

Dr. Ranjan Kumar Barik is a Chief Scientist (Scientist-G) at CSIR-Central Electronics Engineering Research Institute (CSIR-CEERI), Pilani, and a Professor at the Academy of Scientific and Innovative Research (AcSIR). He has more than 21 years of research and development experience in the field of high-power microwave devices.

He completed his B.Tech. in 2001 from the Institute of Radio Physics and Electronics (IRPE), University of Calcutta, Kolkata, and his M.Tech. in 2003 from the Indian Institute of Technology (IIT) Roorkee. In 2005, he joined CSIR-CEERI, Pilani, as a Scientist. He earned his Ph.D. in Electrical Engineering and Computer Science from Seoul National University, South Korea, in 2014.

Currently, Dr. Barik leads the Applied Electronics Group at CSIR-CEERI. His research focuses on the development of advanced electron emitters and cathodes for high-power microwave tubes and satellite thrusters. He is also actively involved in the development of various electronic and plasma-based systems, including Microwave Plasma Chemical Vapor Deposition (MPCVD) systems, microwave plasma torches, essential oil extraction systems, plasma lamps, green hydrogen generation systems, X-ray tubes, and Atomic Layer Deposition (ALD) systems.

Over the years, he has successfully led more than 18 sponsored research projects funded by organizations such as CSIR, DST, DRDO, and ISRO. His work has resulted in several patents and technology developments. Dr. Barik has published over 75 research articles in reputed journals and presented more than 180 papers at national and international conferences. He is also deeply involved in academic mentoring, having supervised four Ph.D. scholars and guided more than 40 M.Tech., M.Sc., and B.Tech. students.

CSIR-CEERI:

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Google Scholar Link:

https://scholar.google.com/citations?hl=en&user=8Z3qrLYAAAAJ&view_op=list_works&gmla=ACrTK9UoHLICuCLY9u09f7Q6g-35tBC76VPM7atHhHLYROJcLI5fXNbG8GZD6rxdV9GI6rNgXcNcJISsYQD--nj3tUHnr3CqsLPLFagpa7b1CsznxXqWhSUIt0rE-c-fjyN3ixwwp1iS1JNbIT-n88NniUCH2nA

Research Gate Link:

<https://www.researchgate.net/profile/Ranjan-Barik-3>

Educational Qualifications:

- **Ph.D. (2014)**
Electrical Engineering and Computer Science, Seoul National University, South Korea
Thesis Title: Experimental study on nanoparticle-based high current density cathode for terahertz devices.
- **M.Tech. (2003)**
Microwave and RADAR
Indian Institute of Technology (IIT), Roorkee, Roorkee
- **B.Tech. (2001)**
Electronics & Communication.
Institute of Radiophysics and Electronics, University of Calcutta, Kolkata (W.B.)
- **B.Sc. (1998)**
Physics (Hons.).
University of Calcutta, Kolkata (W.B.)

Areas of Research Interest

- Electron Emitter/ Cathode: Thermionic Cathode, Cold Cathode
- System Development: development of various electronic and plasma-based systems, including:
 - ✓ Microwave Plasma Chemical Vapor Deposition (MPCVD) systems,
 - ✓ Microwave plasma torches,
 - ✓ Essential oil extraction systems,
 - ✓ Plasma lamps,
 - ✓ Green hydrogen generation systems,
 - ✓ X-ray tubes, and
 - ✓ Atomic Layer Deposition (ALD) systems

Experience: Foreign Deputations

Sept. 15, 2024 – Dec 15, 2024: • Visited Ostbayerische Technische Hochschule (OTH), Regensburg, Germany under the "CSIR-German Academic Exchange Service (DAAD) Bilateral Exchange of Scientists/Academics program - 2023"

R&D Projects As Project Coordinator/Principal Investigator/Co-Principal Investigator: 39

