Exponent®
Engineering & Scientific Consulting

Maqsood Ali Mughal, Ph.D., P.E., CFEI

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Professional Profile

Dr. Mughal is a licensed professional electrical engineer with expertise in areas including synthesis and characterization of thin film materials (chalcogenides, metal sulfides, metal oxides, etc.), renewable energy and distributed systems integration (RDSI), environment and sustainability, embedded systems and Internet of Things (IoT), data science, machine learning (ML) and artificial intelligence (AI).

Dr. Mughal also has extensive exposure with modeling and writing software for data analysis, algorithmic processing, and visualization using MATLAB, Python, LabVIEW, and Simulink.

Prior to joining Exponent, Dr. Mughal was an Assistant Professor of Electrical and Computer Engineering at Worcester Polytechnic Institute (WPI). He taught courses including sensors, signals and systems, digital circuit design, electric circuits, microelectronics, microcontrollers and PLC's, embedded systems and engineering design. He is vastly experienced working with both Xilinx/Intel FPGA development and design tools, and related software platforms such as Vivado for timing analysis and simulations. In this role, Dr. Mughal also frequently collaborated with WPI industry partners on projects related to PCB power supply and sensor design to aid both thermal and power management of the electronics devices. He also worked closely with utility companies to develop efficient ways of delivering renewable energy to the grid.

Dr. Mughal received his Ph.D. in Environmental Sciences, a multidisciplinary program that cuts across several academic disciplines including science, engineering, physics, and chemistry, from Arkansas State University. During this time, he developed expertise that covers a wide range of experimental and analytical tools. He has in-depth experience with a variety of characterization techniques such as photoluminescence (PL) spectroscopy, IV characterization, cyclic voltammetry, impedance analysis, energy-dispersive X-ray spectroscopy (EDS), UV-VIS Spectrophotometer, profilometer, atomic force microscopy (AFM), and scanning electron microscopy (SEM). Dr. Mughal has worked on nanoscale semiconductor device fabrication using both solution- and vacuum-based deposition techniques including electrochemical deposition (ED), chemical bath deposition (CBD), physical vapor deposition (PVD), e-beam (EB) evaporation, and sputtering.

He holds a PE license in the state of Massachusetts and is also a senior member of IEEE. He is a recipient of Amplify Mass and Community Catalyst Awards awarded by Massachusetts Clean Energy Center. He is also a professional member of NSPE and IAENG, and review papers for Solar Energy, Renewable Energy, Environmental Progress and Sustainable Energy, and IEEE Industrial Application Society.

Academic Credentials & Professional Honors

Ph.D., Environmental Sciences, Arkansas State University, 2015

M.S., Engineering Management, Arkansas State University, 2010

KEEN Rising Star, 2019

Amplify Mass Award Winner, Massachusetts Clean Energy Center, 2019

Community Catalyst Award Winner, Massachusetts Clean Energy Center, 2020

IEEE Senior Member, since 2020

Licenses and Certifications

Professional Engineer Electrical, Massachusetts, #56854

Certified Fire and Explosion Investigator (CFEI)

Academic Appointments

Assistant Professor of Teaching, ECE, Worcester Polytechnic Institute, 2018-2022

Assistant Professor, Industrial Technology, Fitchburg State University, 2017

Instructor, College of Engineering, Arkansas State University, 2016

Prior Experience

Assistant Professor of Teaching, ECE, Worcester Polytechnic Institute, 2018-2022

Assistant Professor, Industrial Technology, Fitchburg State University, 2017

Instructor, College of Engineering, Arkansas State University, 2016

Operation and Maintenance Engineer, Relacom Pvt. Ltd, Khi, Pak, 2008-2009

Professional Affiliations

Institute of Electrical and Electronics Engineers – IEEE (senior member)

National Society of Professional Engineer – NSPE (member)

International Association of Engineers – IAENG (member)

Publications

A. Sabuncu, M. A. Mughal, et al. BYOE: An Evaporative Cooler with Virtual Connectivity. American Society for Engineering Education 2021; 10.18260/1-2--36776.

