanical simulator" on the STC (QIP) on "Materials Characterization Techniques", 22-27 March 2021, conducted by Dept. of MEMS, **IIT Indore**

19. Delivered a talk on the topic "Accelerated design of materials using ICME and Machine Learning" conducted by the Department of Fuel Minerals and Metallurgical Engineering (27-28 February 2021), sponsored by TEQIP III, IIT (ISM) Dhanbad

20. Delivered an **invited talk** on the topic "Design and development of multicomponent alloys using ICME and ML framework" conducted by **BARC** to initiate collaborative work on HEA design and development. Date (17/07/2021)

21. Shambhu Kushwaha, Agilan M, **Rahul M R**, G Phanikumar, "Integrated experimental and simulation study to modify the weld thermal cycle in Inconel 718 welding", NMD 13-15 November 2021 (virtual).

22. Rahul Kumar, Ashok K, **Rahul M R**, "Simulation guided grain refinement studies on as-cast multicomponent alloy", 13-15 November 2021 (virtual).

23. Delivered an **invited talk** on the topic "Welding and additive manufacturing studies of Advanced material using experimental and simulation methods" on the STC of "Advanced Materials for structural applications" conducted by the Department of Metallurgy Engineering and Materials Science, **IIT Indore**. Date: 29 /09/ 2020 to 04/10/2020.

24. Delivered an **invited talk** in the webinar on the topic "ICME approach for design and development of high temperature materials" conducted by the Society of Automotive Engineers (**SAE, TKMCE**), Kerala. Date: (05/09/2020)

25. **Rahul M R** and Gandham Phanikumar*, Design and development of high entropy alloys using solidification studies, IWHEM 2020, IIT Kanpur, March 7-8, 2020 **(Invited talk*)**

26. **Rahul M R,** Naishalkumar Shah, Gandham Phanikumar, Accelerated design of Eutectic High Entropy Alloys by integrating experimental and computer simulations, IWHEM 2020, IIT Kanpur, March 7-8, 2020

27. **Rahul M R** and Gandham Phanikumar, Effect of Sn addition on microstructural evolution and growth velocity of undercooled $FeCoNiCuSn_X$ (X= 0.5 & 5) high entropy alloy, International Symposium on Metastable, Amorphous and Nanostructured Materials (ISMANAM), July 8-12, 2019, Chennai, (*Best paper award*)

28. **Rahul M R**, Sumanta Samal, G Phanikumar, Metastable microstructures in solidification of undercooled high entropy alloys, International Symposium on Metastable, Amorphous and Nanostructured Materials (ISMANAM), July 8-12, 2019, Chennai

29. Reliance Jain, **Rahul M R**, Sumanta Samal, Vinod Kumar, Gandham Phanikumar, Hot workability of Co-Fe-Mn-Ni-Tieutectic high entropy alloys, International Symposium on Metastable, Amorphous and Nanostructured Materials (ISMANAM), July 8-12, 2019, Chennai

30. **Rahul M R** and Gandham Phanikumar, Solidification, growth velocity and micromechanical properties of undercooled Fe-Co-Cu alloy, in the "7th International Conference on Solidification Science and Processing (ICSSP-2018)" 19/11/2018 - 22/11/2018 at Trivandrum, Kerala, India. (*Best paper award*)

31. **Rahul M R** and Gandham Phanikumar, Growth rate and segregation studies in undercooled high entropy alloys, in the "7th International Conference on Solidification Science and Processing (ICSSP-2018)" 19/11/2018 - 22/11/2018 at Trivandrum, Kerala, India

32. Reliance Jain, **Rahul M R**, Sandeep Jain, Sumanta Samal, Vinod Kumar**,** Phase evolution and mechanical behaviour of Co-Fe-Mn-Ni-Ti eutectic high entropy alloys, 7th International Conference on Solidification Science and Processing (ICSSP-2018)" 19/11/2018 - 22/11/2018 at Trivandrum, Kerala, India

33. Sandeep Jain, Reliance Jain, **Rahul M R,** Sumanta Samal, Vinod Kumar, Phase equilibria and mechanical properties in multicomponent Al-Ni-X (X= Fe, Cr) alloys, 7th International Conference on Solidification Science and Processing (ICSSP-2018)" 19/11/2018 - 22/11/2018 at Trivandrum, Kerala, India

34. **Rahul M R**, Sumanta Samal, Gandham Phanikumar, Undercooling studies and growth velocity measurements on multi-component FeCuNi{X} alloys, in the "7thInternational Conference on Solidification and Gravity (SG'18)" 03/09/2018 -06/09/2018 at Miskolc - Lillafüred, Hungary.