- **Development of dispenser cathode for high power MW Tubes.** CSIR 12th five Year NW Project.
- **Development and characterization of multi-beam cathode (MBC) and supply of triple alloy coating unit.** MTRDC, DRDO sponsored project.
- **Technology Development of High Current Density Nano- Scandate Cathodes.** MTRDC, DRDO sponsored project.
- **Development of thermionic emitter for high thrust electric propulsion system.** VSSC, ISRO sponsored project.
- **Design & Development of WF Measurement for Thermionic Emitter for ISRO's EPS.** VSSC, ISRO sponsored project.
- **Design and Development of Dispenser Cathodes for Microwave Tubes.** CSIR FTT Project.
- **Investigation on Nano-Technology based Thermionic Cathode for High Power Vacuum Electron Devices (VEDs).** DST sponsored project.
- **Development of technology for small size M-type Dispenser cathode for TWT.** CSIR IDEAL Mission project.
- **Development of high emission density nano-technology based scandate cathode for high power mm wave devices.** CSIR-NCP Project
- **Compact photonic crystal (PhC) based W-Band source.** CSIR-NCP Project.
- **Pyrolysis of methane towards green Hydrogen generation,** CSIR Hydrogen Mission project.
- **Development of microwave-based system for extraction of essential oil.** CSIR-Aroma mission project.
- **Development of Dispenser Cathode for S-Band TWT,** BEL Bengaluru sponsored project.
- **Design and development of hollow cathode assembly for the emission characterization and work function measurement of LaB₆ emitter.** VSSC, ISRO sponsored project.
- **Development of Field-Emitter based Next Generation X-Ray Tube Technology for Medical and Industrial Applications.** CSIR FIRST mode project.
- **Development and Supply of Thermionic Emitter For High Thrust Electric Propulsion System.** VSSC, ISRO sponsored project.
- **Development of M-type dispenser cathode Assembly for travelling wave tube application.** VSSC, ISRO sponsored project.

Patents/Copyrights

- S.K. Shukla, R.K. Barik, R. S. Raju, " Synthesis of Re & Sc Doped Impregnant Mixed Tungsten Nano-Powder For Application of Cathode in THZ Region" Application No: 201611005494 Filed on dated 17/02/2016, Published on dated 26.01.2018, Granted on 17.07.2023 (Patent No: 439147).
- R. S. Raju, R.K. Barik, B. Ram, V. Srivastava " Method for suppressing undesired modes in rf cavity structures" Application No: 202041026022 Filed on dated 19/06/2020, Published on dated 10.07.2020.
- R. S. Raju, R.K. Barik, "Method Of Fabrication Of Multi-Beam Cathode Pellet Using Edm Process" Application No: 202141014355 Filed on dated 30.03.2021, Published on dated 16.04.2021.
- R. K. Barik, S. K. Shukla, A. K. Singh, R. Prajesh, "A software tool for CPD cathode coverage area". Copyright diary number: 12005/2022-CO/SW.
- Chowdhury, S., Manna, S., Kumar, B., Khatun, H., Barik, R.K., Bera, A., Bandyopadhyay, A.K., Panchariya, P.C., (2023). Microwave Assisted System for Liquid Aromatic Compound Extraction. (Indian Patent No. 202311083346). Indian Patent Office. Dated -06/12/2023
- Subham Chowdhury, Subhrajit Manna, Bijendra Kumar, Hasina Khatun, Ranjan Kumar Barik, Ayan Kumar Bandyopadhyay, Anirban Bera, Poonam Chand Panchariya , "Microwave assisted plasma System and method for green Hydrogen generation," (Indian Patent No. 202411008771). Indian Patent Office. Dated -08/02/2024
- Subham Chowdhury, Subhrajit Manna, Arvind Kumar Singh, Ashok Chauhan, Hasina Khatun, Ranjan Kumar Barik, Ayan Kumar Bandyopadhyay, Anirban Bera, Poonam Chand Panchariya, "A Power to X (Hydrogen) Apparatus for High Volume Hydrogen Rich Fluid Decomposition," Filed on 21.06.2024.
- Subhrajit Manna, Subham Chowdhury, Hasina Khatun, Ranjan Kumar Barik, Ayan Kumar Bandyopadhyay, Anirban Bera, Poonam Chand Panchariya, "An integrated-system and Process for Catalyst-free Fabrication of High-Purity Carbon Nano Particle-based Free-Standing field-Emitter film" Filed on 09.08.2025. Application number: 202511085270.

