*British Council Researcher Links Climate Challenge Workshop*

# Delivering a Sustainable Energy Transition for Pakistan

# Delegates' Research and Expertise Summaries

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Dear Colleague,

Welcome to our workshop on Delivering a Sustainable Energy Transition for Pakistan!

The workshop will run over three days, from 8th-10th June, 2021. A timetable of activities and when they will take place can be found under the "Files" tab on the Microsoft Teams Channel called "Delivering a Sustainable Energy Transition for Pakistan" to which you should have access.

The workshop aims to bring together early career researchers from the UK and Pakistan to share research expertise and develop collaborations relevant to enabling a sustainable energy transition in Pakistan. There will be a particular focus on interdisciplinary approaches to this complex challenge, including technical/engineering solutions for renewable energy production & storage and the socio-economic and policy implications of sustainable energy in a Pakistani context. Participants will take part in interactive activities and group discussions led by expert mentors over each of the three days of the workshop. Seed funding will be available to support interdisciplinary UK-Pakistan collaborative research projects that arise as a result of the workshop. Details as to how to apply for this seed funding are present on the Teams channel and we will also cover this during the workshop itself.

Please make every effort to attend all sessions of the workshop. If your attendance is poor or erratic, then the organisers reserve the right to disqualify you from eligibility for seed funding.

The virtual workshop will run using Microsoft Teams. Additional funds to aid delegates with poor internet connectivity may be available. Please contact us if you will require assistance with connectivity. The workshop will be held in English.

The following booklet gives brief biographies and research expertise summaries for all the early career researchers attending the workshop, as well as a full list of delegates, mentors and organisers (and their contact details). As time is limited during the workshop, there will not be time for formal research presentations. Therefore, **you should read this booklet before the workshop starts** and begin to think about who you could form collaborations with to bid for the seed funding.

Finally, we hope that you find the workshop interesting, thought-provoking and fun! We look forward to working with you all.

Warm Regards,

Mark Symes and Salman Arshad

This work was supported by a Researcher Links Climate Challenge Workshop Grant, ID 710884527 and funded by the British Council to implement activities in the run up to COP26 (the 26th United Nations Climate Change Conference of the Parties). For further information, please visit: https://www.britishcouncil.org/education/he-science/opportunities/researcher-links-climate-challenge-workshops

**List of Early Career Delegates and where their Research Summaries can be found**

| Name | Email Address | Institution | Page |
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## Invited Speakers

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| Mazhar Bari | mazhar.bari@siemens.com | Siemens Ltd, Saudi Arabia | 43 |
| Najeeb Ullah | najeeb@nwfpuet.edu.pk | Swat Engineering University | 43 |

## List of Mentors and Organisers

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| Jillian Anable | J.L.Anable@leeds.ac.uk | University of Leeds | Mentor | 44 |
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| Mohammad Irfan | mairfan@uetpeshawar.edu.pk | University of Engineering and Technology, Peshawar | Mentor | 44 |
| Salman Arshad | salman.arshad@lums.edu.pk | Lahore University of Management Sciences | Organiser | 45 |
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# Abdul Basit

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**Main Research Areas:**

- Large scale integration of Renewable Power Plants
- Ancillary Services from Renewable Power Plants
- Power Quality Improvement
- Designing, Development and Operation of hybrid micro and mini grids
- Predictive Maintenance of Transformers and Generators

**Short Biography:** I have received my M.Sc. degree in electrical power engineering from Chalmers University of Technology, Sweden, in 2011 and PhD from the Department of Wind Energy of the Technical University of Denmark (DTU) in 2015. Currently, I am working as an Assistant professor at USPCAS-E where my responsibilities are teaching, supervising graduate student and working on applied research projects focussing indigenous needs.

**Research Interests:** My research interest is to enable the power system that can integrate large scale of renewable power plants by providing support as conventional power plants through ancillary services, such as frequency, voltage or inertial support. During my PhD, **Wind Power Plant System Services**, I have developed and analysed the control strategies that increases Wind Power Plants capability to provide system services, such as active power balancing control, in a modern power system with large scale integration wind power[1-4]. Moreover, along renewable power plants the support from flexible loads can also make the power system operation more reliable [5]. I am also interested and working on energy management systems and on improving power factor in weak distribution grid. The use of artificial intelligence in asset management is another area of interest where predictive maintenance of transformers makes operation of power system more secure[6]. Remote areas are usually deprived from electricity access, one of the key area for research and socio-economic development and citizen empowerment is the designing, development and operation of hybrid micro and mini grids, where indigenous resources can be utilized in providing the electricity access. I have worked on the development of hybrid mini grid by integrating micro hydro power plant (10 KW), solar PV power plant (12 KW) and biogas plant (10 KW); however, more research is required in developing affordable and low cost indigenous design.

**References**

1. Basit, Abdul, “Wind power plant system services”. DTU Wind Energy, 2014. 271 p. (DTU Wind Energy PhD; No. 0043(EN)).
2. Basit, Abdul; et. al., “Wind Power Integration into the Automatic Generation Control of Power Systems with Large Scale Wind Power”/ J0E, IET, 2014
3. Basit, Abdul, et. al. “Compensating Active Power Imbalances in a power system with high wind power penetration”,Journal of modern power system and clean energy, SPRINGER April 2016
4. Basit, Abdul, et. al. “Real-time impact of power balancing on power system operation with large scale integration of wind power” Journal of Modern Power Systems and Clean Energy, March 2017
5. Basit, Abdul, et. al."Flexible Modern Power System: Real-Time Power Balancing through Load and Wind Power." 2019. Energies 12, no. 9: 1710
6. M. Aslam et al., "Dynamic Thermal Model for Power Transformers," in IEEE Access, doi: 10.1109/ACCESS.2021.3078759

# Abdul Shakoor

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**Main Research Areas:**

- Energy Materials , Polymer Composites, Design Engineering
- Materials Characterization, Material development
- International Research collaboration , Innovation breeding and Commercialsation Management at Pakistanis universities

**Short Biography:**. Currently working as Professor in Mechanical Engineering, UET Peshawar. I hold B.Sc (Mechanical Engineering – 2001-Pakistan) , MSc ( Advanced Manufacturing & Management –2006- University of Huddersfield, UK) and PhD ( Polymeric composites Materials – 2013 - Loughborough University, UK). I also led the team at UET Peshawar to manage and administer the university's research, Innovation & Commercialsation portfolio as Director (ORIC) at UET Peshawar for three years.

**Research Interests:** I have a substantial experience in research and development of composites materials. Quite handsome experience in characterising the mechanical, thermal, viscoelastic and morphological properties of the composites have strengthened my understanding of characterization dynamics. Being qualified in mechanical and manufacturing technologies and research expertise in materials science has broadened my horizon of product ideation, managing the product development, material and process development.

Teaching to the mechanical engineering students at highly reputed public sector engineering university of Pakistan, have added immense values to my practical exposure in developmental process of the human product for the industrial and social needs of the under developed country. Working as a university teacher at postgraduate level in high ranked engineering university across the UK, have contributed to enhance my teaching, organisational and team working skills.

The experience and working in national and international cross-cultural cooperation on technical and managerial issues have given me the opportunity to understand the ingenious issues and how to bring a creed alignment in the process

**Professional Links**

Research Gate : https://www.researchgate.net/profile/Dr-Abdul-Shakoor
Google Scholar : https://scholar.google.com/citations?user=OezNoM0AAAAJ&hl=en

# Adnan U Syed

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**Main Research Areas:**

- Oxy-fuel firing; an effective way to reduce $CO_2$ emissions in power generation sector
- In-situ molten salt study using electrochemistry for concentrated solar power application
- Offshore industrial gas turbine corrosion challenges through $H_2S$ and induced Cl deposits
- Role of biomass fuel in power generation sector and its effect on materials degradation

**Short Biography:**

Dr Adnan Syed is a chemistry graduate from University of Karachi. He completed his masters in electro chemistry from Reading university and a PhD in Energy Materials from Cranfield University.
His PhD title was 'High Temperature Corrosion HTC of materials in advance power systems'. At present, his research focus is studying gas turbines alloy materials corrosion degradation under aggressive conditions for aerospace and power generation sector. He is also involved in lecturing for different modules. Topics involve material mechanical properties, environmental assisted cracking, and corrosion protection. He currently holds associate fellow status awarded by Advanced Higher education UK. Dr Syed also has over 10 years of industrial experience, worked for various well known multinational organisations. Dr Syed has published his work in several journals and conference proceedings. He has given several oral presentations and webinar to the international scientific community. His hobbies include, family gathering, travelling, and exploring nature.

**Research Interests:** My research lie in the field of clean power generation technology through research and development of materials. The key research outcome would be findings towards lifetime extension of heat-exchanger materials and other components exposed to aggressive conditions. I am keen on the development of green/renewable technology and make a difference to carbon emission reductions.
***Oxy fuel firing:*** One of the novelties of my PhD was lab scale study for heat-exchanger materials in oxy-fuel firing conditions. I am keen to continue my PhD work further for a better understanding of the materials performance within oxy-firing environment. A recent study[1] shows that significant level of S and Fe in coal and its effect on oxy-firing better understood via conduct the lab scale tests which simulate the coal combustion gas chemistry conditions, finding valuable for the local power plants.
***Concentrated Solar Power:*** HTC challenges in molten salt conditions is an inspiring research area for me. I recently I proposed a project as a MSc group project and outcome was an extraordinary rig designed which can test multiple specimens in molten salt environment and online electrochemistry. I am keen to develop facility for testing materials in molten salt using electrochemistry for thermal batteries, concentrated solar power and nuclear energy applications. This research would add value towards generate efficient thermal/electrical energy[2].
***Offshore gas turbine challenges*** My presentation title in the webinar last year was 'hot corrosion mechanisms for gas turbines'. Since the jet engine and industrial gas turbines both suffer from hot corrosion, a lot of questions and comments I had, were on the salt deposit induced corrosion related issues for industrial gas turbine situated offshore[3]. Students in my lab are currently producing some astounding work on role of chlorine in hot corrosion. Having a background in chemistry and materials and a passion for energy sector, I am very much interested in a detail study of material performance for offshore gas turbines in Cl and $H_2S$ rich environment.
***Waste to Energy (biomass) power plants*** My PhD and current research shows that biomass as fuel on one hand supports the environmental sustainability (reduce carbon emission) but on the other hand it has a severe effect on the boiler components. I am interested in developing test methods at a lab scale to simulate environments for real power plant that encompass tests series, effectively different gas conditions simulate wide variety of agricultural waste, municipal waste available as fuel[4].
My long-term goal is to further develop myself in the field of clean energy research, understanding of materials chemistry at the atomic and their role in sustainable and emerging green energy.

1. B Daia, X Wub, J Zhangb, Y Ninomiyac, D Yud LZ.. *Fuel*. 2020;264.
2. F AG, Cabeza LF. *J Energy Storage*. 2020;29:101381. doi:https://doi.org/10.1016/j.est.2020.101381
3. Faes W, Lecompte S, Ahmed ZY, et al. *Corros Rev*. 2019;37(2):131-155. doi:doi:10.1515/corrrev-2018-0054
4. Wang Y, Sun Y, Jiang L, Liu L, Li Y.. Niu Y, ed. *J Chem*. 2020;2020:1692598. doi:10.1155/2020/1692598

# Akhtar Munir

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**Main Research Areas:**

- Synthesis of metallic/alloy nanoclusters (NCs)/Nanoparticles (NPs) and characterization
- Surface functionalization of supported NPs/NCs via wet chemistry, thermal impregnation and electrodeposition approach.
- Application of nanomaterials in electrochemical water splitting and energy conversion/storage processes

**Short Biography:** I am currently working as Assistant Professor in the Department of Chemistry University of Sialkot (USKT) Sialkot, Punjab. I hold MSc and M.Phil in Chemistry (2014 and 2016, Quaid-I-Azam University Islamabad) and PhD in Chemistry from Lahore University of Management Sciences (LUMS) in 2020. I am currently supervising the research project of 7 M.Phil students as PI and 04 M.Phil students as Co-PI. In addition to the memebr of Board of study (BOS) and Board of Faculty (BOF) I am a focal person to Vice Chancellor (VC) from the faculty of sciences for the research innovation/productivity.

**Research Interests:** I am interested in chemical and electrical aspects of energy and sustainability. During PhD, I mainly focused to develop facile and scalable protocols for the synthesis of transition metal (Ni, Cu, Co, Fe, and Mn) nanoclusters/Nanomaterials (size ≈ 2nm), theirs alloys/thin films and surface assembling on various conducting support (graphene, CNTs, $TiO_2$, Au and porous materials) for electro-assisted water splitting. Thus, electro-and photocatalysis is central to my work at the interface of synthetic chemistry, materials and nano-science. The synthesized novel nanoscale materials have been found highly efficient and stable for both HER and OER with high conversion efficiency due to their decent control over size, shape, surface chemistry and underlying support. Therefore, integration of metal oxides nanoclusters/thin film as single-/multi-site catalytic module for energy conversion and catalysis/sensing are worth considering in future perspectives.

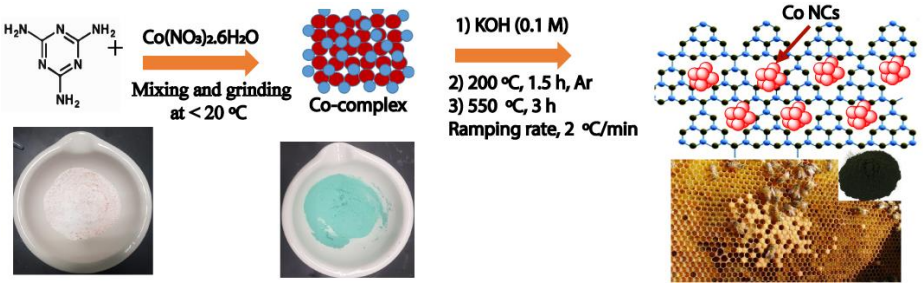


**Fig. 1** Synthesis of Co NCs embedded in N-doped porous carbon support. The size and interaction with support can be controlled by controlling the reaction conditions/parameters.

**References**

1. A. Munir et al., *Chemistry-A European Journal.2020, 26,* 11209-11219.
2. T. ul. Haq, A. Munir et al., *Advanced Functional Materials, 2020,* 30, 1910309.
3. A. Munir et al., *Electrochimica Acta, 2020,* 341, 136032.
4. A. Munir et al., *ChemSusChem*, 2019, 12, 5117-5125.
5. A. Munir et al., *ChemSusChem*, 2019, 12, 1517-1548.
6. A. Munir et al., *ACS Applied Energy Materials*, 2018, 2(1), 363-371.

# Ali Rauf

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**Main Research Areas:**

- Synthesis of nanomaterials and their characterization
- Photochemical and electrochemical characterizations
- Wastewater treatment, solar-water splitting, energy storage

**Short Biography:** I am an Assistant Professor(TTS) in the Department of Chemistry and Chemical Engineering, LUMS since July 2018. I have completed my Ph.D. in Chemical Engineering from Sungkyunkwan University South Korea in 2018 with my B.Sc. from the University of Punjab, Pakistan in 2012.

