# Abhishek Saraswat

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## Research Experience:

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| 09/2024 – Present: | **Graduate Research Assistant, Plasma Science and Fusion Center**<br>Massachusetts Institute of Technology, United States |
| 07/2020 – 08/2024: | **Scientific Officer-E, Fusion Blanket Division**<br>Institute for Plasma Research, Gandhinagar, India |
| 11/2017 - 06/2020: | **Scientific Officer-D, Fusion Blanket Division**<br>Institute for Plasma Research, Gandhinagar, India |
| 07/2015 - 10/2017: | **Engineer-SD, R&D in Fusion Blanket Technologies Division**<br>Institute for Plasma Research, Gandhinagar, India |
| 09/2011 - 06/2015: | **Engineer-SC, R&D in Fusion Blanket Technologies Division**<br>Institute for Plasma Research, Gandhinagar, India |
| 09/2010 - 08/2011: | **Technical Trainee**<br>Institute for Plasma Research, Gandhinagar, India |

## Academic Qualifications:

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| **Master of Science:** | **2024-2026 (expected)** |
| Research area: | Experimental quantification of hydrogen transport properties in molten FLiBe salt for advanced breeding blanket applications |
| Research supervisor: | Dr. Kevin Woller |
| Affiliation: | Plasma Science and Fusion Center (PSFC),<br>Department of Nuclear Science and Engineering |
| Institute: | Massachusetts Institute of Technology, United States |
| CGPA: | 4.5/5 (till Spring Term 2024-2025) |

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| **Master of Science (by Research):** | **2019-2022** |
| Thesis title: | Development of a two-phase detection probe for high temperature lead-lithium liquid metal applications (Thesis) |
| Thesis supervisor(s): | Professor Sateesh Gedupudi and Professor Paritosh Chaudhuri |
| Affiliation: | Heat Transfer and Thermal Power (HTTP) laboratory,<br>Department of Mechanical Engineering |
| Institute: | Indian Institute of Technology Madras, India |
| CGPA: | 9.4/10 |

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| **Bachelor of Engineering:** | **2006-2010** |
| Specialization: | Instrumentation & Control Engineering |
| Institute: | Netaji Subhas Institute of Technology, University of Delhi, India |
| Class: | First Class with Distinction (76.73%) |

## Research Interests:

- Liquid breeder blanket technologies
- Hydrogen transport in molten salts
- Customization of diagnostics for critical environments
- Instrumentation for nuclear fusion applications

## Research Projects:

- Hydrogen permeation studies in molten FLiBe salt
- Evaluation of ceramic insulators for liquid metal applications
- MHD and thermo-fluid investigations on liquid PbLi
- Two-phase flow diagnostics for high temperature liquid Pb/Pb-alloys
- High temperature, high pressure helium cooling system development
- Coolant purification and corrosion studies for liquid PbLi
- Automation and interlock system design for lab-scale liquid metal facilities

## Scholastic Achievements & Awards:

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| 2022 | **Institute Research Award** by Indian Institute of Technology Madras for quality research work |
| 2020 | **2nd prize under best paper category** awarded by Delhi Technological University for the paper *Experimental investigations on bubble detection in water-air two-phase vertical columns* at 2nd International Conference on Recent Advances in Mechanical Engineering |
| 2020 | **Certificate of achievement** by MITx, an online learning initiative of the Massachusetts Institute of Technology, for successfully completing course work on Nuclear Energy: Science, Systems and Society |
| 2006-07 | **Merit scholarships** (tuition fee waiver) awarded by Netaji Subhas Institute of Technology, University of Delhi for academic performance |
| 2006 | **All India Engineering Entrance Examination**, All India Rank 3208 (top 0.65% candidates) |
| 2005 | **3rd position** in 12th board (H.S.C.) in Jaipur region, India |
| 2003 | **5th position** in 10th board (S.S.C.) in Jaipur region, India |