Books/Chapters

- "Cathode Technologies for Terahertz Source," Advances in Terahertz Source Technologies, Jenny Stanford Publishing Pte. Ltd., Edition -01, 2023.

Publications

2013:

1. R.K. Barik, A. Bera, A.K. Tanwar, I.K. Baek, S.H. Min, O.J. Kwon, W.S. Lee, G.-S. Park, "A novel approach to synthesis of scandia-doped tungsten nano-particles for high-current-density cathode applications," International Journal of Refractory Metals and Hard Materials, vol. 38, pp. 60-66, May 2013. DOI: [10.1016/j.ijrmhm.2012.12.009](https://doi.org/10.1016/j.ijrmhm.2012.12.009)
2. R.K. Barik, A. Bera, R.S. Raju, A.K. Tanwar, I.K. Baek, S.H. Min, O.J. Kwon, M.A. Sattarov, K.W. Lee, G.-S. Park, "Development of alloy-film coated dispenser cathode for terahertz vacuum electron devices application," Applied Surface Science, vol 276, pp 817-822, July 2013. DOI: [10.1016/j.apsusc.2013.04.004](https://doi.org/10.1016/j.apsusc.2013.04.004)

2014:

3. A. Bera, R. K. Barik, M. A. Sattarov, O. Kwon, S. H. Min, I.-K. Beak, S. Kim, J.-K. So, and G.-S. Park, "Surface-coupling of Cerenkov radiation from a modified metallic metamaterial slab via Brillouin-band folding," Optics Express, 2014. DOI: [10.1364/OE.22.003039](https://doi.org/10.1364/OE.22.003039)

4. R. K. Barik, S. K. Shukla, M. S. Bisht, A. K. Singh, R. S. Raju, "Dispenser Cathodes for Terahertz Vacuum Devices Application," *International Journal of Electronics & Communication Technology*, Vol. 5, Issue Spl - 2, Jan - March 2014.
5. [Ohjoon Kwon](#), [Matlabjon Abdurahimovich Sattorov](#), [Sun-Hong Min](#), [In-Keun Baek](#), [Seontae Kim](#), [Anirban Bera](#), [R. K. Barik](#), [Ranajoy Bhattacharya](#), [Jin-Young Jeong](#), [Jong-Hyo Won](#), [Gun-Sik Park](#), "Efficient terahertz oscillation using a half-period staggered grating resonator," *Japanese Journal of Applied Physics*, 53(6), April 2014.
DOI: [10.7567/JJAP.53.066201](#)

2015:

6. A. K. Singh, M. Ravi, M. S. Bisht, R. K. Barik, S. K. Shukla, R. Prajesh, T. P. Singh, S. K. Saini, and R. S. Raju, "Study and Development of Active Sintered Controlled Porosity Dispenser Cathode," *IEEE Transactions on Electron Devices*, vol.62,no.11, pp. 3837 - 3843, November 2015.
DOI: [10.1109/TED.2015.2478970](#)

2016:

