Dr. Muhammad Imran Rafiq

(Ph.D. Chemical Engineering)

Assistant Professor

Department of Chemical Engineering,

COMSATS University Islamabad,

Lahore Campus, Pakistan.

Research and Development Scientist

for National Batteries Pvt. Ltd Pakistan.

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Ph.D. in Chemical Engineering with thirteen years of diversified experience in the fields of research and technology development for energy storage by using 3D green templates for free-standing electrodes for hybrid supercapacitors and batteries. Process Engineer for one of the leading battery companies of Pakistan, National Battery Industries Pvt Ltd. Laboratory establishment and management, academic teaching, process monitoring, process optimization, concept and feasibility studies

Professional Experience

Assistant Professor Chemical Engineering

January 2020 – Present

Department Chemical Engineering, COMSATS University Islamabad, Lahore Campus, Pakistan.

Lecturer in Chemical Engineering

July 2015 – September 2016

Department Chemical Engineering, COMSATS University Islamabad, Lahore Campus, Pakistan.

Process Engineer

July 2010-July 2015

National Battery Industries Pvt. Limited

Education

Ph.D. Chemical Engineering & Technology

Fall 2016 – Spring 2022

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

Nanjing University of Science and Technology (NJUST), Jiangsu China.Key Laboratory of Soft Chemistry and Functional Materials, Ministry of Education, Nanjing University of Science and Technology, Nanjing 210094,

Courses Taught

Department of Chemical Engineering, COMSATS University Lahore Campus, Pakistan

Designation: Assistant Professor (November 2020 – to date)

Major responsibilities and jobs accomplished are given as,

Course Instructor (Graduate/Undergraduate) at COMSATS University Islamabad, Lahore Campus, Pakistan.

MME611, Nanomaterials

CHE60, Instrumental Analytical Techniques

CHE214, Fluid Mechanics for Chemical Engineers

CHE141, General Engineering Lab for Chemical Engineers

CHE471, Renewable Energy Sources

CHE333 Simultaneious Heat And Mass Transfer

Certificates

- Certification in 2D and 3D drafting National Institute of Design and Analysis AutoCAD Software Lahore Pakistan.
- Certification in Process Simulation National Institute of Design and Analysis (HYSYS) Lahore Pakistan

Designation: Process Engineering (National Battery Industries Pvt. Limited)

(July 2010 ~ July 2015)

Summary of Skills and Expertise

Electrochemical Methods

Standard battery cycling, cyclic voltammetry, chronoamperometry, and pulse techniques (responsible for routine maintenance and training of students and scientific personnel). Experienced in the electrochemical characterization of an electrode in three cells and two-cell systems to assess its potential window, discharge time, Capacitance, Retention, EIS, Cyclic stability, Energy Density, and Power Density. Experienced in the fields of technology development for energy storage and environmental pollution reduction by using green templates for electrode preparation Hands-on experience in the design, development, and operations of biomass preparation to produce environment-friendly 3D electrodes and their up-gradation technologies

Transmission Electron Microscopy

Proficient in the use of Zeiss T-10C TEM for nanoscale sample characterization; experience in ultramicrotomy and other sample preparation techniques (grid subtracting, positive/negative staining, metal evaporation/coating, and shadowing);

darkroom experience. Proficient in post-collection TEM data manipulation. Completed an advanced theoretical and hands-on course on the use of TEM in material sciences.

Scanning Electron Microscopy

Basic user training in the use of field-emission gun Zeiss Supra 35VP SEM equipped with EDAX Energy Dispersive Spectroscopy detector and HKL Electron Back Scattered Diffraction detector.

BET Surface Area Analysis
Proficient in the use and responsible for routine maintenance and training of students and scientific personnel

Thermogravimetric Analysis (TGA)
Basic user operation experience with Gas Chromatography(GC), Fourier Transfer Infrared Spectroscopy (FTIR), Powder X-ray Diffraction and Optical Microscopy

Related Skills

- Hands-on experience with key analytical equipment such as FT-IR spectroscopy,
- Experienced in the management of Research and Development projects
- Experienced in Publishing research in High Impact Factor Journals
- Teaching and supervising the students at undergraduate and graduate levels
- Possess excellent communication skills, leadership abilities, and qualities to become a perfect team player for the smooth completion of projects.