## Peer Reviewed Journal Publications:

1. A. Saraswat, R. Bhattacharyay, P. Chaudhuri and S. Gedupudi, *Development of a test bed to investigate wetting behaviours of high-temperature heavy liquid metals for advanced nuclear applications*, Liquids, 5(4), 2025.
2. A. Saraswat, A. Fraile, S. Gedupudi, R. Bhattacharyay and P. Chaudhuri. *A comprehensive review of experimental and numerical studies on liquid metal-gas two-phase flows and associated measurement challenges*. Annals of Nuclear Energy, 213, 2025.
3. A. Deoghar, S. Verma, A. Saraswat, A. Prajapati, S. Gupta, A. Patel, H. Tailor, A. Gandhi, S. K. Sharma, V. Vasava and R. Bhattacharyay, *Preliminary assessment of the operational performance of the Pb-16Li heat extraction system*. Fusion Science and Technology, 81(5), 2025.
4. A. Patel, S. Verma, A. Saraswat, P. Satyamurthy, S. Malhotra, R. Bhattacharyay, S. Gupta, A. Prajapati, M. Kumar, T. S. Rao, A. Makwana, D. Sharma, A. Jaiswal, D. Mohanta, S. K. Sharma, V. Vasava, H. Tailor, A. Deoghar, S. Sahu, C. Dodiya, U. Prasad, A. Ranjan and S. Ranjith Kumar. *First operation of LLMHD loop with electromagnet for R & D MHD experiments*. Fusion Engineering and Design, 207, 2024.
5. A. Saraswat, R. Bhattacharyay, S. Gedupudi and P. Chaudhuri. *Design, fabrication and validation of an electrical conductivity principle based two-phase detection sensor array for molten lead (Pb) based heavy metal coolants up to 600°C*. Journal of Instrumentation, T05018, 19(5), 2024.
6. A. Saraswat, R. Bhattacharyay, P. Chaudhuri and S. Gedupudi. *Fabrication aspects and performance characterization of α-$Al_2O_3$/$AlPO_4$ based sandwich configuration flow channel inserts and coatings for high temperature liquid metal applications*. ASME Journal of Nuclear Engineering and Radiation Science, 10(3), 2024.

