Kirutiga Balan

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SUMMARY

Researcher specializing in lithium-ion battery systems, electrochemical modeling, and materials characterization. Experienced in testing and optimizing novel anodes (Zn-Sn), modeling capacity fade, and enhancing metal extraction efficiency using microfluidics and magnetic fields. Skilled in cell testing (GITT, EIS), teardown, and analysis tools (Biologic, JMP, MATLAB, COMSOL, Python). Adept at translating data-driven insights into performance gains for real-world EV cell applications

SKILLS

- **Materials Characterization:** Thin film deposition, SEM-EDS, optical microscopy, Metrology, Microfabrication
- **Electrochemical Systems:** EIS, Battery modeling, Failure analysis, Electrolyte development, Additives
- **Thermal-fluids**: MicroPIV, Numerical modeling, Reactive flow transport, Plasma physics, Thermodynamics
- **Laboratory & Safety Practices:** Wet chemistry, hazardous chemical handling, cell teardown, Glovebox
- **Programming & Simulation:** Python, MATLAB, COMSOL, ANSYS Fluent, JMP, SolidWorks, CATIA V5+

WORK EXPERIENCE

R&D Electrochemistry Intern — **Electra, Boulder CO**

- Developing a beneficial electrolyte with additives for iron electro-deposition. Screening of additives for dendrite suppression.
- Skilled in JMP, Coulometric titration, membrane conditioning, cell assembly and teardown, 6S safety

RESEARCH EXPERIENCE

Localized B-field enhancing extraction efficiency — **Department of Aerospace Engineering, UT Austin**

- Achieved a 4x increase in throughput of in-house microfluidic cell via soft lithography by introducing 3D printing and CAD model with GD&T precision of 10 um ±1 um.
- Increased the extraction efficiency of the copper from simulated brine via magnetic field by 1.25x.
- Analyzed data of over 100 samples utilizing microfluidic PIV methods, revealing critical insights into how different morphologies impacted extraction pathways using image processing of fractal dendrites.
- Established a comprehensive SOP for microfluidic cell assembly and thin film photolithography and glass etching with HF, achieving a 30% reduction in overall setup time.

Electrochemical modeling of Zn-Sn anode — **Texas Materials Institute, UT Austin**

- Engaged in collaborative research with Manthiram lab to develop a mathematical model using GITT data which is used to create a OCV profile for the proprietary Zn-Sn anode, enhancing the accuracy of predicting cell lifetime.
- Formulated a precise algorithm capturing shifting phase fronts in unique alloy anode, enhancing predictive accuracy by optimizing efficiency through parameterized safe operating potential.
- Conducted rigorous data analysis in MAPLE, solving PDEs and ODEs, identifying KPIs for capacity of the anode.

Modeling of blood flow in microvasculature — **Department of Robotics Engineering, DGIST**

- Designed and fabricated a microfluidic phantom device using CAD modeling for simulating blood flow, contributing to improved understanding of hemodynamics.
- Integrated the CAD model in ANSYS FLUENT to simulate blood flow in micro-vessels and analyze blood pressure variation across blood vessels with differing diameters.

Modeling diffusion induced stress in Li-ion batteries — **Department of Energy science, IIT Bombay**

- Implemented mathematical modeling techniques to analyze and predict capacity fade over repeated cycling in batteries caused by diffusion-induced mechanical stress.
- Conducted failure analysis of electrode deformation, validating results with COMSOL and achieving an R^2 accuracy of 0.99.

EDUCATION

University of Texas at Austin — MS, Aerospace Engineering (2022-2025)
University of Texas at Austin — MS, Materials Science and Engineering (2020-2021)
Amrita University — BTech, Mechanical Engineering (2015-2019)