**Research Interests:** I have extensively worked on the material design for photocatalysis and electrocatalysis during my doctorate studies and currently following the same research areas at LUMS within my research team.[1-2] For photocatalysis applications, in particular, I have investigated various strategies in materials design to improve catalytic efficiencies such as heterostructure formation, bandgap tuning, and Z-scheme formation as shown in figure below. This approach has opened a new space in materials design and provided the flexibility of exploring multiple strategies to obtain the best performance from the same semiconductor. Furthermore, different morphologies as a function of different synthesis routes (CVD, hydrothermal, solvothermal, impregnation, sol-gel) have also been investigated to obtain the best catalytic efficiency.

I am exploring first principle calculations such as DFT for theoretical screening of materials before material fabrication. Moreover, DFT can further be helpful for the theoretical validation of experimental results.

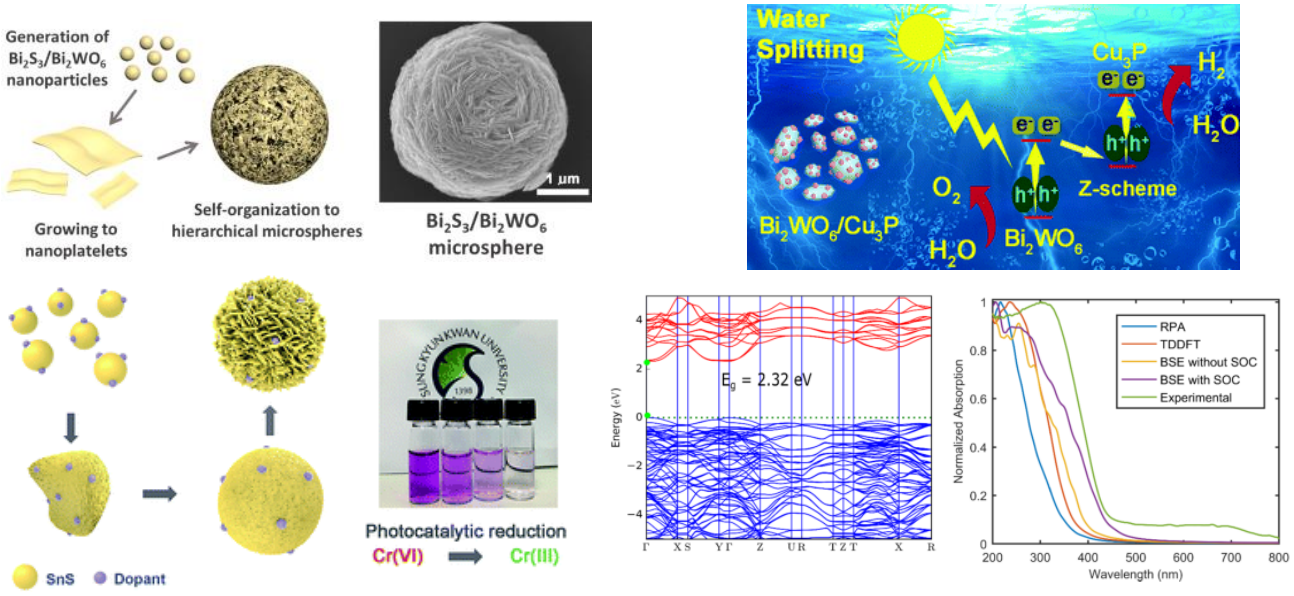


**Fig.** Glimpse of recent research that I have been doing on material design for energy environment applications and in the scope of DFT.

**References**

1. **Rauf, A**. Ming, M. Kim, S.S. Sher Shah, M. S. A. Park, J.H. Yoo, P. J. ***Nanoscale*** **2018**, 10, 3026-3036.
2. Ghafoor, S., Aftab, F., **Rauf, A**. Arshad S., Duran, H., Kirchhoff, K., ***ChemistrySelect*** **2020**, 5, 14078- 14085.

# Edward Brightman

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**Main Research Areas:**

- Electrochemical engineering
- Flow batteries, electrolysers and fuel cells
- Engineering novel devices
- In situ diagnostics for manufacturing quality control

**Short Biography:** I am an experienced electrochemical engineer with a background in diagnostics and characterisation of fuel cells, batteries and electrolysers. After graduating from Oxford (MChem) and Imperial College (PhD) I worked at the National Physical Laboratory, UK for 5 years, pioneering advanced in situ measurement techniques for understanding and mitigating degradation in PEM fuel cells and electrolysers. I subsequently worked as R&D Manager at PEM fuel cell manufacturer Enocell Ltd, leading a £2m Eureka Eurostars R&D project and a £250k InnovateUK Analysis for Innovators project, before joining the University of Strathclyde to lead the Electrochemical Engineering group in 2019.

**Research Interests:** My research interests are in electrochemical energy devices and systems, particularly flow batteries and fuel cells, and I specialise in diagnostics and characterisation of devices for understanding and mitigating degradation. I am currently leading a Faraday Institution project on Graphite-polysulfide flow batteries for emerging economies. My research is focussed on developing innovative diagnostic techniques for elucidating degradation mechanisms and engineering devices with improved performance and durability. In addition, I am interested in novel device concepts, scale-up and system integration, with tangible impact in industry. Some of my specific interests include:

- Using embedded optical fibres to probe the surface chemistry at the catalyst/electrolyte membrane interface in polymer electrolyte membrane devices, via e.g. Raman spectroscopy.
- Engineering novel biomass-fuelled devices for fuel cells or hydrogen production. Such concepts have been proven in laboratory experiments but engineering research is required to develop them into a scalable process.
- Development of novel devices in collaboration with industry partners, including:
    - Metal oxide-based pseudocapacitors
    - Aqueous organic flow batteries
    - Membraneless electrolysers for hydrogen production from seawater

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# Farid Khan

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**Main Research Areas:**

- Energy harvesting for wireless sensor nodes and IoTs applications
- Vibration, acoustic, flow and wind based energy harvesting
- Micro-hydro power generation

**Short Biography:** I am currently a full-time professor at the University of Engineering and Technology, Peshawar. I hold BSc and MSc degrees in Mechanical Engineering (1997 and 2004 from University of Engineering and Technology, Peshawar) and PhD in Mechanical Engineering (2011, The University of British Columbia, Vancouver, Canada).

**Research Interests:** My field of interest is ambient energy harvesting for powering wireless sensor nodes (WSNs), portable devices and internet of things (IoTs) based systems. I developed novel vibration based, acoustic based and hybrid energy harvesters to operate the wireless-based health monitoring systems of industrial machines. Additionally, I have successfully produced vibration and hybrid (targeting both vibration and wind energy at bridge's structure) for the power requirements of health monitoring system of bridges. Moreover, for the power requirements of IoTs based condition monitoring systems of pipelines, novel flow-based energy harvesters are also devised.
Furthermore, I have also interest in the indigenous development of pico and micro hydro turbines. I have successfully developed micro turbines, such as, Kaplan, Pelton Wheel, Cross flow etc. Similarly for run-of-water applications, floating water wheel is also fabricated.

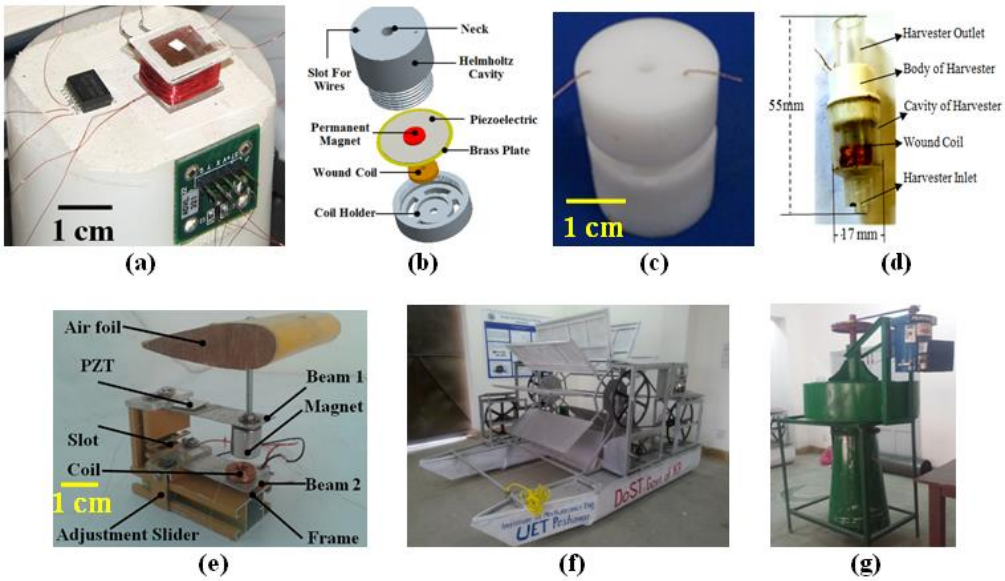


**Fig. 1** Developed energy harvesters and hydro systems: (a) hybrid vibration-based energy harvester, (b) and (c) hybrid acoustic-based energy harvester, (d) flow-based energy harvester, (e) hybrid bridge energy harvester, (f) floating water wheel, (g) Kaplan turbine

**References**

1 **Farid Ullah Khan** and Shahzad Ahmad, Energy Conversion and Management, 2019, **200**, 112089. (Impact factor 7.181)
2 **Farid Ullah Khan** and Muhammad Iqbal, Journal of Sensors, **2018**, 3849683, https://doi.org/10.1155/2018/3849683 (Impact factor 2.024)
3 Muhammad Iqbal, **Farid Ullah Khan**, Energy Conversion and Management, 2018 https://doi.org/10.1016/j.enconman.2018.07.044 (Impact factor 7.181)
4 Farid Ullah Khan, International journal of energy research, 2020, https://doi.org/10.1002/er.5442

# Faroha Liaqat

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**Main Research Areas:**

- Electrochromic photonic Bragg stacks
- Electrochemical sensors: synthesis and DFT
- Nonlinear optical behaviour and charge transfer in push-pull organic chromophores with applications in organic photovoltaics
- Density functional Studies of materials
- Hybrid polymeric superlattices with multifunctional aspects

**Short Biography:**

I am currently an Assistant Professor (Physical Chemistry) in Pakistan's top ranked Quaid-i-Azam University, Islamabad. I have a PhD in Chemistry from Johannes Gutenberg Universitat-Mainz, Germany (2014) on a Max Planck international scholarship and was later awarded the prestigious IRTG fellowship, which allowed me to obtain a dual PhD degree in Chemistry from Seoul National University, South Korea. I did my Postdoc research in the University of Glasgow (2015-16) and am an alumnus of the 2009 Lindau Nobel Laureates Meeting in Chemistry. I am a recipient of two Gold Chancellor medals from QAU Pakistan and in 2009, worked in an Nature/iTv collaborative documentary on climate change, titled "The two degree target".

**Research Interests:**

I have a multi-dimensional research background with expertise in synthesis as well as computational chemistry (density functional studies and molecular docking). While my earlier PhD work was primarily on the fabrication of soft phononic superlattices[1] and study of defected vs symmetrical Bragg stacks, I have also worked on electrochromic photonic devices and aimed on reaching phoxonic materials (photonic + phononic band gap containing materials). Recently, I have been working on sustainable solutions, such as developing bimetallic oxide nanostructured photocatalysts for waste-water treatment, and fabrication of electrochemical sensors for detection of toxic species in environment. These studies combine DFT results and electrochemical evaluation, enabling us to predict the sensing mechanism; the sensing materials employed are conducting polymers as well as nanostructured systems. A recent interest is push-pull metal free organic molecular systems wherein we study charge transfer, nonlinear optical behavior and charge mobilities for application in organic photovoltaics. The synthesis is done in collaboration with an organic chemistry group, while I do the DFT studies, experimental evaluation and device fabrication. Additionally, I have also worked on adhesive multifunctional layered by layered assemblies[2], $CO_2$ reduction mechanism determination through DFT for homogenous catalysts[3] and currently, some graduate students in my group are developing materials as supercapacitors.

**References:**

1. D. Schneider, F. Liaqat et al., *Nanolett.* 2012, **12**, 3101-3108
2. F. Liaqat et al., *Mater. Horizons*. 2015, **2**, 434-441
3. N. Munir, F. Liaqat et al., *RSC Advances*. 2019, **9**, 37986-380009

# Faryal Khalid

College of Engineering, Mathematics and Physical Sciences, University of Exeter, Penryn Campus, UK
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**Main Research Areas:**

- Sustainable and inclusive green energy development
- Local and global supply chain for renewable energy infrastructure
- Structural reliability and lifetime risk analysis
- Location-dependant offshore renewable energy device design
- Numerical modelling and physical testing of renewable energy systems and components

**Short Biography:** I completed my BSc in Earth and Space Sciences at Jacobs University Bremen, Germany in 2014 specialising in Oceanography. I then received my PhD in Offshore Renewable Energy (ORE) from the University of Exeter in 2019 promoting the argument for location–intelligent decision making in offshore wind energy. I developed a methodology to improve the economic viability of offshore wind using lifetime reliability assessment and energy production as risk and return indicators, respectively.
I have been working on research and innovation projects in the ORE sector in the UK since 2017. I was interested in engaging with ORE stakeholders after my PhD and due to the nature of my postdoctoral projects, I have been able to do so extensively. I was involved with EU-wide cross-institutional project planning between industrial partners, research laboratory managers, advisory committees and quasi-government institutes.

Currently, I am a postdoctoral research fellow at the Renewable Energy Department at the University of Exeter demonstrating the performance of an innovative mooring component that improves the reliability of floating structures in the ORE sector. I have experience of working with a range of offshore infrastructures including fixed and floating support structures in the ORE and aquaculture industries.

**Research Interests:** In addition to the research interests listed above, I am interested in investigating the socio-techno-economic landscape of the clean energy transition in Pakistan. I believe a truly meaningful and effective strategy for clean energy transition can only be drafted through an improved understanding of this nexus. While some renewable energy resource characterisation has previously been conducted for Pakistan, thematic maps can also be used to identify the most suitable development locations by visualising expected constraints in tandem with opportunities.

I also have interest in understanding the benefits of the adoption of a local supply chain versus a global supply chain for the development of renewable energy infrastructure.

Additionally, I advocate for a combined approach incorporating indigenous and advanced scientific knowledge to support clean energy transition globally.

# Gordhan Das Valasai

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   Quaid-e-Awam University of Engineering, Science and Technology, Nawabshah, Pakistan
2. EEERG Research Group,
   Mehran University of Engineering and Technology, Jamshoro, Pakistan

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**Main Research Areas:**

- Low carbon development pathways
- Water, energy, and food security nexus
- Water constraints in power generation
- Smart-grid techno-economic modelling/feasibility

**Short Biography:** I am working as an Associate Professor at Quaid -e- Awam University, Nawabshah. I hold B.E. and Ph.D. (2017) in Mechanical Engineering from Mehran University, Jamshoro.