7. A. Deoghar, A. Prajapati, S. Verma, A. Saraswat, S. Gupta, D. Sharma, N. Kumar, C. Sasmal, V. Vasava, H Tailor and R. Bhattacharyay. *Development of lead lithium (Pb-16Li) alloy production system and characterization of the produced alloy.* Fusion Engineering and Design, 198, 2024.
8. B. K. Yadav, A. Gandhi, A. Saraswat, S. Verma and P. Chaudhuri. *Overview of the Experimental Helium Cooling (EHCL) System*. Fusion Engineering and Design, 196, 2023.
9. A. Saraswat, A. Prajapati, R. Bhattacharyay, P. Chaudhuri and S. Gedupudi. *Development of a compact multivariable sensor probe for two-phase detection in high-temperature PbLi-argon vertical columns*. Instruments and Experimental Techniques, 65(1), 2022.
10. A. Saraswat, C. Sasmal, A. Prajapati, R. Bhattacharyay, P. Chaudhuri and S. Gedupudi. *Experimental investigations on electrical-insulation performance of $Al_2O_3$ coatings for high temperature PbLi liquid metal applications*. Annals of Nuclear Energy, 167, 2022.
11. A. Deoghar, A. Saraswat, H. Tailor, S. Verma, S. Gupta, C. S. Sasmal, V. Vasava, S. Sahu, A. Prajapati and R. Bhattacharyay. *Entrapment of impurities inside a cold trap: A purification process for removal of corrosion impurities from molten Pb-16Li*. Nuclear Fusion, 61, 2021.
12. H. Patel, M. Panchal, A. Saraswat, N. Patel and P. Chaudhuri. *Simultaneous measurement of effective thermal conductivity and effective thermal diffusivity of $Li_2TiO_3$ pebble bed using transient hot-wire technique*. Fusion Engineering and Design, 171, 2021.
13. B. K. Yadav, K. T. Sandeep, A. Gandhi, A. Saraswat, D. Sharma and P. Chaudhuri. *Design updates for helium cooling system of Indian LLCB blanket*. Fusion Engineering and Design, 167, 2021.
14. M. Panchal, A. Saraswat and P. Chaudhuri. *Experimental measurements of gas pressure drop of packed pebble beds*. Fusion Engineering and Design, 160, 2020.
15. M. Panchal, A. Saraswat, S. Verma and P. Chaudhuri. *Measurement of effective thermal conductivity of lithium metatitanate pebble bed by transient hot-wire technique*. Fusion Engineering and Design, 158, 2020.
16. S. Ranjithkumar, B. K. Yadav, A. Saraswat, P. Chaudhuri, E. R. Kumar, A. Kunze and B. E. Ghidersa. *Performance assessment of the Helium cooled first wall mock-up in HELOKA facility*. Fusion Engineering and Design, 150, 2019.
17. A. K. Verma, B. K. Yadav, A. Gandhi, A. Saraswat, S. Verma and E. R. Kumar. *3D modelling of loop layout, pipe stress analysis and structural responses of high-pressure high-temperature Experimental Helium Cooling Loop (EHCL)*. Fusion Engineering and Design, 145, 2019.
18. A. Saraswat, A. V. Deoghar and R. Bhattacharyay. *Automation and interlock system design for Pb-Li liquid-metal purification experimental facility*. Fusion Engineering and Design, 141, 2019.
19. M. Kumar, A. Patel, A. Jaiswal, A. Ranjan, D. Mohanta, S. Sahu, A. Saraswat, P. Rao, T. S. Rao, V. Mehta, S. Ranjithkumar, R. Bhattacharyay, E. R. Kumar, S. Malhotra and P. Satyamurthy. *Engineering design and development of lead lithium loop for thermo-fluid MHD studies*. Fusion Engineering and Design, 138, 2019.
20. M. Panchal, A. Saraswat, S. Verma and P. Chaudhuri. *Estimation of effective thermal conductivity for lithium metatitanate ($Li_2TiO_3$) pebble beds using steady state axial heat flow methods*. Journal of Coupled Systems and Multiscale Dynamics, 6(4), 2018.
21. A. Deoghar, A. Jaiswal, P. Rao, S. Verma, C. Sasmal, S. Gupta, A. Saraswat, A. Prajapati, S. Sahu and R. Bhattacharyay. *Design, development and testing of prototype cold trap for Pb-16Li purification*. Fusion Engineering and Design, 137, 2018.
22. A. Saraswat, S. Verma, S. Gupta, A. Sarada Sree and E. R. Kumar. *Data-acquisition, control & interlock system design for corrosion experiments of IN-RAFM steel with flowing Pb-Li in presence of magnetic field*. Fusion Engineering and Design, 132, 2018.
23. A. Sarada Sree, A. Saraswat, C.S. Sasmal, S. Verma, A. Prajapati, A. Jaiswal, S. Gupta, J. Chauhan, K. Pandya, M. Makwana, H. Tailor, H. S. Agravat, P. Rao and E. R. Kumar. *Corrosion experiments on IN-RAFM steel in flowing lead-lithium for Indian LLCB TBM*. Fusion Engineering and Design, 132, 2018.
24. A. Saraswat, S. Sahu, T. S. Rao, A. Prajapati, S. Verma, S. Gupta, M. Kumar, R. Bhattacharyay and P. Das. *Development of diagnostics for high-temperature high-pressure liquid Pb-16Li applications*. World Journal of Nuclear Science and Technology, 7, 2017.
25. B. K. Yadav, A. Gandhi, A. K. Verma, T. S. Rao, A. Saraswat, E. R. Kumar, M. Sarkar and K. N. Vyas. *Conceptual design of experimental helium cooling loop for Indian TBM R&D experiments*. International Journal of Physical and Mathematical Sciences, 8(2), 2014.

## Peer Reviewed Book Chapters:

1. A. Saraswat, *Impact of technological localization on energy security through nuclear fusion*, In: Brears, R.C., Kottari, M. (eds) Palgrave Studies in Sustainable Futures: The Palgrave Handbook of Energy Transition and Renewable Energy, 2025, Palgrave Macmillan (accepted for publication).
2. A. Saraswat, C. Sasmal, A. Prajapati, R. Bhattacharyay, P. Chaudhuri and S. Gedupudi. *Electrically insulating corrosion-resistant tritium permeation barrier coatings for high temperature liquid metal breeders of nuclear fusion reactors*. In: Pakseresht, A., Kamalan Kirubaharan, A. M. (eds) Coatings for High-Temperature Environments: Anti-Corrosion and Anti-Wear Applications, 2024, Springer Cham (invited book chapter).
3. A. Saraswat, A. Prajapati, R. Bhattacharyay, P. Chaudhuri and S. Gedupudi. *Experimental investigations on bubble detection in water-air two-phase vertical columns*. In: Kumar, A., Pal, A., Kachhwaha, S. S., Jain, P. K. (eds) Recent Advances in Mechanical Engineering. Lecture Notes in Mechanical Engineering, 2021, Springer Singapore.