7. R. K. Barik, A. K. Singh, S. K. Shukla, T. P. Singh, R. S. Raju, and G.-S. Park, "Development of Nanoparticle-Based High Current Density Cathode for THz Devices Application," *IEEE Transactions on Electron Devices*, vol.63,no.4, pp. 1715 - 1721, April 2016.
DOI: [10.1109/TED.2016.2524539](#)
8. S. K. Pradhan, J. Kalidoss, R. Barik, B. Sivaiah, A. Dhar, S. Bajpai, "Development of high density tungsten based scandate by Spark Plasma Sintering for the application in microwave tube devices," *International Journal of Refractory Metals and Hard Materials*, vol. 61, pp. 215-224, Sept 2016.
<http://dx.doi.org/10.1016/j.ijrmhm.2016.09.002>
9. S. K. Shukla, A. K. Singh, T. P. Singh, S. K. Saini R. K. Poonia, R. S. Raju, and R. K. Barik, "Study and Development of Yttrium-Doped Nanoscandate Cathode for High-Power VEDs," *IEEE Transactions on Electron Devices*, vol.63, no.12, pp. 4975 - 4980, Dec 2016.
DOI: [10.1109/TED.2016.2619353](#)

2017:

10. S.-H. Min, O. Kwon, M. Sattorov, H. Jung, I.-K. Baek, S. Kim, A. Bera, R. K. Barik, R. Bhattacharya, and G.-S. Park, "Design Study of GW-THz Wave Transmission Without Mode Competition in an Oversized Relativistic Backward Wave Oscillator," *IEEE Transactions on Plasma Science*, vol. 45, No. 4, pp. 610 - 622, April 2017. DOI: [10.1109/TPS.2017.2665523](#)
11. S. K. Pradhan, R. Barik, "Observation of the magneto-transport property in a millimeter-long topological insulator Bi₂Te₃ thin-film Hall bar device," *Applied Materials Today*, vol 7, pp 55-59, June 2017. DOI: <http://dx.doi.org/10.1016/j.apmt.2017.02.002>
12. A. K. Singh, S. K. Shukla, M. S. Bisht, S. E. Rahaman, J. Kalidoss, M. Debata & R. K. Barik, "Synthesis and characterization of nano-brazing alloy for thermionic dispenser cathode application," *Journal of Electromagnetic Waves and Applications*, Jul 2017. DOI: [10.1080/09205071.2017.1357505](#)

