

DR. MUHAMMAD IMRAN RAFIQ

Ph.D. Chemical Engineering & Technology

Assistant Professor | Department of Chemical Engineering | COMSATS University
Islamabad, Lahore Campus

Research & Development Scientist | National Batteries Pvt. Ltd., Pakistan

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ACADEMIC & PROFESSIONAL PROFILE

Ph.D. Chemical Engineer with 16 years of academic and industrial experience in teaching, research, student supervision, energy-storage technology, and industrial R&D. Currently serving as Assistant Professor at COMSATS University Islamabad, Lahore Campus. Research expertise includes batteries, hybrid supercapacitors, functionalized carbon electrodes, sustainable 3D electrodes, and electrochemical energy storage. Experienced in academic-industry collaboration, research project development, laboratory management, and technology-oriented research.

PROFESSIONAL SNAPSHOT

- **Publications:** 17 Peer-Reviewed International Journal Publications
- **Supervision:** MS & PhD Co-Supervision | Interdisciplinary Research
- **Research Funding:** COMSATS Research Grant — PKR 300,000
- **Industry:** R&D Scientist, National Battery Industries Pvt. Ltd.
- **Research:** Batteries | Hybrid Supercapacitors | Advanced Electrodes | Energy Storage
- **Experience:** 16 Years — Academia, Research & Industry
- **Qualification:** Ph.D. Chemical Engineering & Technology, NJUST, China
- **Academic Position:** Assistant Professor, Chemical Engineering, COMSATS University Islamabad, Lahore Campus

CURRENT APPOINTMENTS

Assistant Professor, Department of Chemical Engineering — COMSATS University Islamabad, Lahore Campus | *January 2023 – Present*

Research & Development Scientist — National Batteries Pvt. Ltd., Pakistan | *Industrial & Academic Collaboration*

EDUCATION

Ph.D. in Chemical Engineering & Technology — Nanjing University of Science and Technology (NJUST), Jiangsu, China | *Fall 2016 – Spring 2022*

Doctoral Thesis: *Development of Functionalized Carbon Composites Electrodes for Energy Storage in Supercapacitors*

ACADEMIC & INDUSTRIAL EXPERIENCE

Assistant Professor, Chemical Engineering — COMSATS University Islamabad, Lahore Campus | *January 2023 – Present*

- Deliver undergraduate and graduate-level teaching in Chemical Engineering and related interdisciplinary areas.
- Supervise and mentor students working on advanced electrode fabrication, green-template-based electrodes, and energy-storage materials.
- Contribute to academic research, laboratory activities, research project development, and technology-oriented collaboration.

Lecturer, Chemical Engineering — COMSATS University Islamabad, Lahore Campus | *July 2015 – September 2016*

Research Associate — COMSATS University Islamabad, Lahore Campus | *July 2010 – July 2015*

- Laboratory establishment and management.

TEACHING EXPERIENCE

- CHE141 — General Engineering Laboratory for Chemical Engineers
- HUM434 — Chinese, BBA
- CHE471 — Renewable Energy Sources
- CHE333 — Simultaneous Heat and Mass Transfer

RESEARCH AREAS

- Electrochemical energy storage and advanced energy-storage materials
- Hybrid supercapacitors and battery technologies
- Functionalized carbon composite electrodes
- Freestanding and sustainable 3D electrode architectures using green/biomass templates
- Carbon-based functional materials and electrode development
- Electrochemical characterization and performance evaluation
- Energy-storage technology development and environmental pollution reduction

Research Profile Snapshot (ResearchGate, accessed September 2026): 17 publications and 427 citations; profile focuses on electrochemical supercapacitors, hybrid supercapacitors, 3D graphene, and energy harvesting/storage.