## International Conference Contributions:

1. H. Yang, J. Dark, A. Saraswat, W. Zhou, K. Woller, E. Peterson and R. Delaporte-Mathurin. *Validation of FESTIM hydrogen transport modeling in FLiBe through HYPERION permeation data*, Workshop on Digital Engineering for Fusion Energy Research, December 2025.
2. A. Saraswat, R. Bhattacharyay, P. Chaudhuri and S. Gedupudi. *Experimental investigations on the wetting behaviours of liquid metals for advanced nuclear applications*, 12th International Conference on Fluid Flow, Heat and Mass Transfer (FFHMT-2025), July 2025.
3. A. Saraswat, R. Bhattacharyay and S. Gedupudi. *Design, fabrication and assembly of a two-phase detection sensor array for molten lead (Pb) based heavy metal coolants*. 10th International and 50th National Conference on Fluid Mechanics and Fluid Power (FMFP-2023), December 2023.
4. B. K. Yadav, A. Gandhi, A. Saraswat, S. Verma, P. Chaudhuri and A. Sircar. *Overview of Experimental Helium Cooling (EHCL) system*. 29th IEEE Symposium on Fusion Engineering (SOFE-2021), December 2021.
5. A. Saraswat, C. Sasmal, A. Prajapati, R. Bhattacharyay, P. Chaudhuri and S. Gedupudi. *Experimental investigations on electrical-insulation performance of $Al_2O_3$ coatings for high-temperature lead-lithium liquid-metal applications*. 30th International Toki Conference on Plasma and Fusion Research (ITC30), November 2021.
6. A. Saraswat, A. Prajapati, R. Bhattacharyay, P. Chaudhuri and S. Gedupudi. *Development of compact multivariable sensor probe for two-phase detection in high-temperature lead-lithium/argon vertical columns*. 18th Multiphase Flow Conference and Short Course: Simulation, Experiment and Application (MPF-2021), November 2021.
7. A. Saraswat, A. Prajapati, R. Bhattacharyay, P. Chaudhuri and S. Gedupudi. *Development of a compact multivariable sensor probe for two-phase detection in high-temperature PbLi-Ar columns*. International Conference on Diagnostics for Fusion Reactors (ICFRD-2020), September 2021.
8. A. Deoghar A. Saraswat, H. Tailor, S. Verma, S. Gupta, C. Sasmal, V. Vasava, S. Sahu, A. Prajapati and R. Bhattacharyay. *Entrapment of impurities inside a cold trap: a purification process for removal of corrosion impurities from molten Pb-16Li*. 28th IAEA Fusion Energy Conference (FEC-2020), May 2021.
9. P. Chaudhuri, D. Sharma, B. K. Yadav, A. Srivastava, M. Panchal, C. Sasmal, A. Gandhi, R. Patel, A. Saraswat and A. Sircar. *Status of the design optimization, analysis and R&D activities of Indian HCSB blanket program*. 28th IAEA Fusion Energy Conference (FEC-2020), May 2021.
10. A. Saraswat, A. Prajapati, R. Bhattacharyay, P. Chaudhuri and S. Gedupudi. *Experimental investigations on bubble detection in water-air two-phase vertical columns*. 2nd International Conference on Recent Advances in Mechanical Engineering (RAME 2020), September 2020.
11. A. Patel, A. Kumar, H. Tailor, A. Saraswat, V. Chaudhari, S. Sahu, S. Gupta, A. Abhishek, R. Bhattacharyay and A. Sircar. *The experimental studies on the molten Pb-Li/water interaction*. International Conference on Plasma Science and Applications (ICPSA 2019), November 2019.
12. M. Panchal, A. Saraswat, S. Verma and P. Chaudhuri. *Estimation of effective thermal conductivity for lithium meta-titanate ($Li_2TiO_3$) pebble beds using steady state and axial heat flow methods*. 3rd International Workshop on Mechanics of Energy Materials (IWMEM-2018), November 2018.
13. A. K. Verma, B. K. Yadav, A. Gandhi, A. Saraswat, S. Verma and E. R. Kumar. *Preliminary pipe stress analysis of high pressure, high temperature Experimental Helium Cooling Loop (EHCL)*. 27th IAEA Fusion Energy Conference (FEC-2018), October 2018.