**Research Interests:** I am interested in energy modelling and policy for achieving a sustainable energy future in the country. The country's energy security is dependent on the low carbon energy future; utilizing renewable energy shall result in energy sustainability. The energy modelling and optimization of energy systems with significant policy implications for maximum deployment can help achieve climate neutral, energy security, and sustainability.

I developed the PakistanTIMES energy model during my PhD studies, which examines various options to achieve a least-cost power mix over the coming decades, focusing on the environmental externalities of power generation. Under this study, the environmental costs of power generation were adapted from the EU for Pakistan by using the population density and economic indicators.

I have published 14 research papers related to my interests in energy modelling, policy and economics for Pakistan. Most of these publications focus on the energy.

# Hassan Abbas Khan

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https://scholar.google.com.pk/citations?user=UkjfIDYAAAAJ&hl=en

**Main Research Areas:**

- Electrification strategies (Rural and Urban uptake and trends)
- Renewable power and energy efficiency
- Climate Change mitigation and adaptation
- Microgrids and Solar PV systems
- Energy storage, EVs, and other disruptive energy technologies

**Short Biography:** Dr. Khan received his Bachelors in Electronic Engineering from GIKI, Pakistan in 2005. From 2005 to 2010, he was with The University of Manchester, UK where he first received his MSc (with distinction) and then PhD in Electrical and Electronic Engineering. He joined the Dept. of Electrical Engineering, Lahore University of Management Sciences in 2010, where he is currently working as an Associate Professor.

Dr Khan is a founding member of LUMS Energy Institute and the Director of Energy and Power Systems Lab at LUMS. Dr Khan has over 50 publications in leading venues such as Renewable Energy, Solar Energy, Applied Energy, Energy Policy and IEEE Transactions on Sustainable Energy. He also worked with many funding agencies on delivering successful projects including Cleaners Product Institute (CPI), through a grant from the Embassy of Kingdom of Netherlands (EKN), HEC, Pakistan, UMD, USA, IGC, UK and other funding agencies for projects related to Sustainable Development focusing on developing countries.

**Research Interests:** Dr Khan is an expert on Renewable Power, focusing on both off-grid (rural) and urban electrification strategies and trends.

- In off-grid regimes, his current work includes research and development of novel grid architectures for sustainable decentralized rural electrification using solar energy. He has pioneered a decentralized solar delivery model focusing on peer-to-peer sharing of solar power in off-grid regimes (a novel concept in the area). He is also working on the uptake of solar PV in rural settings with consumer and policy focus on key parameters (such as willingness to pay, technology viability, regulatory regimes) affecting the uptake. He is also working in Climate Change Mitigation through renewable technologies and Adaptation Strategies for off-gird electrification through access to renewable electricity. He investigates energy-centric obstacles to the uptake of adaptive strategies, alongside its more commonly acknowledged role in mitigating climate change.
- In on-grid regimes (urban), he focuses on many key aspects such as energy efficiency and performance ratio maximization for grid-tied solar PV systems. He has extensive experience in the reliability and financial modelling of these systems. He is an expert on system design focusing on various PV technologies and led the deployment of 800 kWp solar PV system deployed at LUMS (with projected savings of over 2 million USD). Dr Khan also focuses on drivers changing the conventional grid, focusing on storage-based systems and EVs to develop evidence-based policymaking for disruptive technologies in the evolving utility grid. His current focus is to establish models for sustainable growth of PV technologies incorporating aspects on policy, institutional, technological, social, financial and market barriers for solar uptake in these settings.

# Huan Doan

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**Main Research Areas:**

- Porous materials synthesis and characterisation
- Synthesis of hierarchical porous materials using green and scalable synthetic approaches
- Innovative catalyst technologies using functional porous materials
- Energy conversion and storage using hierarchical porous materials

**Short Biography:** I am currently an EPSRC Doctoral Prize Fellow at the University of Bristol. I hold a BSc and an MSc in Chemical Engineering (2009 and 2012, Hanoi University of Mining and Geology, Vietnam), an MRes in Sustainable Chemical Technologies (2015, University of Bath, UK) and a PhD in Mechanical Engineering (2019, University of Bristol, UK).

**Research Interests:** I am interested in the synthesis, characterisation and applications of porous materials (metal-organic frameworks, zeolites and functional silicas) to address challenges in sustainable development (catalysis, gas separation and energy storage). I already have 21 peer-reviewed papers in respected journals for my PhD and my postdoctoral projects. I have developed new methodologies to produce metal-organic framework (MOFs) with macropores of different dimensions and geometries via various synthetic strategies including acid etching[1] and supercritical $CO_2$ treatment[2] (Fig 1a,b) to improve their reactivity. The impact of this approach on heterogeneous catalysis was that these new MOFs with hierarchical porosity delivered enhanced performance with fast intercalation of reactants into active sites[3,4] (Fig 1c,d). These studies demonstrated the potential for adjusting the shape and size of the pores for the deployment of MOFs as multifunctional platforms for controlling the mass transport of reactants.

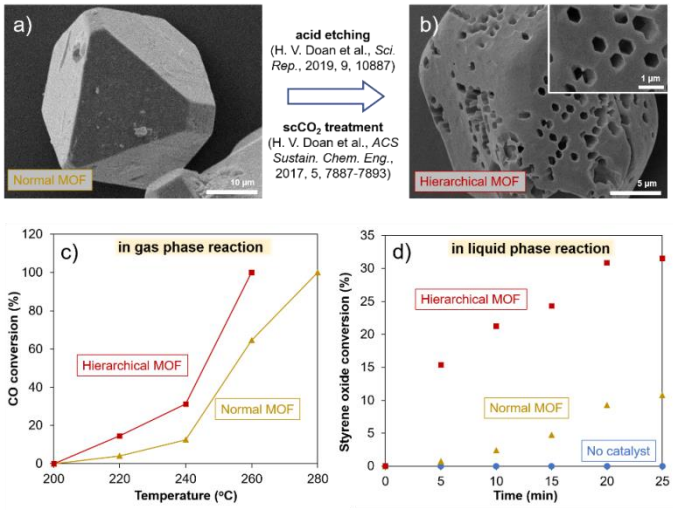


***Fig 1.*** *Normal HKUST-1 MOF (a) and novel hierarchical porous HKUST-1 MOF (b) synthesised via acid etching and supercritical $CO_2$ methods. Results of CO oxidative reactions (c) and styrene oxide methanolysis reactions (d), showing an improvement in activity for the hierarchical porous MOF (red squares), compared to the normal microporous MOF (yellow triangles)*

**References**

1 H. V. Doan et al., *Scientific Reports*, 2019, **9**, 10887.
2 H. V. Doan et al., *ACS Sustainable Chemistry & Engineering*, 2017, **5**, 7887-7893.
3 H. V. Doan et al., *Nano-Micro Letters*, 2019, **11**, 1, 54.
4 H. V. Doan et al., *ChemrXiv*, 2019 (*doi.org/10.26434/chemrxiv.9699863.v1*).

# Juliana Maria Abreu da Silva Morbec

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**Main Research Areas:**

- Computational Materials Physics
- Electronic Structure Calculations
- Materials for Energy Applications

**Short Biography:** I was born and raised in Brazil. I studied Physics and Mathematics at the Federal University of Uberlandia, Brazil, and I did my PhD in Physics in the Sao Carlos Institute of Physics at the University of Sao Paulo, Brazil. Afterwards, I spent nearly 4 years as an Assistant Professor of Physics at the University of Alfenas, Brazil, and I held researcher positions at the University of California-Davis, USA, University of Chicago, USA, and University of Duisburg-Essen, Germany. In August 2019 I was appointed Lecturer in Physics in the School of Chemical and Physical Sciences at Keele University, England.

**Research Interests:** My research focuses on theoretical study and computational simulations of materials for technological applications. I use first-principles quantum mechanical methods based on density-functional theory and many-body perturbation theory to investigate the electronic, magnetic, optical and transport properties of different systems, from molecules to two-dimensional (2D) materials and surfaces. My goal is to gain deep understanding of properties, processes and phenomena on atomic level in order to predict and design materials for spintronics, optoelectronics, sensors, catalysis, and energy conversion. I work in close collaboration with experimentalists joining efforts to explore novel materials and discover new properties. My research interests include (i) 2D materials and van der Waals heterostructures for flexible and portable applications, (ii) hybrid organic/inorganic materials for optoelectronic applications, (iii) transition metal oxide and nitride semiconductors for solar water splitting, and (iv) nanomaterials for spintronics.

# Junaid Ali

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**Main Research Areas:**

- Synthesis and characterisation of 0-2 dimensional nanomaterials
- Printed electronic devices using 0-2 dimensional nanomaterials.
- Printed sensors using 2D materials.
- 2D materials for low-cost sustainable water purification

**Short Biography:** I am currently an assistant professor at optoelectronics research laboratory, Department of Physics, COMSATS University Islamabad. I have MS degree in Physics (2009 from COMSATS University Islamabad, Pakistan) and PhD Mechatronics Engineering (2016, Jeju National University, Korea). My postdoctoral research at University of Manchester, UK focussed on printed 2D materials on flexible substrates for printed electronics.

**Research Interests:** I am interested in use of 0-2D materials for printed electronic devices with sustainable and environmentally friendly approaches. I have 12 peer reviewed research publications in ISI indexed journals of repute from my PhD and postdoctoral projects. I developed synthesis strategy[1,2] to obtain Graphene and MoS2 quantum dots and used them in printed devices. The use of water based exfoliated 2D materials for printed photosensor on paper substrates[3] can be utilized as disposable, low-cost and environmental friendly solution to safeguard our future generations. I am currently exploring the use of 2D materials for water purification, microbial fuel cell and low cost micro supercapacitor applications.

**References**

1. Ali, J., Siddiqui, G. U. D., Yang, Y. J., Lee, K. T., Um, K., & Choi, K. H. (2016). Direct synthesis of graphene quantum dots from multilayer graphene flakes through grinding assisted co-solvent ultrasonication for all-printed resistive switching arrays. *RSC Advances*, *6*(6), 5068–5078. https://doi.org/10.1039/C5RA21699K
2. Ali, J., Siddiqui, G. U., Choi, K. H., Jang, Y., & Lee, K. (2016). Fabrication of blue luminescent MoS 2 quantum dots by wet grinding assisted co-solvent sonication. *Journal of Luminescence*, *169*, 342–347. https://doi.org/10.1016/j.jlumin.2015.09.028
3. Leng, T., Parvez, K., Pan, K., Ali, J., McManus, D., Novoselov, K. S., Casiraghi, C., & Hu, Z. (2020). Printed graphene/WS 2 battery-free wireless photosensor on papers. *2D Materials*, *7*(2), 024004. https://doi.org/10.1088/2053-1583/ab602f

# M. Naveed Zafar

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**Main Research Areas:**

- Homogenous Catalysis/ Electro-Homogenous Catalysis
- Electrocatalysis of Carbondioxide Reduction Reaction
- Electrocatalysis of Proton Reduction Reaction
- Electrocatalysis of Oxygen Evolution Reaction
- Artificial Photosynthesis (Bio-Inspired approach/ Biomimicry)

**Short Biography:** Dr. Muhammad Naveed Zafar is Associate Professor of homogenous electrocatalysis at Quaid-i-Azam University, Islamabad. He is doing teaching and research in the field of catalysis for about ten years after PhD. He got distinctions in BSc (First Position), MSc (First Position), MPhil (First Position) and PhD (Doctoral Award). He specialized in "Development of New Ligands for Homogenous Transition Metal Catalysts" during his PhD from The University of Auckland, New Zealand. He has published more than 50 W-category (HEC recognized) research articles with impact factor above 100. Some of his reasearch articles are highlighted in references.[1-6] He has presented his research work in number of national and international conferences in the lights of international conference on inorganic chemistry (IC08) held in University Christchurch, Canterbury, New Zealand and 39th International Conference on Coordination Chemistry (ICCC39) in Convention Center, Adelaide, Australia. He has successfully completed number of research grants in the field of homogenous electrocatalysis; NRPU # 3257 and 6173 (National research program for University). So far, 07 MSc and 19 M.Phil research theses are supervised by him and out of five PhD research students, three are in final year of their research in the field of homogenous electrocatalysis.

**Research Interests:**

I am interested in utilizing non-innocent redox active ligands for promoting transition metal in variable oxidation states during catalytic cycles. These ligands are very promising for $CO_2$ reduction to fuels and useful chemicals, water oxidation and reduction catalysis as well as in bioinspired (mimic) catalysis. This programme involves the design, synthesis and study of new acyclic and macrocyclic ligands that are capable of coordinating and holding a metal or two in such a way that bound substrate molecules can be activated both through interactions with the metal centers and strategically placed functional groups on the ligand backbone. Metal complexes of this type are expected to display new and unusual electrocatalytic activity for reactions involving industrially important compounds. They are of interest as potential enzyme models and as catalysts. Number of Schlenk line assemblies for oxygen and moisture sensitive reactions are available in my research laboratory. UV, LC-MS and NMR spectroscopic techniques are accessible in QAU, Islamabad as characterization techniques.

**References**

1. M.N. Zafar *et al.*, *Inorganic Chemistry* 2011, 50, **21**, 10522-10524.
2. M.N. Zafar *et al.*, *Dalton Transactions* 2014, **43**, 17006-17016. (**Front cover**)
3. M.N. Zafar *et al.*, *Dalton Transactions* 2019, **48**, 15408-15418. (**Back cover**)
4. M.N. Zafar *et al.*, *RSC Advances*, 2019, **48**, 15408-15418.
5. M.N. Zafar *et al.*, *Journal of $CO_2$ Utilization* 2021, 101560 (In press)
6. M.N. Zafar *et al.*, *Inorganica Chemica Acta* 2021, **514**, 119982.

# Mohammad Ijaz

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**Main Research Areas:**

- Building Energy Conservation
- Sustainable and Green Buildings
- Use of Advanced Building Materials in Construction

**Short Biography:** After completing his bachelors in materials sciences and metallurgical engineering from GIKI, Ijaz pursued his career in Oil & Gas sector across the Middle east. Later, he left for his MBA from Eu Business School Barcelona, Spain alongside a PGD, in International Business from Harvard University, USA. For the last 5 years Ijaz has been actively involved in commercial as well as research side on the advanced building materials and their impact on sustainable and green buildings. Ijaz wants to focus on qualitative research with the commercial impact, which can help in bringing all stakeholders to an agreement on the importance of sustainable buildings for future.