13. S.-H. Min, O. Kwon, M. Sattarov, H. Jung, I.-K. Baek, S. Kim, J.-Y. Jeong, J. Jang, D. Hong, R. Bhattacharya, R. K. Barik, A. Bera, S. Park, J. Ahn, S.-H. Lee, Y.-J. Yoon, & G.-S. Park, "Effects on electronics exposed to high-power microwaves on the basis of a relativistic backward-wave oscillator operating on the x-band," *Journal of Electromagnetic Waves and Applications*, Jul 2017. DOI: [10.1080/09205071.2017.1354728](https://doi.org/10.1080/09205071.2017.1354728)
 14. S. E. Rahaman, R. K. Barik, A. K. Singh, S. K. Shukla, S.-H. Min & G.-S. Park (2017): Design of high efficiency and high thrust grid system for ion thruster, *Journal of Electromagnetic Waves and Applications*, DOI: [10.1080/09205071.2017.1349002](https://doi.org/10.1080/09205071.2017.1349002)
 15. S. E. Rahaman, A. K. Singh, S. K. Shukla, and R. K. Barik, "Analytical Modeling of Low Erosion Extraction Grid for Ion Thruster," *IEEE Transactions on Plasma Science*, vol. 45, No. 11, pp. 2974 - 2978, Nov 2017. DOI: [10.1109/TPS.2017.2752260](https://doi.org/10.1109/TPS.2017.2752260).
- 2018.
16. S.-H. Min, O. Kwon, M. Sattarov, I.-K. Baek, S. Kim, D. Hong, J.-Y. Jeong, J. Jang, A. Bera, R. K. Barik, R. Bhattacharya, I. Cho, B. Kim, C. Park, W. Jung, S. Park, and G.-S. Park, "Transient pulse analysis of ionized electronics exposed to γ -radiation generated from a relativistic electron beam," *AIP ADVANCES* 8, 025001, Feb 2018, <https://doi.org/10.1063/1.5018727>
- 2019.
17. S-H Min, O Kwon, M Sattarov, S Kim, D Hong, C Park, B H Hong, I-S Jung, I Cho, W-T Hwang, R K Barik, A Bera, and G-S Park, "Low-level RF control of a klystron for medical linear accelerator applications," *AIP Advances*, s 9, 025012, Feb. 2019; doi: 10.1063/1.5084172.
 18. S. K. Shukla, A. K. Singh, & R. K. Barik, "Synthesis of Rhenium-Scandia Doped Tungsten Nano-Particles for Shrinkage Investigation," *Journal of Sol-Gel Science and Technology*, 2019.
 19. S. K. Shukla, A. K. Singh, S. K. Pradhan, R. K. Barik, "Design and development of thermionic emission microscope for the characterization of multi-beam cathode, *Ultramicroscopy*, vol. 22, pp. 140-147, July 2019. <https://doi.org/10.1016/j.ultramic.2019.04.012>
- 2020.
20. S. K. Shukla, A. K. Singh, and R. K. Barik, "Synthesis of Rhenium–Scandia doped tungsten nanoparticles for shrinkage investigation," *Journal of Sol-Gel Science and Technology*, 95, pp 384-392, Feb 2020. DOI: <https://doi.org/10.1007/s10971-020-05253-8>
 21. A. K. Singh, S. K. Shukla, M. Ravi, and R. K. Barik, "A Review of Electron Emitters for High-Power and High-Frequency Vacuum Electron Devices," *IEEE Transactions on Plasma Science*, vol. 48, No. 10, pp. 3446 - 3454, October 2020. DOI: 10.1109/TPS.2020.3011285.
- 2021.
22. S-H Mina, O Kwon, M Sattarov, S Kim, I-K Baek, S Park, R K Barik, A Bera, D Hong, S Kim, B H Hong, C Park, S Maa, M K Kyo, C Lee, Y J Lee, H B Kwon, Y J Yood, and G-S Park, "Cell-type continuous electromagnetic radiation system generating millimeter waves for active denial system applications," *Defence Technology*, November 2021. DOI: <https://doi.org/10.1016/j.dt.2021.10.014>
- 2022.
23. A. K. Singh, S. K. Shukla, V. S. Rawat, T. P. Singh, S. Manna, and R. K. Barik, Graphene-Based High Current Density Electron Emitters for THz-VEDs, *IEEE TRANS.ON PLASMA SCIENCE*, USA VOL. 50(9), 2864-2869, 2022, DOI: 10.1109/TPS.2022.3198790
- 2025.

24. S. Manna, V. S. Rawat, A. K. Singh, S. K. Shukla, Senior Member, IEEE, T. P. Singh, and **R.K. Barik**, "Copper Doped Reduced Graphene Oxide for Field Emitter Application," IEEE Trans. On Plasma Science, Vol. 53, No. 11, pp. 3313-3318, November 2025, DOI: 10.1109/TPS.2025.3612704. 2026.
25. **S. Chowdhury**, N. Kumar, H. Khatun, R. Kumar Barik, A. Kumar Bandyopadhyay and A. Bera, "Catalyst-Free Methane Decomposition Using Microwave-Assisted Plasma: A Simple Green Solution Toward Mitigation of Greenhouse Gases," in IEEE Transactions on Plasma Science, DOI: 10.1109/TPS.2026.3652587.
26. S. Chowdhury, H. Khatun, R. K. Barik, A. K. Bandyopadhyay, and A. Bera, "Microwave assisted extraction of essential oil: An approach towards green technology," in Journal of Electromagnetic Waves and Applications TEWA, DOI: <https://doi.org/10.1080/09205071.2026.2631110>.
27. S. Chowdhury, H. Khatun, R. Kumar Barik, A. Kumar Bandyopadhyay and A. Bera, "High-Throughput Catalyst-Free Microwave-Assisted Plasma Cracking of Methane for Carbon and Hydrogen Recovery," unpublished manuscript. (Under Review)