M. A. Mughal and R. Sharma. Cadmium Sulfide-buffered PV Systems: Assessing the Environmental, Health, and Economic Impacts, Journal of the Arkansas Academy of Science 2019; 73:106-118.

S. Thapa, M. A. Mughal, et al. Optimization of Process Parameters in Palletization of Crop Residues by Taguchi-grey Relational Analysis. International Journal of Agriculture, Environment and Bioresearch 2018; 3:60-74.

M. A. Mughal, Robert Engelken, Rajesh Sharma. Progress in indium (III) sulfide (In2S3) buffer layer deposition techniques for CIS, CIGS, and CdTe-based thin film solar cells. Solar Energy 2015; 120 131-146.

M. A. Mughal, Robert Engelken, et al. Morphological and Compositional Analysis of Electrodeposited Indium (III) Sulfide (In2S3) Films. Journal of the Electrochemical Society 2015; 162:265-271.

M. A. Mughal, M. Jason Newell, J. Bruce Johnson et al. Optimization of the Electrodeposition Parameters to Improve the Stoichiometry of Films for Solar Applications Using the Taguchi Method. Journal of Nanomaterials 2014; 2014:1-10.

Presentations

M. A. Mughal. Cloud Motion Vector System to Detect Clouds and Forecast Real-time Photovoltaic System Performance. Poster presentation. 48th IEEE Photovoltaic Specialist Conference (PVSC), Virtual, 2021.

M. A. Mughal. All-Electrodeposited p-Cu2ZnSnS4/n-In2S3 Heterojunction Formation for Solar Cell Applications. Poster presentation. 45th IEEE Photovoltaic Specialist Conference (PVSC), Hawaii, 2018.

M. A. Mughal. Thin Film Semiconductors for Solar Cells Applications. Oral presentation. 78th New England Association of Chemistry Teachers (NEACT), Fitchburg, MA, 2017.

M. A. Mughal. Update on Semiconductor Film Electrodeposition Research at Arkansas State University. Poster presentation. ASSET Initiative Annual Meeting, Little Rock, AR, 2014.

M. A. Mughal. Morphological and Compositional Analysis of Electrodeposited In2S3 films. Poster presentation. 40th IEEE Photovoltaic Specialist Conference (PVSC), Denver, CO, 2014.

M. A. Mughal. Statistical Analysis of Electroplated Indium (III) Sulfide (In2S3) Films, a Potential Buffer Material for PV (Heterojunction Solar Cells) Systems, using Organic Electrolytes. Poster presentation. TechConnect Conference, Washington, D.C., 2013

M. A. Mughal. CdTe/In2S3 Solar Cells by Electrodeposition and Evaporation. Poster presentation. Arkansas State Capitol, in Little Rock, AR, 2013

M. A. Mughal. Progress and Challenges in Electrodeposition of Indium (III) Sulfide (In2S3) Films from Organic Electrolytes for Potential Solar Cell Use. ASSET Initiative Annual Meeting, Springdale, AR, 2012.

M. A. Mughal. Taguchi Analysis and Characterization of Electrodeposited Indium Sulfide Films for Use as Potential Buffer Layers in Solar Cells. Oral presentation. 96th Arkansas Academy of Science (AAS) Annual Conference, Magnolia, AR, 2012.

M. A. Mughal. Elemental Sulfur-based Electrodeposition of Indium Sulfide Films. Oral presentation. 95th Arkansas Academy of Science (AAS) Annual Conference, Monticello, AR, 2011.

Project Experience

Designed a light sensor based IoT system that utilizes machine learning models and real-time prediction algorithms to predict photovoltaic power and detect cloud motion with high precision. The system can compute cloud motion parameters such as cloud size, speed, and direction, and predict changes in power generation due to cloud cover enabling utility grid operators to better understand and mitigate the effects of PV power variability on grid planning and operations.