**Research Interests:** One of the major areas of Ijaz's research is "Building Envelope". As this area primarily drives to bridge the gap, for sustainable buildings and conventional building materials. Advanced building materials are inevitable and Ijaz has worked extensively in collaborations with research institutes from within Pakistan and from UAE to conduct qualitative research. Cool roof coating is a recent trend, and it falls under advanced building materials category, which corelates with the concept of sustainability. Cool roof coating is a generic name, and Liquid Silicone is the chemical group which falls under this category.
Liquid Silicones are extremely unique blend, where Silicone resin is being used with specialty additives to give flowability to silicone resin required in its uncured form and upon interaction with moisture from the air, the chain reaction starts causing to cure silicone, which causes the formation of a thin film elastomeric coating.
Liquid Silicones are unique and advanced in terms of its application and functionality as a roof top coating. Liquid Silicone will ultimately perform as permanent waterproofing, heat reduction, UV resistance, fire retardant and most importantly, the elasticity and all these features together will give it a life of more than 30 years and bring the building to be more sustainable.
Liquid Silicones have the highest SRI values not only initially but most importantly aged SRI values.

| | |
|---|---|
| Initial Reflectivity | 0.9 |
| Initial Emissivity | 0.9 |
| Initial SRI Value | 114 |

| | |
|---|---|
| Aged Reflectivity | 0.76 |
| Aged Emissivity | 0.88 |
| Aged SRI Value | 94 |

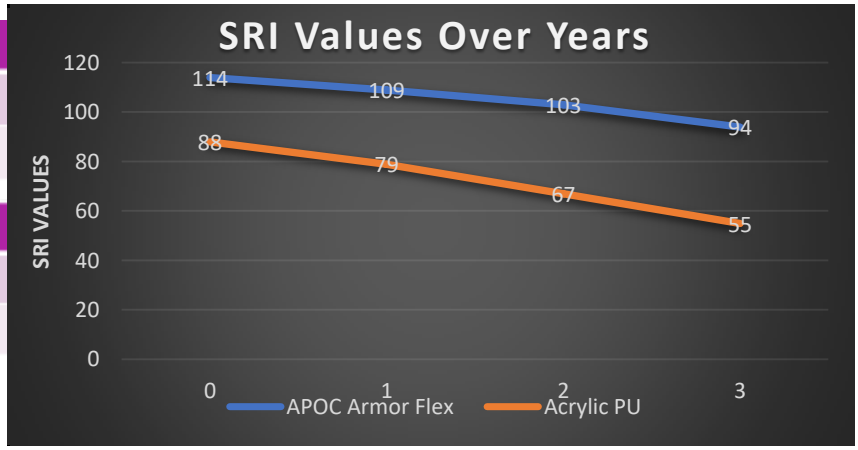


**Fig. 1** Solar Reflective Index (SRI) Over Time.

**References**


1 A. Syneffa & H. Akbari, Estimating the effect of using cool roof on building energy loads. 2006. University of Athens & Berkeley National laboratory, University of California

# Moritz Kuehnel

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Fraunhofer Institute for Microstructure of Materials and Systems, Halle
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**Main Research Areas:**

- Solar hydrogen generation
- Waste-to-value
- Sustainable materials
- $CO_2$ Conversion

**Short Biography:** I am a senior lecturer in inorganic chemistry at Swansea University (Wales) and a group leader for hydrogen technologies at Fraunhofer Institute for Microstructure of Materials and Systems in Halle (Germany). I obtained my chemistry undergraduate degree and PhD from Freie Universität Berlin (Germany) in the field of homogeneous catalysis. As a postdoc with Erwin Reisner at Cambridge (UK), I developed catalysts for electro-, photo- and photoelectrochemical $H_2$ generation[1] and $CO_2$ reduction[2] before starting my independent career in Swansea 2018.

**Research Interests:** My research focuses on using solar energy to convert waste into clean fuels and chemical feedstocks.[3] We develop photocatalysts that can break down waste biomass[4] and plastics,[5] and simultaneously evolve $H_2$ from water or convert $CO_2$ to formic acid. We also look at combining the removal of other pollutants from water (e.g. heavy metals, biological pathogens) with $H_2$ generation[6] and producing useful materials from waste biomass.[7] We are interested in applying our approach to real-world waste streams, such as industrial wastewater, domestic waste, sewage, local biomass etc. We are looking for collaborators to scale-up our work to practically relevant dimensions and we are keen to test and develop new catalyst materials. We have excellent facilities for photocatalysis & electrochemistry testing and materials synthesis & characterisation.

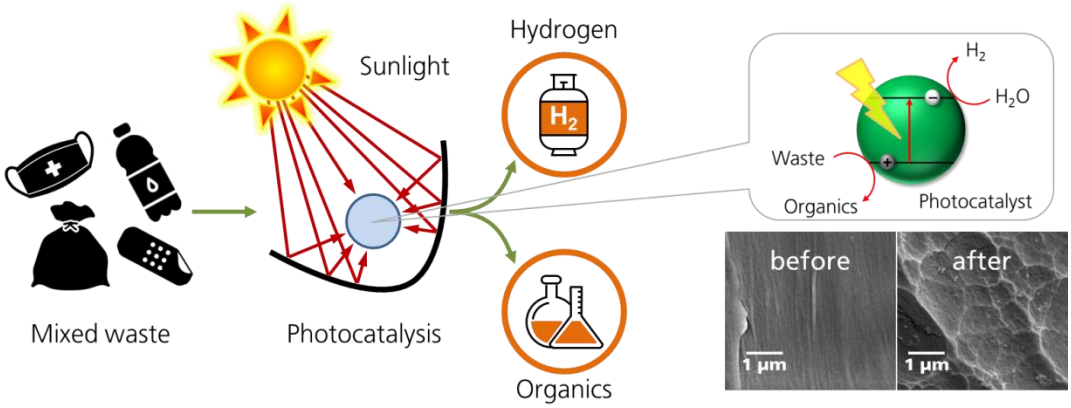


**Fig. 1** Schematic of the photocatalytic process to generate value from waste.

**References**

1 M. Crespo-Quesada, L.M. Pazos-Outón, J. Warnan, M.F. Kuehnel, R.H. Friend, E. Reisner, Nat. Commun. 2016, 7, 12555
2 M.F. Kuehnel, K.L. Orchard, K. E. Dalle, E. Reisner, *J. Amer. Chem. Soc.* 2017, **139**, 7217
3 M.F. Kuehnel*, E. Reisner,* *Angew. Chem. Int. Ed.* 2018, **57**, 3290
4 D.W. Wakerley, M.F. Kuehnel, K.L. Orchard, K.H. Ly, T.E. Rosser, E. Reisner, Nat. Energy 2017, 2, 17021
5 T. Uekert, M.F. Kuehnel,* D.W. Wakerley, E. Reisner,* *Energy Environ. Sci.* 2018, **11**, 2853
6 B. Jones, K.R. Davies, M.G. Allan, I. Mabbett, T. Watson, J. Durrant, M.F. Kuehnel, S. Pitchaimuthu, Sustainable Energy Fuels, 2021, doi: 10.1039/D1SE00232E
7 M.O. Omorogie, J.O. Babalola, M.O. Ismaeel, J.D. McGettrick, T.M. Watson, D.M. Dawson, M. Carta, M.F. Kuehnel*, *Adv. Powder Technol.* 2021, **32**, 839

# Muhammad Kashif Shahzad

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**Main Research Areas:**

- Multivendor meter data collection (MDC) systems interoperability
- Short/Medium/Long term electricity demand forecasting
- Demand side management in smart grids

**Short Biography:** I am Chief Technology Officer, at PITC, with 23+ years of national/international experience in designing, developing and deploying IT enabled R&D driven technology solutions, employing AI and Machine Learning. I hold BSc. Mechanical Engineering (2000, UET, Lahore), MS Total Quality Management (2005, Punjab University), Master Industrial Engineering specialization AI and Knowledge Management (2008, Grenoble Institute of Technology, France), PhD Industrial Engineering specialization CS applications in industry (2012, University of Grenoble, France). The key projects completed are public sector ERP, Customer Care and Billing System, short/long term electricity/materials demand forecasting, Enterprise Content Management (ECM), price bracketing. Moreover, I led Large scale EU projects INTEGRATE (E27.7 Million €, SP1-2012-8, 27 partners), IMPROVE (35 Million €, SP8, 32 Partners), IMPLEMENT (34 Million €, SP7, 36 Partners), USAID sustainable energy for Pakistan (SEP) project (2018-2021) [smart Grid Integration Testing lab, universal data integration layer (UDIL) design specifications, UDIL testing suite and transformer monitoring system (TMS) pilot for PESCO and MEPCO], USEA Business Innovation Partnership (BIP) project (2021-2023) [data center infrastructure planning and cyber security pilot for CTBCM model for Energy sector] etc.

**Research Interests:** I have 7 journals, 22 international conferences, 2 book chapters and 1 poster. My current research interests include multivendor MDC interoperability which if not handled result in vendor lockin situation for distribution companies. I have designed and developed universal data integration layer (UDIL) standard specifications to achieve MDC interoperability and is operational in Pakistan. Moreover, I am working with the USAID in integration energy planning project for short, medium and long-term electricity demand forecasting for capacity building of DISCOs to facilitate implementation of CT-BCM (competitive trading bilateral contract market) power market model in Pakistan.

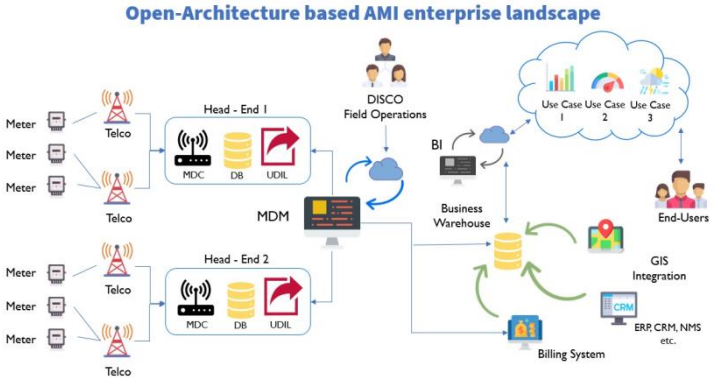


**Fig. 1** Multivendor MDC Interoperability[1]

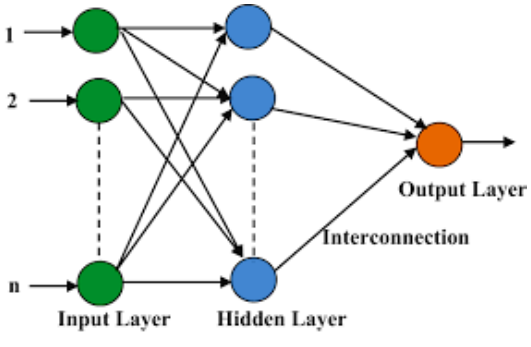


**Fig. 2** Short term load forecasting[2]

**References**

1. Pati Uttamarani, Ray Papia and Singh Arvind R. (2021) "An intelligent approach towards very short-term load forecasting" International Journal of Emerging Electric Power Systems.
2. http://www.pitc.com.pk/index.php/features/open-architecture-based-ami.

# Muhammad Saghir

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Your email address: M.saghir@keele.ac.uk; m.saghir@ecoresearchltd.co.uk

**Main Research Areas:**

- Energy and chemicals from waste
- Smart energy integration
- Affordable and safe drinking water
- Smart and organic agriculture
- Advanced composite materials

**Short Biography:** I have built my career working on advanced thermochemical conversion of wastes into energy and chemicals by working on advanced thermochemical conversion technologies such as Pyrolysis, gasification, Trans-esterification, combined heat, power and cooling. I have worked on a variety of funded projects mostly in Europe, Middle East and Far East Asia as a key engineering resource on varying scales of R&D plants from gram to ton per hour scale. Currently, I am working as a key resource on SEND project at Keele University, on 2 Innovate UK funded projects for Africa addressing energy access to rural poor in Nigeria, sierra Leone and Liberia. I am also a co-researcher on an ongoing waste to energy to water desalination project in Saudi Arabia which is funded by Saudi Ministry of Education.

**Research Interests:** I am also a serial entrepreneur, a scientist and chemical engineer with specialization in production of energy and chemicals from biomass resource through advanced thermochemical conversion technologies. I have completed B Eng. (Hons), PgD and PhD in Chemical Engineering from University of Birmingham and Aston University. I am currently employed at University of Birmingham as Research Fellow for European Union's Horizon 2020 funded (£10m) for sustainable aviation fuel at commercial scale. My current research interests include sustainable biofuels and bioenergy, bio-carbon to displace fossil carbon applications, bioplastics, water desalination, organic fertilizers, combined cooling, heat and power generation. I am an associate member of Institute of Chemical Engineers.

In the past I have served as a Bioenergy Plant manager at European Bioenergy Research Institute (EBRI) in Birmingham UK (2012-2015). During this appointment I was one of the key resource person to setup UK's first fully integrated bio based cooling, heat and electricity production plant with further integration of Vehicle to Grid (V2G) charging and discharging system at EBRI. I played professional role in many EU funded projects such as European Regional Development Fund (£16.5m) for setting up the Bioenergy plant and laboratories at EBRI, Interreg Bioenergy NW IVB project (£11m), Pyrogas project from IAAP, Energy Harvest project in India to name a few.

**Most Recent Publications**

1. Saghir, M., Rehan, M. and Nizami, A.S., 2018. Recent Trends in Gasification Based Waste-to-Energy. In *Gasification for Low-grade Feedstock*. IntechOpen.
2. Muhammad Saghir, Fahd Rasul, Ashfaq Ahmad, Muhammad Arif, Ishaq Ahmad Mian, Kawsar Ali, Muhammad Farooq Qayyum, Qaiser Hussain, Muhammad Aon, Shahzad Latif, Ruben Sakrabani, Genxing Pan and Simon Shackley; 2017. Biochar for Agriculture in Pakistan. *Sustainable Agriculture Reviews*, *22*, p.57.
3. Ouadi, M., Fivga, A., Jahangiri, H., Saghir, M. and Hornung, A., 2019. A review of the valorization of paper industry wastes by thermochemical conversion. *Industrial & Engineering Chemistry Research*.
4. Saghir, M., Zafar, S., Tahir, A., Ouadi, M., Siddique, B. and Hornung, A., 2019. Unlocking the Potential of Biomass Energy in Pakistan. Front. *Energy Res*, *7*, p.24.

# Muhammad Shoaib

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**Main Research Areas:**

- Synthesis of electrode materials for $Li^+$/$Na^+$ batteries.
- Reaction mechanism study of electrochemical energy storage.
- Utilization of DFT for study of battery electrode materials.

**Short Biography:** I am currently working as an Assistant Professor at Department of Chemistry and Chemical Engineering, Lahore University of Management Sciences (Pakistan). I completed my B.Sc in Chemical Engineering from University of the Punjab (Pakistan) in 2008 and MS-Ph.D. in Energy Science and Engineering from Sungkyunkwan University (South Korea) in 2018. Later I worked at Department of Energy Science, Sungkyunkwan University as a Post-Doc Research Fellow for one year.

