

Abdulla Arham

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KEY QUALIFICATIONS

Electrochemical Materials Scientist with deep expertise in ion-exchange membrane systems, non-PGM catalyst development, and MEA optimization for PEM and AEM platforms. 3+ years hands-on experience advancing next-generation hydrocarbon-based polymer technologies for fuel cells and electrolyzers, with proven success in achieving 96% synthesis consistency, scaling materials from lab to pilot production, and deploying advanced characterization techniques (EIS, XRD, SEM/TEM) to drive performance improvements up to 22%. Passionate about eliminating PFSA dependencies and accelerating the renewable hydrogen economy through durable, environmentally responsible materials innovation.

EXPERIENCE

Graduate Research Student | University of Toronto

May 2023 - February 2024

Toronto, Ontario

- Engineered and optimized **15+ membrane-electrode assembly (MEA) configurations** for PEM water/CO₂ electrolyzers and fuel cells, systematically evaluating hydrocarbon-based ionomer integration strategies that improved current density while maintaining voltage stability across 50+ experimental runs
- Conducted advanced electrochemical impedance spectroscopy (EIS), polarization analysis, and cyclic voltammetry characterization to quantify ohmic and charge-transfer resistances, generating performance datasets that directly informed MEA design iterations and reduced interfacial resistance
- Led in operando synchrotron X-ray imaging campaigns at Canadian Light Source to visualize real-time catalyst degradation and membrane delamination mechanisms in operating electrochemical cells, troubleshooting 20+ technical challenges that enabled breakthrough understanding of catalyst layer-ionomer interactions
- Spearheaded electrochemical characterization for cross-functional research team supporting 3 parallel fuel cell/electrolyzer projects, providing critical performance benchmarking that accelerated development timelines by 15-20% and informed strategic material selection decisions

Research Coordinator & Engineer | Presidium Equipments

April 2022 - August 2022

London, Ontario

- Architected and scaled novel **polyurethane formulations from 100mL lab-scale to 50L pilot batches**, implementing custom reaction injection molding protocols and coordinating with external manufacturing partners to deliver production-ready materials **15% under budget** and 7 days ahead of schedule
- Executed **factorial DOE studies across 5 alternative polymer precursors**, performing comprehensive FTIR, XRD, and mechanical property analysis (tensile strength, durability, UV resistance) that prevented potential 6-day production delays and saved **\$18,000-\$25,000** per run through proactive supply chain risk mitigation
- Established rigorous polymer characterization protocols ensuring 100% specification compliance, while training 3 team members on advanced analytical instrumentation operation, reducing analysis turnaround by **25%** and enhancing departmental technical capabilities

Materials Research Assistant | Thomson Lab, University of Waterloo

September 2019- December 2019

Waterloo, Ontario

- Optimized synthesis of **superparamagnetic iron oxide nanoparticles (SPIONs)** achieving **96% batch-to-batch consistency** (improved from 89% baseline) through factorial DOE controlling reaction atmosphere, temperature, and precursor ratios across 50+ synthesis experiments
- Executed electrochemical degradation of phenol contaminants using SPION catalysts at graphite electrodes, demonstrating **85-92% removal efficiency** via HPLC analysis of 200+ samples and comprehensive ICP-OES/ICP-MS/TEM characterization quantifying nanoparticle composition and morphology

Research Scientist | Institute of Functional Nano & Soft Materials (FUNSOM)

January 2019 - April 2019

Suzhou, Jiangsu, China

- Developed and optimized non-PGM **Mo₂C nanomaterial electrocatalysts** for hydrogen evolution reaction (HER) in alkaline media through 50+ hydrothermal synthesis iterations, achieving **18-22% improvement in catalytic activity** (overpotential reduction) suitable for integration with anion-exchange membrane systems
- Performed extensive **SEM/TEM morphological characterization** (100+ high-resolution images) and BET surface area analysis to establish structure-property-performance relationships, correlating active site density with electrochemical performance to guide synthesis optimization for AEM-compatible catalyst systems
- Fabricated and electrochemically tested catalyst-coated electrodes using linear sweep voltammetry, generating comprehensive HER performance datasets that supported 2 research publications and demonstrated viability of **low-cost, PGM-free catalysts for alkaline water electrolysis**

EDUCATION

Bachelor of Applied Science, Nanotechnology Engineering | University of Waterloo | 2016 – 2022

Certified Associate in Project Management (CAPM) | Project Management Institute (PMI)

SKILLS

Electrochemical Systems: PEM/AEM Fuel Cells & Electrolyzers, MEA Fabrication & Optimization, Electrochemical Impedance Spectroscopy (EIS), Linear Sweep/Cyclic Voltammetry, Polarization Analysis, Ionomer Integration, Non-PGM Catalyst Development

Synthesis & Scale-Up: Nanoparticle Synthesis, Hydrothermal Methods, Polymer Formulation, Batch Process Optimization, Pilot-Scale Manufacturing, Reaction Injection Molding, DOE/Factorial Analysis

Data & Software: Python (Data Analysis, ETL), SQL, Power BI, CFD Modeling, Advanced Excel, Agile Project Management, Technical Report Writing

Materials Characterization: XRD (Rietveld Refinement), SEM/EDX, TEM, BET Surface Area, FTIR/Raman Spectroscopy, Thermal Analysis (TGA/DSC), HPLC, ICP-OES/MS, Mechanical Testing (UTM)