14. B. K. Yadav, A. Gandhi, A. Saraswat, D. Sharma, K.T. Sandeep and P. Chaudhuri. *Design optimization of helium cooling systems for Indian LLCB TBM*. 27th IAEA Fusion Energy Conference (FEC-2018), October 2018.
15. B. K. Yadav, A. Gandhi, A. Saraswat, S. Verma, T. S. Rao, A. K. Verma, D. Mohanta, U. Patel, P. Chaudhuri, E. R. Kumar, A. Sircar and S. Bhattacharya. *Development of Experimental Helium Cooling Loop (EHCL) for testing nuclear fusion blanket components*. 30th Symposium on Fusion Technology (SOFT-2018), September 2018.
16. M. Panchal, A. Saraswat, S. Verma, M. Makwana, P. Chaudhuri and E. R. Kumar. *Design and development of an experimental set-up for the measurement of the effective thermal conductivity of $Li_2TiO_3$ pebble bed by steady state and axial heat flow methods*. 13th International Symposium on Fusion Nuclear Technology (ISFNT-13), September 2017.
17. A. Saraswat, S. Sahu, T. S. Rao, A. Prajapati, S. Verma, S. Gupta, M. Kumar, R. Bhattacharyay and P. Das. *Development of sensors for high-temperature high-pressure liquid Pb/Pb-16Li applications*. 26th IAEA Fusion Energy Conference (FEC-2016), October 2016.
18. A. Deoghar, S. Sahu, A. Saraswat, T.S. Rao, S. Verma, A. Ranjan, A. Prajapati, V. Mehta, R. Bhattacharyay and P. Das. *Current status of R&D in liquid metal diagnostics development for Indian LLCB TBM*. 3rd International workshop on Measuring Techniques for Liquid Metal Flows (MTLM 2015), April 2015.