**Research Interests:** My research work mainly revolves around $Li^+$/$Na^+$ batteries to address the environmental and sustainability challenges. I investigated the charge compensation mechanism in different electrode materials by using a variety of different electrochemical and material characterization techniques including synchrotron-radiations based characterization for *in situ* studies of electrode materials and phase changes at elevated temperatures. I am interested in study of anionic redox mechanism of lithium-rich cathode materials by experimental as well as DFT-based theoretical methods. Anomalous high capacity in $Li_2MnO_3$-based lithium-rich cathode materials is currently a hot topic of discussion, in one of my studies I investigated the role of oxygen in charge compensation and structure stability by using a variety of different material characterization techniques.[1] Thermal safety is another challenge faced by high-energy batteries as at higher temperatures organic solvent-based electrolyte can ignite and troch the batteries. To understand the thermal degradation mechanism of lithium-ion batteries, I studied the phase change of electrode material in the presence of electrolyte while elevating the temperature to 600 °C as shown in the schematic figure below. I have published more than 20 research articles on lithium-ion batteries in reputed journals with 850 citations so far. My current research includes electrochemical study of electrode materials for high energy batteries.

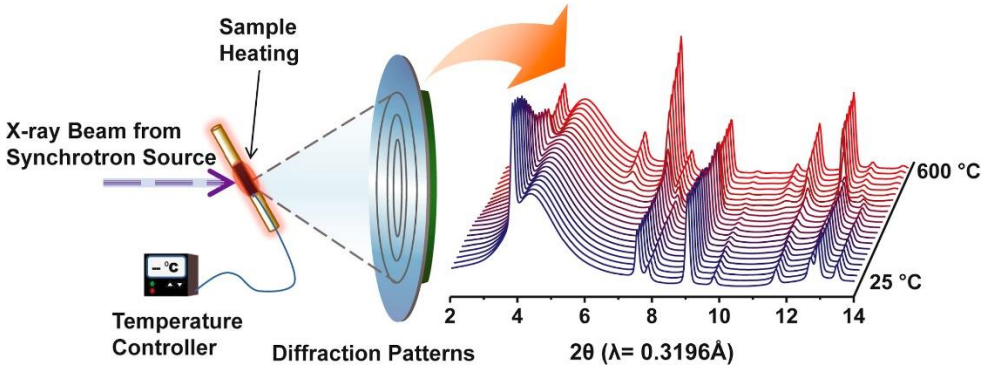


**Fig. 1:** *In situ* X-ray diffraction patterns of charged $0.5Li_2MnO_3$-$0.5LiMn_{0.33}Co_{0.33}Ni_{0.33}O_2$ cathode material during heating from 25 to 600 °C in the presence of electrolyte.[2]

**References**

1. Shoaib Muhammad et. al., *Nano Energy*, 21 (2016), 172-184, https://doi.org/10.1016/j.nanoen.2015.12.027
2. Shoaib Muhammad et. al., *Journal of Power Sources*, 285 (2015), 156-160, https://doi.org/10.1016/j.jpowsour.2015.03.054

# Muhammad Sultan

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**Main Research Areas:**

- Next generation solar cells and optoelectronics
- Spectroscopy of nanomaterials
- Charge transfer & dynamics of solids, surfaces & interfaces
- Nanomaterials and their emerging applications

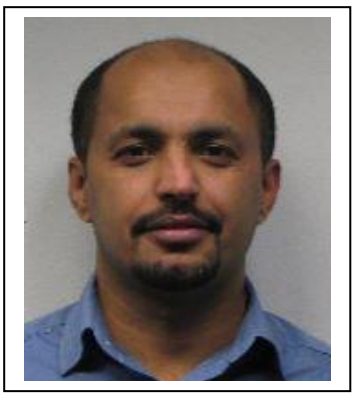
**Short Biography:** I completed my PhD in the field of ultrafast dynamics of nanostructures (Physics) from Freie University Berlin, Germany in 2012. I have ten months post PhD experience at Lawrence Berkeley National Laboratory, Berkeley California where I worked on the spectroscopy of nanomaterials for energy applications. Currently I am working as Associate Professor at Nanoscience and Technology Department of National Centre for Physics (NCP) Islamabad, where I am conducting research on novel materials for photovoltaic and optoelectronic applications.

**Research Interests:** I have interest in the field of next generation photovoltaics and optoelectronic devices[1]. In recent years we worked on different organic and inorganic perovskite solar cells. Study of charge transfer and dynamics at interfaces and surfaces is also topic of interest. We are also considering various applications of nanomaterials.

**References**

1 A. Fakharuddin, U. Shabbir, W. Qiu, T. Iqbal, M. Sultan, P. Heremans, L. Schmidt-Mende, Advanced Materials 31(27), 1807095 (2019).

# Muhammad Tariq Sajjad



**Senior Lecturer**, School of Engineering,
London South Bank University, London, UK

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**Main Research Areas:**

- Solar cells
- Photocatalysis
- Photophysics of energy materials and devices

**Short Biography:** Tariq Sajjad is a Senior Lecturer in Energy Engineering and Materials Devices in the School of Engineering at London South Bank University (LSBU), London and a member of the London Centre for Energy Engineering (LCEE) in the same School. He founded and leads the Energy Engineering and Materials Devices (TEMD) group at LSBU. Prior to joining LSBU as a lecturer in December 2019, he worked at Organic Semiconductor Centre (OSC), University of St Andrews, first as a research fellow and then as a senior research fellow, where he made a broad contribution across the fields of optoelectronic materials and devices. In St Andrews, he also worked as coordinator of two centres (Advanced Functional Materials Research Centre and Organic Semiconductor Centre), where he (with Dr Miller) has developed and administered a facility for fabrication, structural and functional characterisation of materials at the nanoscale. He received his MSc and PhD, both from Advanced Technology Institute (ATI), University of Surrey, UK. During his PhD, he has investigated the exciton dynamics in carbon nanotubes (CNTs) for their possible application in solar cells and lasing.

Tariq has made a significant contribution to the field of energy and sustainability. In recognition of his contribution to the field, the Royal Society of Chemistry (RSC, UK) recognized him as one of the emerging investigators in the field of energy and invited him for an article in the Journal of Materials Chemistry A Emerging Investigators Theme Issue 2020.1 EPSRC recently invited him to become a member of peer Review College. He is also working as a topic editor of journal "Coatings"

**Research Interests:** My group interests focussed on understanding the physics of the materials and devices, with the aim of improving them. Recently we have been focusing on the development of low-cost energy devices. Our strong track record is evidenced by high-quality publications in high impact peer-reviewed journals including Advanced Materials2, Materials Horizons3, Nano Energy4, ACS Applied Materials & Interface5 and Journal of Material Chemistry A (JMCA)6. Moreover, some of our articles have appeared on the front cover of prominent journals such as JMCA7 and Nanoscale8. Our solar cell work published in JMCA1 was designated as a "Hot Article of the Year 2016" and another paper published in Chemistry of Materials9 was one of the top 20 most highly downloaded papers of the month.

**References**

1 M. T. Sajjad et al., *J. Mater. Chem. A, **2020**,* 8, 15687
2 B. Siegmund, M.T. Sajjad et al., *Advanced Materials*, **2017,** 29, 1604424**.**
3 O. Blaszczyk et al., *Mater. Horiz., **2020**,* 7, 943
4 B. Li et al., *Nano Energy,* **2020**, 78, 105249
5 L. K. Jagadamma et al., *ACS Applied Materials & Interfaces*, **2018**, 10, 24665-24678.
6 M. T. Sajjad et al., *J. Mater. Chem. A**, 2018,*** 6, 9445.
7 J. Park, M.T. Sajjad et al., *J. Mater. Chem. A,* **2016**, 4, 82.
8 M. Waszkielewicz et al., *Nanoscale*, **2018,** 10, 11335
9 Y. Zhang, M. T. Sajjad et al., *Chemistry of Materials*, **2019,** 31, 6548

# Muhammad Zahir Iqbal

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**Main Research Areas:**

- Supercapattery
- Supercapacitors
- Batteries
- Solar Cells
- Hybrid Energy Devices

**Short Biography: Dr. Muhammad Zahir Iqbal** has completed his PhD degree from Universitat Politècnica de Catalunya (UPC), Barcelona, Spain in 2014 and second PhD degree from Sejong University, Seoul, South Korea in 2015. Furthermore, he did his post-doctorate from Georgia State University, Atlanta, USA in 2015. Currently, he is working as an **Associate Professor** at GIK Institute of Engineering Sciences and Technology, Pakistan. He has been recently awarded with **Pakistan Academy of Sciences (PAS) Gold Medal**, 2020. He has been the recipient of the **Annual Best Researcher of the Year Award** at GIK Institute of Engineering Sciences and Technology consecutively since 2016. He is also the winner of **HEC Best Research Paper Award of Pakistan**. He has published **5 book chapters** and **123 articles** with total **Impact Factor of 518.**

**Research Interests:** Porous Materials, 2D Materials, Metal Oxides, Sulfides and Phosphates, metal-organic frameworks, Solar Cells, Modelling of Energy Storage Devices, Supercapattery, Supercapacitors and Batteries.

# Nazish Shekha

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**Main Research Areas:**

- Net-Zero Strategies
- Climate Policy/ Strategy for Companies
- Lifecycle Assessment
- Energy Management
- Increasing the renewable energy mix as a power source

**Short Biography:**
A BSc Human Environmental Sciences from King's College London(2002) and a MSc in Poverty Reduction: Policy and Practice from SOAS, University of London (2017). For my thesis in my masters degree, I focused on how climate change awareness can be increased. In relation to my academic background, I had the opportunity to present my Masters Thesis at a conference on climate change in Islamabad in December 2017.

I currently head the research at the Centre of Excellence in Responsible Business (CERB) at the Pakistan Business Council. I am also involved in CERB's SDG Leadership Programme -which is a series of workshops and webinars enabling business to learn about reporting commitments to the SDGs.

Prior to this, as an independent consultant I assisted companies in three essential areas: benchmarking, research and analysis to develop effective strategies and reporting on sustainability. I have experience in conducting surveys, creating carbon footprints, impact evaluation, documenting and evaluating sustainability reports. Prior to becoming an independent consultant, worked in Ernst and Young Pakistan for 4 years assisting in the development of the firm's sustainability practice and identifying opportunities for carbon reduction.

**Research Interests:** Companies the world over have committed to setting net-zero emission targets to halve emissions by 2030.[1] Pakistan's textile sector holds a certain niche in exporting to global brands. In anticipation of global trends, a number of companies have openly committed to net-zero emissions targets.

At the 'starting line', companies need to identify the steps which companies follow for the emissions: **Pledge** - Set an interim target to achieve in the next decade, which reflects maximum effort toward or beyond a fair share of the 50% global reduction in CO2 by 2030 identified in the IPCC Special Report on Global Warming of 1.5C; **Plan** - Identify actions to be taken toward achieving both interim and longer-term pledges, especially in the short- to medium-term; **Proceed** - action toward achieving (net) zero, consistent with delivering interim targets specified and **Publish** - Commit to report publicly both progress against interim and long-term targets

To set specific targets in order to achieve net-zero emissions will essentially involve calculating carbon footprint of a product's lifecycle and identifying measures for reducing emissions through the inventory analysis. The climate strategy would essentially be based on reducing energy consumption by improving process efficiency and opting for renewable energy solutions. As companies begin to map the processes and set science-based targets, a collation of the approaches can be analysed to identify where the opportunities lie for emission reductions and feasible renewable-energy options for the textile sector.

**References**

1. UNFCCC (2020) *Race to Zero Criteria 2.0*: https://racetozero.unfccc.int/wp-content/uploads/2021/04/Race-to-Zero-Criteria-2.0.pdf

# Nilanthy Balakrishnan

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**Main Research Areas:**

- 2D materials
- Semiconductors
- Optoelectronics
- Photovoltaics
- 2D materials growth

**Short Biography:** I obtained BSc Hons degree in Physics from University of Jaffna, Sri Lanka in 2010, and MSc by Research and PhD in Condensed Matter Physics from the University of Nottingham in 2012 and 2015, respectively. Following my PhD, I worked as a postdoctoral researcher for 3 years at the University of Nottingham and 18 months at the University of Manchester. I was appointed as a Lecturer in Physics at Keele University in October 2019.

**Research Interests:** My research focusses on the fundamental properties and applications of novel two-dimensional (2D) materials, especially III-VI van der Waals layered materials. Among the large family of 2D van der Waals crystals, the 2D layered III-VI (III = Ga, In, and VI = S, Se, Te) compounds are attracting increasing interest for their excellent electronic and optical properties. They exist with different stoichiometry and polytype phases (α, β, γ, *etc*.) with physical properties relevant for applications in photovoltaics, thermoelectric, and optoelectronics.

I have successfully developed a physical vapour deposition method to grow β-$In_2Se_3$ on different substrates ($SiO_2$, mica and graphite)[1] and γ-InSe and the α, β and γ phases of $In_2Se_3$ on GaSe crystals[2]. Currently I am focussing to develop different band alignment and potential profiles by growing III-VI layers on different layered semiconductors. By combining materials with different band gap energies enable me to fabricate different optoelectronic devices, including multi-colour solar cells.

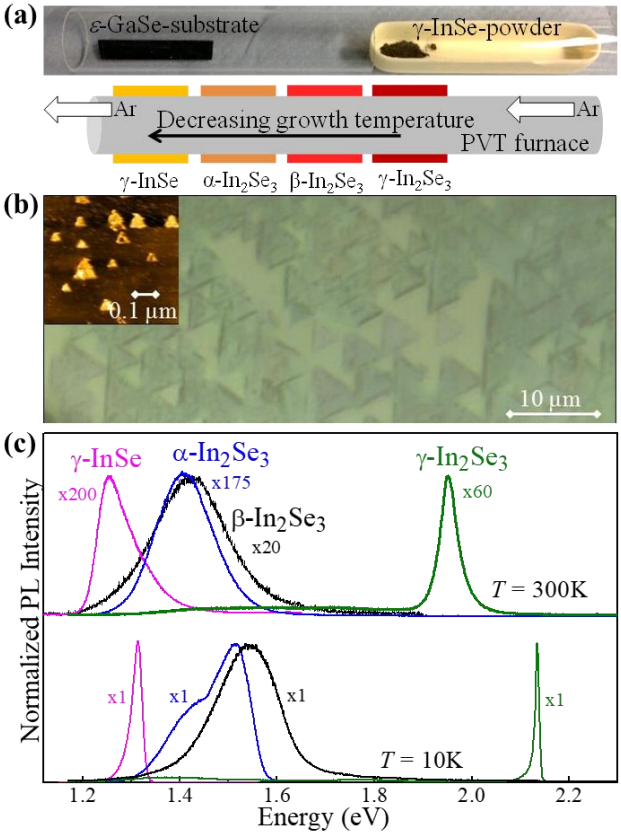


**Fig.1**: **(a)** Image and schematic diagram of the quartz tube for the physical vapour deposition of $In_xSe_y$ on ε-GaSe. The temperature gradient in the quartz tube enables the growth of different stochiometries and phases of $In_xSe_y$. **(b)** Optical micrograph and AFM image, **(c)** Room temperature ($T$ = 300 K) and low temperature ($T$ = 10 K) $\mu$PL spectra of γ-InSe, α-$In_2Se_3$, β-$In_2Se_3$ and γ-$In_2Se_3$ layers grown on exfoliated ε-GaSe flakes.