RESEARCH, INDUSTRIAL & ELECTROCHEMICAL EXPERTISE

- Technology development for energy storage using green templates for electrode preparation.
- Design, development, and operation of biomass preparation routes for environment-friendly 3D electrodes and their upgrading technologies.
- Electrochemical characterization using two-electrode and three-electrode systems, including potential window, discharge time, capacitance, retention, electrochemical impedance spectroscopy (EIS), cyclic stability, energy density, and power density.
- Battery cycling, cyclic voltammetry, chronoamperometry, and pulse techniques.
- Research and Development project management and academic–industrial collaboration.

- Laboratory establishment, routine maintenance, and training of students and scientific personnel.

ANALYTICAL & CHARACTERIZATION SKILLS

- Transmission Electron Microscopy (TEM): nanoscale characterization, sample preparation, and post-collection data manipulation; advanced theoretical and hands-on training.
- Scanning Electron Microscopy (SEM): field-emission SEM with EDAX Energy Dispersive Spectroscopy and Electron Backscatter Diffraction experience.
- BET surface-area analysis: operation, routine maintenance, and training of students/scientific personnel.
- Thermogravimetric Analysis (TGA).
- FTIR spectroscopy, Powder X-ray Diffraction (XRD), Optical Microscopy, and basic Gas Chromatography (GC) operation.

PROFESSIONAL & TECHNICAL CERTIFICATIONS

- 2D and 3D Drafting — AutoCAD, National Institute of Design and Analysis, Lahore, Pakistan.
- Process Simulation — HYSYS, National Institute of Design and Analysis, Lahore, Pakistan.

PEER-REVIEWED JOURNAL PUBLICATIONS

Publications are presented in IEEE reference style and arranged from latest to earliest.

- [1] I. Sultana, I. Rao, S. Ilyas, S. Ramzan, Q. Abbas, I. Rafiq, A. Mir, H. Latif, S. Akhtar, S. Q. Hussain, and A. Razaq, “Eco-friendly and highly porous Cu-doped ZnO electrodes for high-performance DSSCs,” JOM, 2026, doi: 10.1007/s11837-026-08403-5.
- [2] S. A. Ehsan, S. Anwar, G. Amin, I. Rafiq, K. Taufail, and A. Mir, “Preparation of biomass base 3D hybrid flexible electrode with improved super capacitive performance via in situ polymerization of polyaniline,” J. Appl. Polym. Sci., vol. 143, no. 1, p. e57936, 2026, doi: 10.1002/app.57936.
- [3] S. Ilyas, I. Sultana, F. Kainat, W. Ali, M. Batool, M. Habib, I. Rafiq, F. Iqbal, S. Akhtar, and A. Razaq, “ZnO and carbon nanotubes-based freestanding binder-free paper electrodes for environmentally safe energy storage devices,” Ionics, vol. 31, pp. 11229–11241, 2025, doi: 10.1007/s11581-025-06595-5.
- [4] R. Khan, Y. A. Haleem, M. I. Rafiq, N. Abbas, A. Zeb, S. Sahar, M. A. Habila, S. Farooq, A. Mir, M. F. Saleem, and M. Habib, “Synthesis of HfSe₂ and CuHfSe₂ crystalline materials using the chemical vapor transport method and their applications in supercapacitor energy storage devices,” Nanotechnology Reviews, vol. 14, no. 1, p. 20250198, 2025, doi: 10.1515/ntrev-2025-0198.
- [5] S. Ilyas, F. Kainat, S. Manzoor, I. Sultana, I. Rafiq, N. Ahmad, S. M. Ramay, and A. Razaq, “Electrodeposition of fabricated tin sulfide nanoparticles on graphene oxide and natural fibers based robust freestanding electrodes for flexible energy storage devices,” J. Electroceram., vol. 53, pp. 393–403, 2025, doi: 10.1007/s10832-025-00404-1.
- [6] G. Amin, S. Anwar, I. Rafiq, A. Mir, M. Idress, and S. A. Ehsan, “Fabrication of 3D flexible electrode derived from biomass material for hybrid supercapacitor via electrospinning,” JOM, vol. 77, no. 7, pp. 4932–4942, 2025, doi: 10.1007/s11837-025-07385-0.
- [7] R. Siddiqui, M. Rani, A. A. Shah, M. I. Rafiq, S. N. U. Bukhari Shah, and M. A. Khan, “Synergistic electrochemical and optical properties of a UVC class quaternary nanocomposite incorporating

graphene oxide and samarium chromium oxide perovskite,” *Diamond Relat. Mater.*, vol. 147, p. 111222, 2024, doi: 10.1016/j.diamond.2024.111222.