## National Conference Contributions:

1. A. Saraswat, R. Bhattacharyay, P. Chaudhuri and S. Gedupudi. *Fabrication aspects and characterization of sandwich configuration flow channel inserts for liquid metal applications upto 600°C*. 37th National symposium on Plasma Science and Technology (PLASMA 2022), December 2022.
2. B. K. Yadav, A. Gandhi, A. Saraswat, S. Verma and P. Chaudhuri. *Development of Experimental Helium Cooling Facility at IPR*. 37th National symposium on Plasma Science and Technology (PLASMA 2022), December 2022.
3. S. Verma, A. Deoghar, A. Patel, A. Saraswat, S. Gupta, T. S. Rao and R. Bhattacharyay. *Upgradation of instrumentation & control system for lead-lithium MHD experimental system*. 37th National symposium on Plasma Science and Technology (PLASMA 2022), December 2022.
4. B. K. Yadav, A. Gandhi, A. Saraswat, S. Verma and P. Chaudhuri. *Design updates and current status of installation works of Experimental Helium Cooling Loop (EHCL)*. 36th National symposium on Plasma Science and Technology (PLASMA 2021), December 2021.
5. H. Patel, M. Panchal, A. Saraswat and P. Chaudhuri. *Design and development of an experimental test facility based on transient hot wire techniques for effective thermal conductivity measurement of ceramic pebble beds*. 34th National symposium on Plasma Science and Technology (PLASMA 2019), December 2019.
6. M. Panchal, A. Saraswat and P. Chaudhuri. *Experimental measurements of gas pressure drop of packed pebble beds*. 34th National symposium on Plasma Science and Technology (PLASMA 2019), December 2019.
7. B. K. Yadav, A. Saraswat, A. Gandhi, S. Verma, P. Chaudhuri and A. Sircar. *Overview of the operational and control philosophy of the experimental helium cooling facility of IPR*. 34th National symposium on Plasma Science and Technology (PLASMA 2019), December 2019.
8. B. K. Yadav, S. Ranjithkumar, A. Saraswat, T. S. Rao, S. Gupta, P. Chaudhuri and E. R. Kumar. *Experimental program for testing TBM FW mock-up in HELOKA facility*. 33rd National symposium on Plasma Science and Technology (PLASMA 2018), December 2018.
9. T. S. Rao, S. Verma, A. Saraswat, D. Mohanta, A. Patel, R. Bhattacharyay and K. Mahajan. *Design and development of instrumentation & control system for lead-lithium MHD experimental loop*. 33rd National symposium on Plasma Science and Technology (PLASMA 2018), December 2018.
10. A. K. Verma, B. Yadav, A. Gandhi, S. Verma, A. Saraswat, T. S. Rao and E. R. Kumar. *Modelling and piping flexibility analysis of Experimental Helium Cooling Loop (EHCL)*. 32nd National symposium on Plasma Science and Technology (PLASMA 2017), November 2017.
11. B. K. Yadav, A. Gandhi, A. K. Verma, T.S. Rao, A. Saraswat, S. Y. Verma and E. R. Kumar. *Overview of high pressure, high temperature helium cooling system- an attractive coolant for fusion blankets*. 32nd National symposium on Plasma Science and Technology (PLASMA 2017), November 2017.
12. M. Kumar, A. Patel, A. Jaiswal, A. Ranjan, D. Mohanta, S. Sahu, A. Saraswat, T. S. Rao, V. Mehta, R. Bhattacharyay and E. R. Kumar. *Engineering Design and development of lead-lithium loop for thermo-fluid MHD studies*. 32nd National symposium on Plasma Science and Technology (PLASMA 2017), November 2017.
13. S. Kanjiya, M. Panchal, A. Saraswat, M. Makwana and P. Chaudhuri. *Study of effective thermal conductivity of lithium meta-titanate and aluminium oxide pebble beds by transient hot wire method*. 32nd National symposium on Plasma Science and Technology (PLASMA 2017), November 2017.

14. A. Kumar, V. Mehta, A. Saraswat, K. T. Sandeep, S. Verma, R. Bhattacharyay, A. Prajapati, A. Jaiswal and S. Gupta. *Preliminary investigations on turbulent heat transfer to lead-lithium in developing flow regime*. 30th National symposium on Plasma Science and Technology (PLASMA 2015), December 2015.
15. S. Verma, A. K. Verma, A. Saraswat, J. Chauhan and E.R. Kumar. *Experimental determination of effectiveness of thermal insulating materials for high temperature process pipes in LLCB TBS*. 30th National symposium on Plasma Science and Technology (PLASMA 2015), December 2015.
16. T. S. Rao, A. Saraswat and D. Mohanta. *Instrumentation & control system architecture for Experimental Helium Cooling Loop*. 30th National symposium on Plasma Science and Technology (PLASMA 2015), December 2015.
17. A. Saraswat, T. S. Rao, S. Sahu, A. Prajapati, S. Gupta, R. Bhattacharyay and E. R. Kumar. *Testing of process sensors for high temperature liquid metal applications*. 29th National symposium on Plasma Science and Technology (PLASMA 2014), December 2014.
18. T. S. Rao, A. Saraswat, D. Mohanta and E. R. Kumar. *Preliminary design for instrumentation & control for Experimental Helium Cooling System*. 29th National symposium on Plasma Science and Technology (PLASMA 2014), December 2014.

## Journals & Books Refereed:

1. Journal of Micromechanics and Microengineering (IOP)
2. Transactions of the Institute of Measurement and Control (SAGE)
3. Journal of Physics D: Applied Physics (IOP)
4. Fusion Engineering and Design (Elsevier)
5. Measurement Science and Technology (IOP)
6. IEEE Transactions on Plasma Science (IEEE)
7. Nuclear Science and Techniques (Springer)
8. Coatings for High Temperature Environments (Springer)

## Membership of Professional Organizations:

1. American Nuclear Society
2. Plasma Science Society of India