35. **Rahul M R,** Reliance Jain, Sumanta Samal, Gandham Phanikumar, Microstructure evolution and mechanical properties of Co-Fe-Ni-Ti-V eutectic high entropy alloy, in the "7th International Conference on Solidification and Gravity (SG'18)" 03/09/2018 - 06/09/2018 at Miskolc - Lillafüred, Hungary

36. **Rahul M R**, Sumanta Samal and Gandham Phanikumar, Phase evolution and kinetics in undercooled FeCoNiCuX$_{0.5}$ alloys, The 16th International Conference on Rapidly Quenched and Metastable Materials (RQ16), 27 August 2017 - 01 September 2017, Leoben, Austria

37. **Rahul M R**, Sumanta Samal and G.Phanikumar, Experimental and FEM simulation of hot deformation behaviour of multicomponent Fe-Co-Ni-Cr-Al eutectic high entropy alloys, National Gleeble Users Conference, IIT Bombay, 2017

38. **Rahul M R**, S. Samal, G.Phanikumar, Phase selection kinetics in undercooled FeCoNiCuX$_{0.5}$ alloys, International Workshop on High Entropy Materials (IWHEM-2017, School of Engineering Sciences and Technology, University of Hyderabad, March 11-12, 2017

39. **Rahul M R**, S. Samal, G.Phanikumar, Hot Deformation Behaviour and Processing Map of Multicomponent Fe-Co-Ni-Cr-Al Eutectic High Entropy Alloy, International Workshop on High Entropy Materials (IWHEM-2017, School of Engineering Sciences and Technology, University of Hyderabad,), March 11-12, 2017

40. **Rahul M R**, S. Samal, G.Phanikumar, Development of Novel Fe-Co-Ni-Cu-Nb Magnetic High Entropy Alloy, International Symposium for Research Scholars, Department of Metallurgical and Materials Engineering, IIT Madras,2016

41. **Rahul M R** and G. Phanikumar, HAZ simulation and Deformation studies in Ti-15-3 alloy using Gleeble, National Conference on Thermomechanical processing of steels using Gleeble Simulation and 5th Gleeble User Workshop India (GUWI-2015), 6th – 7th August 2015 at CSIR-NML, Jamshedpur-831007, India

42. S. Samal, **Rahul M R**, G. Phanikumar, Hot Deformation Behaviour and Processing Map of Multicomponent Co-Cu-Fe-Ni-Ti High Entropy Alloy, National Conference on Thermomechanical processing of steels using Gleeble Simulation and 5th Gleeble User Workshop India (GUWI-2015), 6th – 7th August 2015 at CSIR-NML, Jamshedpur-831007, India.

43. **Rahul M R** and G.Phanikumar, Correlation of HAZ microstructure and mechanical properties of Ti-15-3 alloy simulated in Gleeble, International Symposium for Research Scholars, Department of Metallurgical and Materials Engineering, IIT Madras,2014

44. **Rahul M R** and G.Phanikumar, HAZ Simulation and characterisation of Ti-15-3 alloy, National Gleeble Users Conference, IIT Madras, 2014

GUIDANCE

Ph.D. Scholars (Ongoing)

1. **Manish Kumar Singh (Main guide)**
   Area of Research: Simulation-guided design of High entropy alloys
   Articles published from thesis work:
   - Manish Kumar Singh, B. Nithin, Kesavan Ravi, M.R. Rahul*, Simulation-guided design of novel precipitation-strengthened eutectic high entropy alloy, Intermetallics 175 (2024), 108501, https://doi.org/10.1016/j.intermet.2024.108501, (Q1, Impact factor: 4.4)
2. **Kumar Deepak**
   Area of Research: ICME and Microstructure Informatics
3. **Kirty Madhavi**
   Area of Research: ICME and Microstructure Informatics
4. **Raushan Kumar (Co-Guide)**
   Area of Research: Welding and Additive Manufacturing

M Tech- 7 (5 Completed + 2 Ongoing)

Completed M Tech projects

Sl No	Student name	Thesis title	Year	Publication/Remark
1	Rahul Kumar	Simulation-guided grain refinement studies on as-cast multicomponent alloys	2022	Article under review
2	Shambhu Kushwaha	Welding simulation and validation of materials used in advanced ultra-supercritical (AUSC) power plants	2022	https://doi.org/10.1007/s40192-023-00317-3 (Q2 journal)
3	Sarita Shit	Thermal field simulation of electron beam welding of Ni-based superalloys	2023	https://doi.org/10.1016/j.matchar.2024.114699 (Q1 journal)
4	Saswati Swateelagna	Design and development of refractory high entropy alloys by using an integrated framework of machine learning and experiments	2023	https://doi.org/10.1016/j.intermet.2024.108198 (Q1 journal)
5	Navneet Mishra	Technology development to develop advanced materials using coal tailings	2024	