**References**

1 N. Balakrishnan *et al*., *2D Mater*. 2016, **3**, 025030.
2 N. Balakrishnan *et al*., *2D Mater*. 2018, 5, 035026.

# Philip Sandwell

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**Main Research Areas:**

- Sustainable electricity access in developing countries and displacement settings
- Techno-economic energy system modelling, simulation and optimisation
- Solar / battery / biomass / diesel / grid-connected / hybrid mini-grids
- Life cycle analysis and greenhouse gas mitigation potential

**Short Biography:** I am a Postdoctoral Research Associate in the Department of Physics at Imperial College London. My research focuses on supporting sustainable energy access in rural areas of developing countries and displacement situations, such as refugee camps. For two years I worked with Practical Action, an international non-governmental organisation, in designing and implementing sustainable energy interventions in three refugee camps in Rwanda. I am currently seconded to the United Nations Institute for Training and Research where I support the work of the Global Platform for Action for Sustainable Energy in Situations of Displacement.

**Research Interests:** I research the potential of renewable technologies to bring electricity to rural communities in developing countries and in situations of displacement such as refugee camps. This spans topics such as electricity demand estimation, technological performance of solar PV and battery storage, integration with other generation technologies as part of hybrid systems, and analysing their impact in terms of cost, $CO_2$ mitigation potential and service quality.

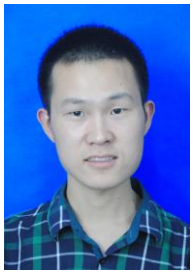
I developed the CLOVER model[1] for simulating, optimising and analysing rural electricity systems and investigating the implications of their deployment strategies. CLOVER has been applied to studies in South Asia (India, Nepal), Africa (Rwanda, Kenya, Uganda, Djibouti, Senegal) and Latin America (Brazil, Peru) to assess the performance of renewable electricity systems for household electricity, productive energy services, power for health clinics and more. The CLOVER model is open source and is continually developed to increase its functionality.

Most of my work focuses on the techno-economic analysis of solar minigrid systems in rural areas of developing countries[2]. I am also interested in other renewable generation sources (e.g. biomass[3]), technologies (solar home systems[4]) and the long-term financial sustainability of electricity systems[5].

**References**

1 P Sandwell, CLOVER model source code. https://github.com/phil-sandwell/CLOVER
2 P Sandwell et al., Solar Energy Materials and Solar Cells, *Off-grid solar photovoltaic systems for rural electrification and emissions mitigation in India* (2016) **156**, 147-156.
3 CL Chambon, T Karia, P Sandwell and JP Hallett, Renewable Energy, *Techno-economic assessment of biomass gasification-based mini-grids for productive energy applications: The case of rural India* (2020) **154**, 432-444
4 PJM Thomas, P Sandwell, SJ Williamson and PW Harper, Renewable and Sustainable Energy Reviews, *A PESTLE analysis of solar home systems in refugee camps in Rwanda* (2021) **143**, 110872.
5 JB Alonso, P Sandwell and J Nelson, Sustainable Energy Technologies and Assessments, *The potential for solar-diesel hybrid mini-grids in refugee camps: A case study of Nyabiheke camp,* Rwanda (2021) **44**, 101095.

# Qiao He



**Address:** Department of Chemistry and Centre for Plastic Electronics
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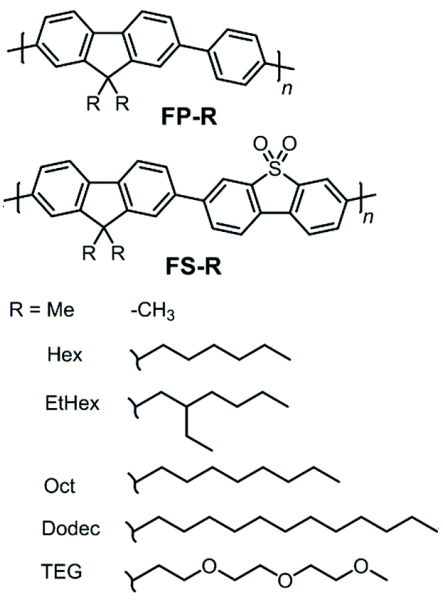
**Main Research Areas:**

- Organic/polymer materials synthesis and characterisation
- Organic solar cells fabrication and measurements
- Organic field-effect transistors fabrication and measurements

**Short Biography:** Qiao is a former IC-CSC PhD scholar in the Department of Chemistry and Centre for Plastic Electronics at Imperial College London and continue as a full-time research associate with Prof. Martin Heeney in 2021. Before coming to Imperial, Qiao have been acknowledged with some key awards such as the Chinese National Scholarship, National Endeavour Scholarship and Outstanding University Graduate. After completing his PhD studies, he was awarded the PE-CDT Prize for the Thesis of the Year. He has rich experience in organic synthesis of conjugated small molecules and polymers, and proficient practical skills in fabrication and evaluation of OPV and OFET devices.

**Research Interests:** Qiao's expertise focuses on developing new synthesis methods and designing new organic semiconducting materials mainly for organic photovoltaics and field-effect transistors application. He has focussed on the role of molecular shape (cruciform, saddle, calamitic) on optoelectronic properties, developing several novel classes of materials. Utilisation of solar energy to produce sustainable fuels is another active research topic currently. For example, most attempts to produce hydrogen from water have been focused on either inorganic oxide materials (such as $TiO_2$, $WO_3$, and $SrTiO_3$) or metal-organic materials as photocatalysts. Recently, linear conjugated polymers (Fig. 1) have become a very promising class of hydrogen evolution photocatalysts, as they have the potential to fulfil these requirements and because of their advantages of structural diversity and tuneable electronic properties. Design and preparation of these functional materials are crucial to achieve efficient energy transition and provide promising approach for climate challenge.




| Polymer | HER[e]/ μmol $h^{-1}$ |
|---|---|
| **FP-Me** | 0.20 ± 0.03 |
| **FP-Hex** | 0 |
| **FP-EtHex** | 0.10 ± 0.03 |
| **FP-Oct** | 0.13 ± 0.03 |
| **FP-Dodec** | 0.15 ± 0.03 |
| **FP-TEG** | 7.65 ± 0.15 |
| **FS-Me** | 21.00 ± 0.50 |
| **FS-Hex** | 34.25 ± 0.75 |
| **FS-EtHex** | 13.38 ± 0.08 |
| **FS-Oct** | 17.00 ± 0.75 |
| **FS-Dodec** | 12.00 ± 0.15 |
| **FS-TEG** | 72.50 ± 2.50 |

**Fig. 1** Structures and hydrogen evolution rates (HER) of the linear conjugated fluorene co-phenyl (FP-R) and fluorene-co-dibenzo[b,d]thiophene sulfone (FS-R) polymer series where R is the alkyl group which is modified as shown.[1]

**References**

1. ***Energy Environ. Sci***., 2020, **13**, 1843-1855.

# Rihab Khalid

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**Main Research Areas:**

- Energy demand and efficiency in the built environment
- Energy and space use
- Gender
- Socio-technical approaches in energy research
- In-depth qualitative methodologies

**Short Biography:**
Rihab is a Research Fellow at Lucy Cavendish College and Lecturer (temp) at the Department of Architecture, University of Cambridge UK. She completed her PhD in Architecture from the University of Cambridge in 2020. Before moving to the UK in 2014, Rihab completed her MSc in Architecture from the University of Engineering & Technology, Lahore Pakistan.

**Research Interests:**
Rihab is an interdisciplinary researcher in sustainable energy consumption and demand management, focusing on socio-technical approaches to energy transitions. In particular, she is interested in the intersections of gender, energy infrastructure and space use in Pakistan and more broadly in the Global South. Her PhD dissertation: 'Socio-material constructs of domestic energy demand: Household and housing practices in Pakistan' demonstrated how the "normalisation" of contemporary housing standards and comfort expectations predetermine unsustainable patterns of consumption, leading to unprecedented household electricity demands. Based on this, she framed sustainability interventions in house design and use, highlighting implications for housing and energy policy in Pakistan. Rihab is committed to problem-driven research to tackle societal challenges, and to improve energy efficiency and sufficiency to meet climate change targets.

Rihab is currently Co-I on the QR-GCRF project: 'Gender equity and energy access in the Global South', headed by the Global Sustainability Institute at Anglia Ruskin University. The project aims to investigate the interlinks between UN SDG 7 "access to affordable, reliable, sustainable and modern energy" and SDG 5 "gender equality" and its implications for energy policy and practice. Through collaboration with 11 partners across six countries, the project has undertaken 86 semi-structured interviews with professional experts in the energy sector from Nigeria, Ghana, India and Pakistan. In this, Rihab is project lead for Pakistan, overseeing the review of existing energy governance models, data collection from 21 interview participants on their expectations and experiences of gender equity in the energy sector, and policy brief development.

Rihab is specifically interested in expanding the role and engagement of Social Science and Humanities (SSH) perspectives in energy policy and research through interdisciplinary and mixed-methods approaches. It is now recognised that a multidisciplinary approach is necessary to tackle global 21$^{st}$ century challenges such as those of energy demand reduction, energy justice and climate change mitigation. In this, the Arts, Humanities and Social Sciences certainly have a greater role to play.

# Rizwan Raza

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**Main Research Areas:**

- Electrochemistry and fuel cell research with emphasis on SOFCs, PEMFCs
- Material characterization for energy conversion devices fuel cell, solar cell.
- Functional nanomaterials like metal oxides based electrodes for energy applications
- Oxygen carriers' materials for chemical looping combustion and gasification
- Renewable Energy Resources

**Short Biography:** I have, completed PhD (Energy Technology) from, KTH, Sweden in 2012. Post doc from Linköping University, Sweden in 2019-2020. I am also visiting researcher in Chalmers University of Technology, Sweden in Energy and Materials division. Currently working as a Tenured Associate Professor at COMSATS University Islamabad, Lahore Campus.

**Research Interests:** My research interests pertain to current and potential applications as well as new methodologies in energy material, renewable energy technologies and electrochemical devices.
Further, I have completed several multidisciplinary projects regarding Energy conversion & Energy storage devices (Fuel cells, Solar cells, Batteries). The fuel cell research was explored in many directions starting from slurry formulations of materials, particle sizing with rotary and planetary ball milling, screen printing the electrolyte ink, tape casting of electrodes and fuel cell fabrication, the impregnation of catalytic ions onto these cell parts and, finally fuel cell testing, electrochemical characterization and see the degradation mechanism. Besides, the nanostructures of all synthetic/fabrication steps were elaborated using SEM and XRD techniques. Engineering the porosity in anode, cathode, and electrolyte parts of the fuel cell, was also learnt. Recently, we have prepared core shell materials for fuel cells and catalyst for ethanol-based fuel cells.

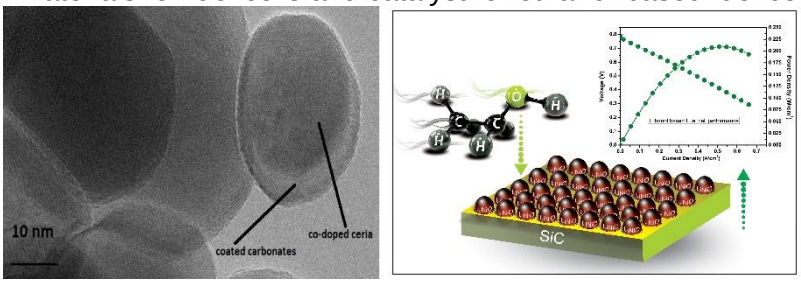


**Fig. 1** a) Core shell electrolyte b) SiC as catalysts for ethanol SOFC.

**References**


1. Sarfraz, Amina ; Rizwan Raza*. M Catalytic Effect of Silicon Carbide in the Composite Anode of Fuel Cells" ACS Applied Energy Materials, ae-2021-00197m.R2, (accepted) May2021.
2. Amtul N, Murid H, Imran S, Qaisar A, Duygu Y, Marriam Z, Rizwan Raza* The robust catalysts (Ni1-x-Mox/doped ceria and Zn1-x-Mox/doped ceria, x = 0.1 and 0.3) for efficient natural gas reforming in solid oxide fuel cells, Electrochimica Acta 2020,361, 137033.

# Reiner Sebastian Sprick

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**Main Research Areas:**

- Solar fuels production
- Photocatalysis
- Conjugated polymers
- Hybrid systems
- Pathogen inactivaiton

**Short Biography:** Dr Reiner Sebastian Sprick obtained his PhD in Chemistry from The University of Manchester in 2013. He then joined Prof. Andrew Cooper's Group at the University of Liverpool first as a Post-Doctoral Research Associate and before working in the same group as a Research Lead. In the summer of 2020, he joined the University of Strathclyde to start his independent research group. His research group has a major research interests across a wide spectrum of polymer chemistry, but with a particular interest addressing challenges in sustainability.

**Research Interests:** My group is mainly interested in the synthesis and application of conjugated materials in the context of sustainability. As such we are interested in materials that facilitate photocatalytic reactions, *i.e.* overall water splitting, hydrogen production from water, oxygen production, carbon dioxide reduction and hydrogen production coupled to oxidation reactions (such as biomass). We are also interested in photoatalytic pathogen inactivation and other catalytic processes that conjugated materials can perform, such as electrocatalytic and photoelectrocatalytic processes.
We use a range of different conjugated material classes (**Fig 1.**) such as covalent organic frameworks,[1] unbranched conjugated polymers (with a particular interest in solution processible polymers)[2,3] and conjugated microporous polymers[4] allowing us to tailor the properties to the desired application.