- [8] M. Habib, S. Ullah, F. Khan, M. I. Rafiq, A. S. Balobaid, T. Alshahrani, and Z. Muhammad, “Supercapacitor electrodes based on single crystal layered ZrX_2 ($X = S, Se$) using chemical vapor transport method,” *Mater. Sci. Eng. B*, vol. 298, p. 116904, 2023, doi: 10.1016/j.mseb.2023.116904.
- [9] Z. Ullah, F. Kainat, S. Manzoor, H. Liaquat, A. Waheed, S. Akhtar, I. Rafiq, S. H. M. Jafri, H. Li, and A. Razaq, “Natural fibers and zinc hydroxystannate 3D microspheres based composite paper sheets for modern bendable energy storage application,” *J. Appl. Polym. Sci.*, vol. 140, no. 1, p. 53275, 2022.
- [10] A. Ali, M. I. Rafiq, B. Zhou, and W. Tang, “Evaluating the impact of Hartree-Fock exact exchange on the performance of global hybrid functionals for the vertical excited-state energies of fused-ring electron acceptors using TD-DFT,” *Phys. Chem. Chem. Phys.*, vol. 24, pp. 21270–21282, 2022, doi: 10.1039/D2CP02228A.
- [11] T. Farid, Y. Wang, M. I. Rafiq, A. Ali, and W. Tang, “Porous flexible wood scaffolds designed for high-performance electrochemical energy storage,” *ACS Sustainable Chem. Eng.*, vol. 10, no. 21, pp. 7078–7090, 2022, doi: 10.1021/acssuschemeng.2c01108.
- [12] T. Farid, M. I. Rafiq, A. Ali, and W. Tang, “Transforming wood as next-generation structural and functional materials for a sustainable future,” *EcoMat*, vol. 4, no. 1, p. e12154, 2022, doi: 10.1002/eom2.12154.
- [13] A. Ali, M. I. Rafiq, B. Zhou, and W. Tang, “Evaluating the nature of vertical excited-states of fused ring electron acceptors using TD-DFT and density-based charge transfer,” *Phys. Chem. Chem. Phys.*, vol. 23, pp. 15282–15291, 2021, doi: 10.1039/D1CP01917A.
- [14] M. I. Rafiq, X. Wang, T. Farid, J. Zhou, J. Tang, and W. Tang, “Carbonyl-enriched hierarchical carbon synergizes redox electrolyte for highly-efficient and stable supercapacitors,” *Chem. Commun.*, vol. 57, pp. 3716–3719, 2021, doi: 10.1039/D0CC08432H.
- [15] A. Ali, M. I. Rafiq, Z. Zhang, J. Cao, R. Geng, B. Zhou, and W. Tang, “TD-DFT benchmark for UV-visible spectra of fused-ring electron acceptors using global and range-separated hybrids,” *Phys. Chem. Chem. Phys.*, vol. 22, pp. 7864–7874, 2020, doi: 10.1039/D0CP00060D.
- [16] M. I. Rafiq, T. Farid, J. Zhou, A. Ali, J. Tang, and W. Tang, “Carbonized wood-supported hollow $NiCo_2S_4$ eccentric spheres for high-performance hybrid supercapacitors,” *J. Alloys Compd.*, vol. 811, p. 151858, 2019, doi: 10.1016/j.jallcom.2019.151858.
- [17] Y. Yuan, J. Zhou, M. I. Rafiq, M. Si, J. Dai, J. Tang, and W. Tang, “Growth of Ni–Mn layered double hydroxide and polypyrrole on bacterial cellulose nanofibers for efficient supercapacitors,” *Electrochim. Acta*, vol. 295, pp. 82–91, 2019, doi: 10.1016/j.electacta.2018.10.090.