Journal Publications

1. **Rafiq MI**, Wang X, Farid T, Zhou J, Tang J, Tang W. Carbonyl-enriched hierarchical carbon synergizes redox electrolyte for highly efficient and stable supercapacitors. **Chem Comm** 2021.DOI: 10.1039/D0CC08432H.
2. **Rafiq MI**, Farid T, Zhou J, Ali A, Tang J, Tang W. Carbonized wood supported hollow $NiCo_2S_4$ eccentric spheres for high-performance hybrid supercapacitors. **J Alloys and Compounds** 2019; 811:151858.
3 Ali A, **Rafiq MI**, Zhang Z, Cao J, Geng R, Zhou B, et al. TD-DFT benchmark for UV-visible spectra of fused-ring electron acceptors using global and range-separated hybrids. **Phys Chem Chem Phys** 2020; 22:7864-7874.
4 Ali A, **Rafiq MI**, Zhou B, Tang W. Evaluating the Nature of Vertical Excited - States of Fused Ring Electron Acceptors Using TD-DFT and Density-Based Charge Transfer. **Phys Chem Chem Phys** 2021; 23:15282-15291.
5 Yuan Y, Zhou J**, Rafiq MI**, Dai S, Tang J, Tang W. Growth of Ni –Mn layered double hydroxide and poly pyrrole on bacterial cellulose nanofibers for efficient supercapacitors**. Electrochemica Acta** 2019; 295:82-91.

6 Farid T, **Rafiq MI**, Ali A, Tang W. Transforming wood as next - generation structural and functional materials for a sustainable future. **Eco Mat** 2022; 04; 12154.

7 Ali A, **Rafiq MI**, Zhou B, Tang W, 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** DOI: 10.1039/D2CP02228A

8 Farid T, Wang Y, **Rafiq MI**, Ali A, Tang W, Porous Flexible Wood Scaffolds Designed for High-Performance Electrochemical Energy Storage. **ACS Sustainable Chemistry &Engineering** 2022, 10, 21, 7078-7090.

9 Zahid Ullah, Fatima Kainat, Hamza Liaquat, Arslan Waheed, Sultan Akhtar, **Rafiq MI**, S. Hassan M. Jafri, Hu Li, Aamir Razaq, Natural fibers and zinc hydroxystannate 3D microspheres based composite paper sheets for modern bendable energy storage application. **Journal of Applied Polymer** 2022, 140, 1,53275

10 Habib M, Ullah S, Khan F, Rafiq MI, Balobaid AS, Alshahrani T, Muhammad Z, Supercapacitor electrodes based on single crystal layered ZrX2 (X= S, Se) using chemical vapor transport method, 2023,298,116904.

Research and Development Specialist (Industrial and Academic Collaboration)

Working as a research and development scientist for one of the leading energy storage industries in Pakistan, National Batteries Private Limited Pakistan.

Student Supervisions

Sidra Iqbal

MS Student (18 years education)

Research Topic: *An Efficient Energy Storage Electrode from Conversion of MOF (Metal Organic Framework) to CNT's (Carbon Nanotubes) on Green Template*

Asifa Iqbal

MS Student (18 years education)

Research Topic: *Fabrication of Green Template Based Flexible Electrodes for Hybrid Supercapacitors*

Suffa Mukarram

& Hafsa

BS Students (16 years education)

Research Topic: *Functionalization of wood chips for organic based energy storage appliances*

Research Profile

Google Scholar	https://scholar.google.com/citations?user=fcD-4pIAAAAJ&hl=en
Research Gate	https://www.researchgate.net/profile/Muhammad-Rafiq-2
COMSATS University Faculty Profile	https://lahore.comsats.edu.pk/chemical/Faculty.aspx

References

1. **Prof. Dr. Zulfiqar Ali**
   Head of Department of Chemistry,
   COMSATS University Islamabad,
   Lahore Campus, Pakistan.
   Email:
   Zulfiqar.ali@cuilahore.edu.pk
   Contact No. +92 345 4453343

2. **Prof. Dr. Khaliq Majeed**
   Head of Department of Chemical Engineering, COMSATS University Islamabad, Lahore Campus, Pakistan.
   Email:
   khaliqmajeed@cuilahore.edu.pk
   Contact No. +92 334 7378082