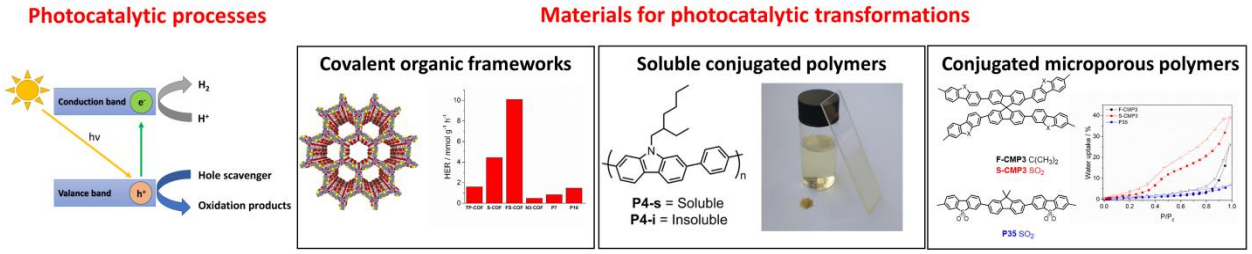


**Fig. 1** Photochemical fundamental processes and materials that my group studies.

**References**

1 X. Wang, L. Chen, S. Y. Chong, M. A. Little, R. Clowes, Y. Yan, M. A. Zwijnenburg, R. S. Sprick, A. I. Cooper, *Nat. Chem*., 2018, **10**, 1180–1189.
2 R. S. Sprick, B. Bonillo, R. Clowes, P. Guiglion, N. J. Brownbill, B. J. Slater, F. Blanc, M. A. Zwijnenburg, D. J. Adams, A. I. Cooper, *Angew. Chem. Int. Ed*., 2016, **55**, 1792-1796
3 D. J. Woods, S. A. J. Hillman, D. Pearce, L. Wilbraham, L. Q. Flagg, W. Duffy, D. S. Ginger, I. McCulloch, J. R. Durrant, A. A. Y. Guilbert, M. A. Zwijnenburg, R. S. Sprick,* J. Nelson, A. I. Cooper, *Energy Environ. Sci*., 2020, **13**, 1843-1855.
4 R. S. Sprick, J.-X. Jiang, B. Bonillo, S. Ren, T. Ratvijitvech, P. Guiglion, M. A. Zwijnenburg, D. J. Adams, A. I. Cooper, *J. Am. Chem. Soc.,* 2015, **137**, 3265-327.

# Stefano Landini

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**Main Research Areas:**

- Solar systems, Solar PV, Solar Thermal Collectors
- Thermal Management of Li-Ion Cells for Ageing/Degradation Depletion
- Thermal Management of Mechanical/Electrical/Electronic Devices
- Passive, Active, Hybrid Cooling with Phase Change Materials
- Design/Optimisation of Renewable Energy Systems with Storage Integration

**Short Biography:** BSc (2009-2012) and MSc (2012-2014) in Energy Engineering at Polytechnic of Milan (Italy) with Distinction. MSc Renewable Energy Engineering (2015-2016) at Heriot-Watt University with Distinction. PhD Mechanical Engineering (2017-2020) at Heriot-Watt University on Thermal Management of Li-Ion Cells, awarded an ETP PECRE Research Grant to establish collaboration with HSLU Luzern CC Thermal Energy Storage (Switzerland). Research Associate (2020-Now) at nESSI Research Group Heriot-Watt University working on an InnovateUK project on the development of novel low-cost solar thermal collectors in collaboration with SolarisKit Ltd. Previous industry collaborations: Sorgenia Spa, Sunamp Ltd, Soltropy, AES Ltd. Academic collaborations: HSLU Luzern CC Thermal Energy Storage (Switzerland), University of Padova Nano Heat Transfer Lab (Italy), Wollongong University (Australia).

**Research Interests:** Research Associate currently working on optical and thermodynamic optimisation of low-cost solar thermal collectors, development of solar thermal collectors smart AI IoT based controller, and thermal management of Li-Ion cells[1,2,3,4,5]. My main research interests include thermal management, phase change cooling, heat transfer, renewable energy technologies, electrical and thermal energy storage, energy/exergy analysis, and optimisation of energy systems

**References**

1. S. Landini et al., “Effect of geometry and thermal mass of Direct-Metal-Laser-Sintered aluminium heat exchangers filled with Phase Change Materials on Lithium-Ion cells’ passive cooling”, *Appl. Therm. Eng.*, 2021 (under review)
2. S. Landini et al., “Experimental Investigation of Lithium-Ion Cells Ageing under Isothermal Conditions for Optimal Lifetime Performance”, *J. Energy Storage*, 2021 (under review)
3. S. Landini, T. O’Donovan “Novel experimental approach for the characterisation of Lithium-Ion cells performance in isothermal conditions”, *Energy*, vol. 214, no. January, p. 118965, 2021.
4. S. Landini et al., “Passive cooling of Li-Ion cells with direct-metal-laser-sintered aluminium heat exchangers filled with phase change materials,” *Appl. Therm. Eng.*, vol. 173, no. February, p. 115238, 2020.
5. S. Landini, J. Leworthy, T. O’Donovan, “A Review of Phase Change Materials for the Thermal Management and Isothermalisation of Lithium-Ion Cells,” *J. Energy Storage*, vol. 25, no. February, p. 100887, 2019.

# Taqi Mehran

Assistant Professor, School of Chemical and Materials Engineering

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**Main Research Areas:**

- Electrochemical energy conversion/storage devices
- Solid oxide fuel cells (SOFC) and solid oxide electrolysis cells (SOEC)
- Green fuel and materials production by electrochemical methods
- Waste to Fuel, Waste to Energy, Energy to Fuel

**Short Biography:** I am working at School of Chemical and Materials Engineering, National University of Sciences and Technology (NUST), Islamabad, Pakistan as Assistant Professor of Chemical Engineering and I completed my Ph.D. in Advanced Energy Technology from Korea University of Science and Technology (UST), South Korea (2017) and MS in Process Engineering from Pakistan Institute of Engineering and Applied Sciences (PIEAS, 2009), Islamabad. I worked at fuel cell laboratory of Korea Institute of Energy Research, South Korea for more than 5 years as graduate student researcher and postdoctoral fellow. I have published his research in more than 55 SCI journal papers, 60+ international conferences and invented 6 patents. I received Best Researcher Award (Gold) 2017 at Korea Institute of Energy Research, UST Research Excellence Award 2016, and several other research awards at international forums.

**Research Interests:** My focus of research is on advanced electrochemical energy conversion and storage technologies such as solid oxide fuel cells, solid oxide electrolysis cells, supercapacitor, next-generation batteries. Recently, we have developed perovskite based electrocatalysts and their composites with LDHs and MXenes for alkaline water splitting [1]. We have also worked on improving the durability of solid oxide electrolysis electrode by microstructure tailoring [2]. In another collaborative work, we focus on power to fuel, power to hydrogen and waste to energy concepts [3]. We have also developed a greener way to synthesis MXene without hydrofluoric acid and used the novel MXene for electrode fabrication. Work on exploiting the non-stoichiometry and lattice strain to enhance the reactivity and conductivity of layered and double perovskites is also in progress. In summary, I am interested in energy conversion and green fuel production technologies with focus on solid oxide fuel and electrolysis cells, nano-structured electrocatalysis for green fuels production and energy to fuels.

**References**

[1] R. Khan *et al.*, “3D hierarchical heterostructured LSTN@ NiMn-layered double hydroxide as a bifunctional water splitting electrocatalyst for hydrogen production,” *Fuel*, vol. 285, p. 119174, 2020.

[2] M. T. Mehran *et al.*, “Production of syngas from H 2 O/CO 2 by high-pressure coelectrolysis in tubular solid oxide cells,” *Appl. Energy*, vol. 212, pp. 759–770, Feb. 2018, doi: 10.1016/j.apenergy.2017.12.078.

[3] I. Ali *et al.*, “Kinetic and thermodynamic analyses of dried oily sludge pyrolysis,” *J. Energy Inst.*, vol. 95, pp. 30–40, 2021.

# Uzma Hira

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University of the Punjab, Lahore, Pakistan
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Website: http://pu.edu.pk/faculty/description/2324/Dr-Uzma-Hira.html

**Main Research Areas:**

- Synthesis and characterization of oxide materials for energy conversion and storage applications
- High temperature thermoelectric properties, photocatalysis and water splitting of perovskite oxide and oxide materials
- Magnetic, dielectric and electrochemical properties of oxide materials

**Short Biography:** I am currently working as Assistant Professor (Physical Chemistry) at the University of the Punjab, Lahore, Pakistan. I have received PhD degree in Chemistry in 2019 from Lahore University of the Management Sciences (LUMS), Lahore, Pakistan. I have completed M.Phil (Physical Chemistry) in 2014 with distinction and MSc (Chemistry) in 2010 from University of Peshawar, Pakistan.

**Research Interests:**
I am interested in the synthesis, characterization and applications of oxide/perovskite oxide materials to address challenges in sustainable development (energy conversion; thermoelectrics, water splitting, photocatalysis and energy storage). I already have 8 peerreviewed papers in reputed international journals from my PhD projects.
I have synthesized first time $A_{2-x}Bi_xCoRuO_6$ (A = Ba & Sr) double perovskite oxides, $Ca_{3-2x}Na_{2x}Co_{4-x}M_xO_9$ (M = Mo & W)[1-2] and $Bi_{2-2x}Na_{2x}Sr_2Co_{2-x}W_xO_y$ ($0 \le x \le 0.075$)[3] materials through soild-state reaction method and investigated crystal structure and phase purity through Rietveld refinement of synchrotron and neutron diffraction data by using GSAS program. We have reported improved power factor and zT values for these synthesized materials. We observed highest $zT$ ~ 0.35 for the $Bi_2Sr_2Co_2Oy$ system as shown in Fig. 1.

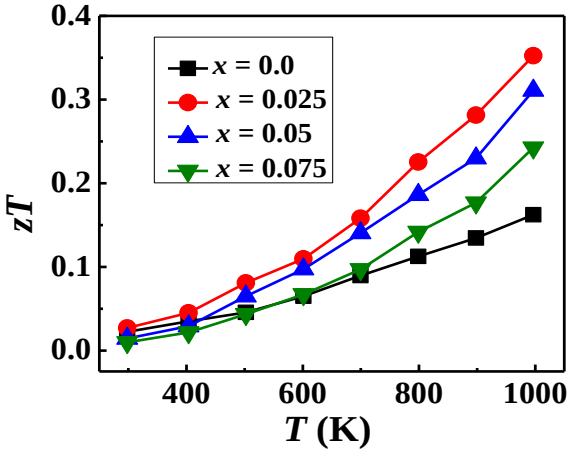


**Fig. 1** Temperature dependent $zT$ for $Bi_{2-2x}Na_{2x}Sr_2Co_{2-x}W_xO_y$ ($0 \le x \le 0.075$) samples.

**References**

1. U. Hira, et al., RSC adv. 2019, **9**, 31274.
2. U. Hira, et al., RSC adv. 2018, **8**, 12211.
3. U. Hira, et al., J. Electron. Mater. 2019, **48**, 4616.

# Wattala Fernando

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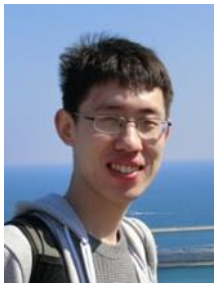
**Main Research Areas:**

- Global, Island, National and International energy planning. The local community, single project and all scale energy planning.
- Sustainable energy technologies and transitions.
- Smart cities and smart buildings, Waste to Energy projects, Renewable Energy technologies and Integration of RET.
- Smart Energy Systems, Electric vehicles, Biofuels and Biomass generation using AD systems.

**Short Biography:** Wattala received his bachelor's degree in Mobile Communication Engineering from Northumbria University Newcastle Upon Tyne UK in 2011. After graduation, he acquired significant experience working with several employers - Ericson, Vodafone and Huawei for Olympic Project (London Cluster), MBNL Network project (Scotland), Vodafone SRAN project (Manchester & Liverpool cluster), Vodafone and Telefonica LTE project (London cluster) and Vodafone and Telefonica Beacon project (Glasgow and Manchester cluster). In 2015 he completed MSc in Energy, Water and Environmental Management from Abertay University Dundee, UK. The work at Ericson, Vodafone and Huawei gave him valuable industrial and practical experience, especially in the field of power engineering and that helped him to follow his MSc. In 2020, he completed a PhD degree in the field of energy engineering, and the main aim of the project seeks to enhance Smart Energy System for 100% Renewable Energy and Transport Solutions for Sri Lanka
Currently, Wattala is actively participating in designing and implementing new renewable energy projects carried out by the Sri Lankan public sector and private sector to encourage Sri Lanka's Green Energy concept. These projects have helped him to prepare feasibility reports for a few renewable energy projects. Wattala has involved in undermentioned energy-related projects in Sri Lanka and has made a valuable contribution to the projects by proposing some innovative ideas based on some technical calculations to prepare feasibility reports and presentations for the government approval.
Currently, Wattala is working as a lecturer at Edinburgh Napier University and visiting lecturer at University of Applied Management Studies, Mannheim, Germany and German Business School, the University of Tunis for MBA in Energy Management. Wattala is expanding his network in academia with research work in community energy designs, small scale energy system design and 100% renewable smart energy system design with many countries. He is an active member of the Institute of Engineering and Technology, Institute of Electrical and Electronics Engineers, Energy Institute and Charted Institute of Waste Management. Currently, he is preparing his application form for Charted Engineer membership with the Institute of Engineering and Technology.

**Research Interests:** I have extensive research experience in energy system design, power electronics, community energy projects, small-scale renewable energy projects and sustainable energy projects in the UK, Sri Lanka, India, Israel, Indonesia, Tunisia, Northern Island and Cyprus. The projects focused on energy system design and optimisation, environmental management, renewable energy technologies and power engineering. My work provides a useful link between Universities and government energy authorities to make a proper dialogue to reform private energy sectors.

# Wenzhuo Cao



Department of Earth Science and Engineering,
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**Main Research Areas:**

- Geo-energy (deep geothermal energy, aquifer heat storage and recovery, shale gas, etc.)
- Sealing integrity and fault stability in $CO_2$ geological storage
- Coupled thermo-hydro-mechanical-chemical modelling of fractured rocks
- Monitoring, modelling and evaluation of excavation/injection-induced seismicity
- Characterisation and modelling of subsurface discrete fracture network

**Short Biography:** I obtained my PhD degree on mining geomechanics (funded by the EPSRC International Scholarship) at Imperial College in 2019. Since then, I have progressively adapted my research interests to address broader needs, involving $CO_2$ geological storage, geothermal systems, aquifer heat storage and recovery, and coalbed methane. The outcomes of my research have led to over 30 journal publications (attracting >1,000 citations). My PhD theses led to my research being recognised as worthy of the 2021 Rocha Medal Runner-up Award by the International Society for Rock Mechanics (ISRM). I was also recognised as an ARMA Future Leader by the American Rock Mechanics Association (ARMA), and received the BGA Fund Award by the British Geotechnical Association (BGA) in 2021. I serve as the Theme Lead for Thermal Energy and Nuclear Waste Storage in ARMA, a session chair in the 55$^{th}$ US Geomechanics / Rock Mechanics Symposium, and a reviewer for 1 UK research council, 3 international conferences, and over 40 journals.