STUDENT SUPERVISION

MS Student — Sidra Iqbal — An Efficient Energy Storage Electrode from Conversion of MOF (Metal Organic Framework) to CNTs (Carbon Nanotubes) on Green Template.

MS Student — Asifa Iqbal — Fabrication of Green Template Based Flexible Electrodes for Hybrid Supercapacitors.

BS Students — Suffa Mukarram & Hafsa — Functionalization of wood chips for organic-based energy storage appliances.

MS — Ramsha Nain (M.S. Chemistry, CUI Lahore Campus) Co-Supervisor. Thesis: “The Use of Conductive Polymer Composite to Enhance the Cyclic Life of Energy Storage Devices.”

MS — Ameer Hamza (M.S. Physics, CUI Lahore Campus) Co-Supervisor. Thesis: “Synthesis of Energy Efficient Free-Standing Electrode for Supercapacitors.”

PhD — Shazima Shahid (Ph.D. Physics, CUI Lahore Campus) Co-Supervisor and Member, Supervisory Committee.

ACADEMIC, RESEARCH & PROFESSIONAL STRENGTHS

- Undergraduate and graduate teaching, academic mentoring, and student supervision.
- Research and Development project management and technology-oriented research.
- Publication of research in international peer-reviewed journals.
- Academic–industry collaboration and multidisciplinary project participation.
- Laboratory establishment, management, maintenance, and scientific training.
- Communication, leadership, teamwork, and collaborative research.

RESEARCH GRANTS & FUNDED PROJECTS

COMSATS Research Grant (CRGP), Grant No. 16-2/CRGP/CUI/LHR/25/856882 — Project: “**Sustainable EV Batteries: Advanced Composite Electrodes for Pakistan.**” | *Approved/Re-awarded 27th January 2026*

- Approved budget: PKR 300,000.

INDUSTRIAL & ACADEMIC COLLABORATION

National Battery Industries Pvt. Ltd. — Industrial & Academic Collaboration — Formal letter of industrial and academic collaboration supporting research partnership with Dr. Muhammad Imran Rafiq.

- National Battery Industries Pvt. Ltd., a lead battery/energy storage manufacturing industry in Pakistan, expressed interest in collaborative research partnerships in energy storage, supercapacitors, batteries, and redox-active electrolytes.
- The company stated its commitment to assist in translating academic or lab-scale energy-storage device prototypes into industrial-scale products.
- The collaboration provides an academic–industry pathway for research translation, technology development, prototype validation, and potential industrial application in energy-storage technologies.

ACADEMIC & ADMINISTRATIVE RESPONSIBILITIES

- Member, Postgraduate (PG) Office — FA25.
- Member, Supervisory Committee for PhD student CIIT/SP18-PPH-003/LHR; Research Supervisor: Dr. Muhammad Aamir Raza; Co-Supervisor: Dr. Muhammad Habib.
- Secretary, Health, Safety & Environment (HSE) Committee — SP26.
- Invigilation duties during Midterm and Final Term examinations — FA25 and SP26.
- Member, FYDP Design Evaluation Team — FA25 and SP26.
- Batch Advisor, FA23-CHE — FA25 and SP26.
- Proctor, Department of Chemical Engineering — FA25 and SP26.

RESEARCH PROFILES

Google Scholar: <https://scholar.google.com/citations?user=fcD-4pIAAAAJ&hl=en>

ResearchGate: <https://www.researchgate.net/profile/Muhammad-Rafiq-2>

COMSATS Faculty Profile: <https://lahore.comsats.edu.pk/chemical/Faculty.aspx>

REFERENCES

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