B Tech- 13 (12 Completed + 1(IIT Indore-Co-Guide)) + 3 (Ongoing)

Publications from B Tech projects:
Number of Q1 Publications: 6
Number of Q2 Publications: 4

- Internships- 20 Completed

TEACHING

Courses taught in IIT (ISM) Dhanbad

- Non-Ferrous Extractive Metallurgy (B Tech 2020- July)
- Extractive Metallurgy Lab (B Tech 2020- July, M Tech 2021-January)
- Elements of Materials Engineering (B Tech 2021- January & 2022- January)
- Phase transformation and heat treatment (B Tech 2023-January/ B Tech 2024- January)

New courses developed and taught in IIT (ISM) Dhanbad

- Advanced Engineering Materials (PG. 2021-July)
- Advanced Materials and Applications (PG. 2022- July/ PG 2023- Aug)
- Joining of Materials (B Tech 2022-July/ B Tech 2023- July)
- Metal Forming Technology (PG 2024- January)
- Welding Metallurgy (B Tech- 2024 July)

New Courses proposed and added to the curriculum

- Computational Materials Science (B Tech Level)
- Integrated Computational Materials Engineering (PG Level)
- Analysis and Modelling of Welding (B Tech Level)

SKILLS

Software skills: Thermo-Calc®, Micress®, Sysweld®, JMatPro®, Simufact forming®, Simufact welding®, Simufact Additive®, SolidWorks®, PFV® software for high speed video analysis.

Equipment trained: XRD (X'pert Pro PANalytical®), SEM (Quanta 200®, Quanta 400® and InspectF®), Optical microscope, Thermo-mechanical simulator (Gleeble®), Undercooling studies using electromagnetic levitation setup, High speed camera imaging (Photron®), Arc Melting, TIG welding, Nano-indentation (Hysitron®), Vickers hardness tester.

ACHIEVEMENTS AND AWARDS

- The project idea "Scrap to Advanced Materials by Guiding the Communities" is shortlisted as one of the **best 75 ideas** in "**LiFE Global Call for Ideas and Papers**" by **NITI Aayog out of 2538 idea proposals from 67 countries, 2023** (https://www.niti.gov.in/sites/default/files/2023-06/Thinking-For-Our-Planet-75-Ideas-to-Promote-LiFE.pdf)
- Initiatives taken by our group made the IIT (ISM) Dhanbad globally at 7th position in ML-based HEA design according to Scopus affiliation (https://timesofindia.indiatimes.com/city/ranchi/novel-research-puts-iit-ism-in-elite-global-club/articleshow/101230748.cms)
- Received letter of appreciation from the Director, IIT (ISM) Dhanbad, for excellent teaching feedback.

- Certificate for outstanding service as a reviewer to Transactions of The Indian Institute of Metals (TIIM) 2022.
- **Keshav Ranganath award – IIT Madras** (Best Researcher at the institute level, First recipient from the Department of Metallurgical and Materials Engineering, 2020)
- **Best thesis award (Sudarshan Bhat prize) - IIT Madras** from the Department of Metallurgical and Materials Engineering, 2020
- Best paper award- **Rahul M R** and Gandham Phanikumar, "Solidification, growth velocity and micromechanical properties of undercooled Fe-Co-Cu alloy" in the "7th International Conference on Solidification Science and Processing (ICSSP-2018)" 19/11/2018 - 22/11/2018 at Trivandrum, Kerala, India.
- Best paper award- **Rahul M R** and Gandham Phanikumar, "Effect of Sn addition on microstructural evolution and growth velocity of undercooled FeCoNiCuSn$_X$ (X= 0.5 & 5) high entropy alloy", ISMANAM 2019
- Best paper award- **Rahul M R**, "Microstructure evolution and growth velocity measurement of FeCoNiCuNb$_{0.5}$ High entropy alloy at different undercooling conditions: experimental and simulation approach", IHS 2017
- Teaching Assistant for NPTEL online course on Analysis and Modeling of welding, IIT Madras
- **Kerala University First Rank Holder in B Tech from Mechanical Engineering (stream production) Department**
- Awarded Sri. K. A. George memorial gold medal for the topper in B Tech from Mechanical Engg (stream production) Department. from TKMCE in the year 2012
- Got Vysakh memorial cash prize in the year 2011 from TKMCE for the highest mark in the University Examination held up to VI semester
- Secured TKMCE Alumni merit award for topper in mechanical production engineering in the first, second, and third year of B Tech
- Qualified in GATE 2012 and 2013 (Mechanical)
- Reviewer of Computational Materials Science, Metallurgical and Materials Transactions A, Nature Scientific Reports, Journal of Alloys and Compounds, etc.

23/1/2025