**Research Interests:** My core research expertise is in the areas of geomechanics, reservoir engineering, both hard rock and coal mining and resource evaluation. My research has so far concerned the application of reservoir geomechanics principles to underground rock engineering applications. At one end of the spectrum is the modelling of reservoir behaviour related to conventional and unconventional reservoir exploitation, $CO_2$ storage, and geothermal energy systems. At the other end of the spectrum is the risk assessment and modelling of geomechanical behaviour associated with industrial underground activities such as hard rock and coal mining, tunnelling and blasting. I have researched and published on topics such as coupled hydromechanical modelling, monitoring and forecasting of induced seismicity, discrete fracture network (DFN)-based microseismicity modelling, fracture characterisation, hydrofracturing, and fracture behaviour of rocks subjected to saturation/thermal treatment. My research has presented a suite of research frameworks, including (1) a two-way coupled reservoir and geomechanical modelling framework to assess $CO_2$ storage[1], (2) a fully coupled hydromechanical modelling methodology for unconventional reservoir exploitation, (3) a forecasting and assessment framework for excavation/injection-induced hazardous seismicity[2], (4) a discrete fracture network (DFN)-based microseismicity model to evaluate excavation-induced seismicity, and (5) a multi-scale geometric analysis framework to characterise and generate subsurface fracture networks[3]. My expertise in earth science and engineering, complemented by disciplinary areas such as solar energy, energy storage, carbon capture technology and social science, provides geo-engineering carbon-neutral solutions for the energy transition of Pakistan.

**References**

1 W. Cao, J.Q. Shi, S. Durucan and A. Korre, *Int. J. Greenh. Gas Control* 2021, **107**, 103302.
2 W. Cao, S. Durucan, W. Cai, J.Q. Shi, and A. Korre, *Int. J. Coal Geol.* 2020, **232**, 103627.
3 W. Cao, and Q. Lei, *Pure Appl. Geophys.* 2018, **175**, 2167-2179.

# Xiaolei Fan

Address: C18, The Mill, The University of Manchester, Oxford Road, Manchester, M13 9PL, UK
Email: xiaolei.fan@Manchester.ac.uk

**Main Research Areas:**

- Heterogeneous catalysis
- Porous materials
- Hydrogen production
- Process intensification
- Biorefinery

**Short Biography:** Xiaolei Fan received his PhD in Chemical Engineering from the University of Bath in 2010, worked in catalytic reaction engineering, flow chemistry and structured reactors. From 2010 to 2013, he took the postdoctoral positions at the University of Warwick and University of Cambridge, focusing on the research in catalytic kinetics and CFD simulation of reacting flows in structured reactors. In October 2013, he joined The University of Manchester and now is a Reader of Chemical Engineering. He is the committee member of RSC Applied Catalysis group and British Zeolite Association, and elected as the Chair of the Chinese Society of Chemical Science and Technology in the UK in 2019.

**Research Interests:** His research broadly encompasses the heterogeneous catalysis [1], plasma catalysis [2-4], catalytic reaction engineering [5], structured catalysts/reactors [6] and porous materials [7-8]. His research is recognised internationally with several awards such as the 2018 Lee Hsun Young Scientist Lecture award on Materials Sciences by the Chinese Academy of Sciences. RSC React Chem Eng 2019 Emerging Investigators and 2020 ACS I&EC Research Influential Researchers.

**References**

1 R. Vakili, T.J.A. Slater, C. Hardacre, A.S. Walton, X. Fan, *J. Catal.* 2020, **391**, 522–529.
2 S. Xu, S. Chansai, S. Xu, C.E. Stere, Y. Jiao, S. Yang, C. Hardacre, X. Fan, *ACS Catal.* 2020, **10**, 12828–12840.
3 S. Xu, S. Chansai, S. Xu, Y Wang, S. Haigh, Y. Mu, Y. Jiao, C. E. Stere, H. Chen, X. Fan, C. Hardacre, *Appl. Catal. B* 2020, **268**, 118752.
4 S. Xu, S. Chansai, C. Stere, B. Inceesungvorn, A. Goguet, K.T. Wangkawong, S.F.R. Taylor, N. Al-Janabi, C. Hardacre, P.A. Martin, X. Fan, *Nat. Catal.* 2019, **2**, 142–148.
5 H. Chen, Y. Mu, C. Hardacre, X. Fan, *Ind. Eng. Chem. Res.* 2020, **59**, 8202–8211.
6 X. Ou, C. Wu, K. Shi, Hardacre, J. Zhang, Y, Jiao, X. Fan, *Appl. Catal. A* 2020, **559**, 117626.
7 S. Abdulridha, J. Jiang, S. Xu, Z. Zhou, Y. Zhou, A.A. Garforth, Y. Jiao, X. Fan, *Green Chem.* 2020, **22**, 5115–5122.
8 Y. Jiao, L. Forster, S. Xu, H. Chen, J. Han, X. Liu, Y. Zhou, J. Liu, J. Zhang, J. Yu, C. D'Agostino, X. Fan, *Angew. Chem. Int. Ed.* 2020, **59**, 19478–19486.

# Zeeshan Ali

School of Chemical and Materials Engineering (SCME)
National University of Sciences and Technology (NUST), Islamabad, Pakistan

**Main Research Areas:**

- Transition metal chalcogenides: Design, synthesis, and characterizations of nano structured electrode materials.
- Utilization of hierarchically porous nanomaterials in metal ion ($Na^+/Li^+/K^+/Mg^{++}$) batteries for sustainable future

**Short Biography:** I am currently Assistant Professor (on Tenure Track System) at the National University of Sciences and Technology (NUST), Islamabad. I hold doctorate degree in Materials Science from **Peking University,** China (2015-2019). Before that, I did my Masters in Materials and Surface Engineering from NUST (2012-2015) and Bachelors from University of Engineering and Technology, Lahore (2008-2012).

**Research Interests:** My research interests include design, synthesis, and characterizations of nano structured electrode materials for the application as electrode in metal ion batteries. I have intensive hands-on experience of materials synthesis using solid-state, CVD, and solution methods. I have been using these materials to prepare coin-cell as well as pouch cell type batteries for lithium, lithium-S, sodium, potassium, and magnesium ion chemistries. Besides this, we also performed in-situ/ex-situ characterization studies to understand storage mechanism of batteries. During my PhD, I gained extensive hands-on experience on several characterization techniques for material evaluation and coin cell fabrication. We developed several interesting electrode materials and succeeded in publishing several high impact articles.

Recently, I have won a joint grant of Pakistan Science Foundation (PSF) and National Natural Science Foundation of China (NSFC) worth 16 Million PKR for the fabrication of flexible sodium sulfur batteries. Besides this, I am also preparing several proposals to obtain funding for the work on enabling the domestic manufacturing of lithium-ion batteries in Pakistan for the sustainable development and empowerment of electric vehicle policy.

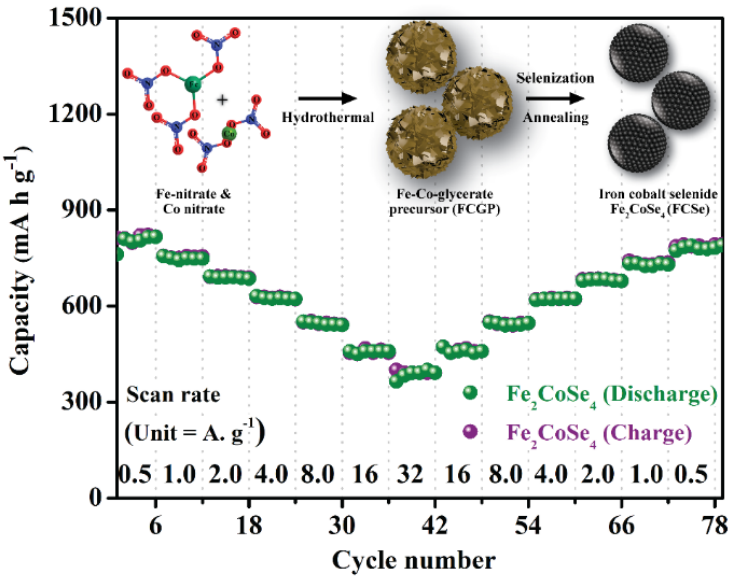


**Fig. 1** Binary transition metal selenide ($Fe_2CoSe_4$, termed as FCSe) nanospheres, prepared by an exclusive methodology and presented as a promising anode of sodium ion batteries (SIBs)[1].

**References**

1 Ali, Z., *et al.*, *Advanced Materials* (2018) **30** (32), 1802745
2 Ali, Z., *et al.*, *Materials Today* (2020) **35**, 131
3 Ali, Z., *et al.*, *Small* (2019) **15** (33), 1901995
4 Ali, Z., *et al.*, *Energy Storage Materials* (2018) **13**, 19
5 Ali, Z., *et al.*, *Advanced Materials* (2019) **31** (2), 1805430

# Zhiwei Gao

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**Main Research Areas:**

- Offshore wind turbine foundations
- Finite element modelling
- Constitutive modelling of soils
- Submarine landslides
- Rock catch fences

**Short Biography:** I am a Senior Lecturer in Geotechnical Engineering in the James Watt School of Engineering at University of Glasgow. I am a member of the Glasgow Computational Engineering Centre (GCEC) funded by the EPSRC. I received my Bachelor and Master degrees in Civil Engineering from Beihang University in China and PhD degree in Geotechnical Engineering from Hong Kong University of Science and Technology (HKUST). After working as a postdoctoral researcher in HKUST for one year, I joined the University of Glasgow in July 2013.

**Research Interests:** I have been working on constitutive modelling of soils since 2010. I have proposed a new method for modelling the anisotropic mechanical behaviour of geomaterials, including rock, soil and fibre-reinforced soil. Based on the new method, I have developed the first multiaxial constitutive model for sand which can account for the evolution of anisotropy. The new model has been applied in solving some challenging geotechnical engineering problems, including the shear band development in sand and the bearing capacity of strip footings. I have also developed the first multiaxial constitutive model for fibre-reinforced sand using this method. The research has been published in Géotechnique which is considered one of the best international journals for geotechnical engineering. I have also done comprehensive research on the mechanics of gassy clay. I was the first to propose a constitutive model for gassy clay which can consider the composite internal structure of this soil. I have published 28 papers in leading international journals, with over 580 citations and one ESI highly cited paper. I have been the PI of 3 research projects and participated in two other projects. Recently, I started research collaboration with Geowynd in the UK to develop a new design method for offshore wind turbine foundations. This research includes both laboratory tests and numerical modelling.

# Invited Speakers

## N. A. Zuberi

Senior Advisor and Deputy CEO
Kohala Hydro Power Project
China Three Gorges South Asia Investment Limited (C-SAIL)
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Mr. Zuberi advises and monitors the company on various technical, legal, commercial and financial issues related to development and implementation of 720 MW Karot, 590 MW Mahal, and 50 MW Wind Private Power Projects. As DCO Kohala Project, Mr. Zuberi handles all matters related to 1124 MW Kohala Hydro Power Project. Previously, he served as the Managing Director of Private Power and Infrastructure Board (PPIB), Ministry of Energy, Govt. of Pakistan, where his leadership was instrumental implementing Power Policy 1994 and successfully adding 6000 MW of private power generation to the national grid in just 3-4 years.

## Mazhar Bari

SVP Technology & Innovation &
Head of MindSphere Application centre
Siemens Ltd, Saudi Arabia
Email: mazhar.bari@siemens.com

Mazhar is the subject matter expert on renewable energy, Circular Carbon Economy (CCE) and Digitalization and responsible for driving business growth. Dr Bari has contributed to the CCE discourse in Saudi Arabia and given several invited lectures on the subject. He was invited to present at the G20 Circular Carbon Economy workshop on '*Emissions to Value business potential: $CO_2$ reduction for production of higher hydrocarbons & oxygenates'* (1st July 2020). He has contributed to the T20 policy brief titled '*Staying cool sustainably in a warming climate*'. He is author of the New Siemens White paper on the *Circular Carbon Economy: Critical infrastructure for the new Molecular Economy'* which will be published in August 2021.
URL: https://www.linkedin.com/in/dr-mazhar-bari-92abb176/?originalSubdomain=sa

## Najeeb Ullah

Co-founder Cambridge Solar Environmental Solutions (CAMSES)
Founding Project Director US Pakistan Center for Advanced Studies in Energy
Project Director of Swat Engineering University
Email: najeeb@nwfpuet.edu.pk

Najeeb has PhD in Materials Science from the University of Cambridge. He is an entrepreneur and co-founder of a start-up, Cambridge Solar Environmental Solutions (CAMSES), at University of Cambridge UK based on his patent from PhD work. He is also awarded an entrepreneurial visa by UK government due to his entrepreneurial ventures. As a founding project Director, established the US Pakistan Center for Advanced Studies in Energy (USAID Funded Project of $20 million), 2013-2019. Currently working as Project Director of Swat Engineering University (Project of PKR 8 billion). Worked as consultant with UNDP (10 years energy plan of FATA), Country Expert with Tufts University Boston (Chinese overseas investment in renewable energy projects through the Belt and Road Initiative). Also working as Principal Investigator of the Project "Commercialization of Third Generation (perovskite) solar PV".

# Mentors and Organisers

## Irshad Hussain

Pakistan Mentor
Lahore University of Management Sciences
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Irshad is one of the foremost experts in nanomaterials for energy applications in Pakistan. He is well-connected with both industry and government, currently leading the National Core Group of Nanotechnology under the Prime Minister of Pakistan's Task Force on Science & Technology. Research pages URL: https://lums.edu.pk/lums_employee/1922

## Jillian Anable

UK Mentor
University of Leeds
Email: J.L.Anable@leeds.ac.uk
Jillian has nearly 20 years' experitise in the societal aspects surrounding the energy transition, including transport, energy and climate change policy. She is currently the co-director of the UK Energy Research Centre where she leads the Mobility and Energy Theme. Research pages URL: https://environment.leeds.ac.uk/transport/staff/915/professor-jillian-anable

## Mark Symes

UK Co-organiser
University of Glasgow
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Mark has expertise across energy conversion, energy storage and electrochemistry. He is a member of the Royal Society of Edinburgh's Young Academy of Scotland and is the Chair of the Royal Society of Chemistry Electrochemistry Group. Research pages URL: www.symeslab.com

## Mohammad Irfan

Pakistan Mentor
University of Engineering and Technology, Peshawar
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Mohammad is the Dean Faculty of Mechanical, Chemical and Industrial Engineering at UET Peshawar with many years of experience in the energy sector. He is a Certified Energy Manager with research interests in the carbon footprint of industries, industrial waste heat recovery and rapid prototyping. He is also an expert in industrial energy audits. Research pages URL: https://scholar.google.com/citations?user=BRH6F7AAAAAJ&hl=en

## Salman Arshad

Pakistan Co-organiser
Lahore University of Management Sciences
Email: salman.arshad@lums.edu.pk
Salman has led the nanofibers research group at LUMS since 2014, looking at the synthesis, characterization and applications of these materials, especially in energy conversion and storage. Research pages URL: https://nanofiber.lums.edu.pk/

## Serena Corr

UK Mentor
University of Sheffield
Email: s.corr@sheffield.ac.uk
Serena is an expert in the design, synthesis and characterization of functional nanomaterials, especially for applications in energy storage. She is a member of EPSRC's Strategic Advisory Committee, and associate editor of the journals Nanoscale, Nanoscale Adv. and Progress in Energy. Research pages URL: https://corrgroupsheffield.com/group/