Dipobrato Sarbapalli

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EDUCATION

University of Illinois Urbana Champaign (UIUC) *Urbana-Champaign, IL*
Ph.D. in Materials Science and Engineering, GPA: 3.90/4.00 *Dec 2022 (expected)*
Adviser: Dr. Joaquín Rodríguez-López

University of Illinois Urbana Champaign (UIUC) *Urbana-Champaign, IL*
Master of Science in Civil Engineering, GPA: 4.00/4.00 *May 2018*

WORK EXPERIENCE

Battery Engineer Intern, *Natrion, Champaign* || CEO: Alexander Kosyakov *Jan - May '22*

– *Research and development*
- Identified cell failure modes such as dendrite formation arising from interface issues between Li metal anodes and solid-state electrolytes
- Developed an interface modification solution, leading to >10x reduction in cell resistances, while enabling 1C equivalent current densities in Li-metal half cells without dendrite formation
- Performed post-mortem analysis using SEM and EDS on Li metal surfaces and cross-sections to characterize solid-electrolyte interphase formation

– *Coin cell prototyping and materials evaluation*
- Evaluated performance of solid state electrolytes using impedance spectroscopy and symmetric cells
- Established compatibility of solid-state electrolytes with high loading (>10 mg/cm^2) cathodes (LFP, NMC 811, 532) and anodes (Si/graphite composites, graphite) with Li-metal half cells
- Prepared baseline coin cells with commercial $LiPF_6$ based liquid electrolyte and evaluated their rate capability and cycle life performance

– *Python scripting*
- Created a freeware for internal use by designing a GUI interface using PyQt for plotting and deconvoluting EIS data with *impedance.py* [Screenshot]
- Wrote multiple scripts for rapid data plotting and analysis of galvanostatic cycling, impedance, cyclic voltammetry and cycle life data

Intern, *BASF, Ludwigshafen, Germany* || Superviser: Dr. Tobias Umbach *May - Jul '17*

- Used atomic force microscopy (AFM) to measure deformation of paint and adhesive polymer particles to inorganic fillers like calcium carbonate, mica, silica and iron oxide
- Applied numerical models to measure adhesion to substrates from experimental deformation data using Mathematica scripts

RESEARCH EXPERIENCE

Effects of graphene surface functionalization on Li-ion intercalation *May '21 - Present*

- Synthesized and characterized multi-layer graphene functionalized with oxygen and nitrogen surface

modifiers with Raman and X-ray photoelectron sectroscopy (XPS)
- Discovered a reduction in Li^+ ion resistance across interphases (SEI) formed in surface-modified graphene by EIS and Cyclic Voltammetry (CV) measurements

Reversible Na-ion intercalation on fluorinated few-layer graphene *Jan '19 - Dec '21*

- Identified kinetic barriers originating from solid electrolyte interphase (SEI) to Na-ion intercalation using CV; discovered preformed Li-based SEI mitigates the issue
- Developed a custom *in-situ* Raman cell which enables robust three-electrode electroanalytical measurements on transparent working electrodes
- Observed Na-ion intercalation into graphene electrodes at 10x capacities than previously reported using SECM and *in-situ* Raman

Assessing the Transient and Steady-State Oxygen Evolution from Li-ion Battery Cathodes via In-Situ Scanning Electrochemical Microscopy *Aug '20 - Dec '21*

- Collaborated in the development of an *in-situ* technique to detect oxygen evolution from Li-ion battery cathodes (such as NMC 111, 811 and LCO) using SECM
- Identified transient and continuous oxygen loss from commercial battery cathodes, and corroborated findings with *ex-situ* XPS and COMSOL finite element simulations

Tracking Passivation and Cation Flux at Incipient Solid-Electrolyte Interphases on Multi-Layer Graphene using High Resolution SECM *Aug '20 - Aug '21*

- Wrote Python scripts for quantitative SECM analysis of passivation during SEI formation on graphene electrodes in Li^+, Na^+, and K^+ electrolytes
- Characterized SEI composition with *ex-situ* XPS and correlated findings with passivation and ion-uptake behavior measured with SECM during SEI formation
- Observed Li-based SEIs to passivate rapidly, with fluorinated phases strongly influencing passivation

SKILLS

Programming Languages & Packages: Python, Matlab, Mathematica, OriginPro, COMSOL, ImageJ, AutoCAD 2D, VESTA, CasaXPS, TOPAS, Illustrator, Solidworks

Electrochemical Characterization: Galvanostatic Cycling, Cyclic Voltammetry, Scanning Electrochemical Microscopy, Electrochemical Impedance Spectroscopy, Potentiostatic Intermittent Titration

Materials Characterization: Scanning Electron Microscopy, Atomic Force Microscopy, X-Ray Photoelectron Spectroscopy, Infrared and Raman Spectroscopy, X-Ray Diffraction, Thermogravimetric analysis, Isothermal Calorimetry, Dynamic Light Scattering, Gas adsorption

HONORS

- Honorable mention, Link Foundation Energy Fellowship (9/120 applicants) (June 2021)
- Best Poster Award, SEAC Poster session, PITTCON, Chicago (Feb 2020)
- DAAD-RISE Professional Fellowship: Internship with BASF, Germany (March 2017)
- Outstanding Teaching Assistant (TA): CEE 300 – Behavior of Materials (Spring 2018)
- Outstanding & Excellent TA: CEE 401 – Concrete Materials (Fall 2016, 2017)

PUBLICATIONS

- Y. Zeng, Z T. Gossage, D. Sarbapalli, J. Hui and J. Rodríguez-López. *ChemElectroChem* **2021**, *9*, e202101445. DOI: 10.1002/celc.202101445
- D. Sarbapalli, A. Mishra and J. Rodríguez-López. *Anal. Chem.* **2021**, *93*, 14048–14052. DOI: 10.1021/acs.analchem.1c03552
- D. Sarbapalli, A. Mishra, Z. T. Gossage, K. Hatfield, and J. Rodríguez-López. *Scanning Electrochemical Microscopy: A Versatile Tool for Inspecting the Reactivity of Battery Electrodes*, IOP Science, **2021**. DOI: 10.1088/978-0-7503-2682-7ch9
- J. Hui, A. Nijamudheen, D. Sarbapalli, C. Xia, Z. Qu, J. L. Mendoza-Cortes, and J. Rodríguez-López. *Chem. Sci.* **2021**, *12*, 559-568. DOI: 10.1039/D0SC03226C
- T. S. Watkins*****, D. Sarbapalli*****, M. J. Counihan*****, A. S. Danis, J. Zhang, L. Zhang, K. R. Zavadil, and J. Rodríguez-López. *J. Mater. Chem. A* **2020**, *8*, 15734–15745. DOI: 10.1039/D0TA00836B
- J. Hui, Z. T. Gossage, D. Sarbapalli, K. Hernández-Burgos, and J. Rodríguez-López. *Anal. Chem.* **2019**, *91*, 60–83. DOI: 10.1021/acs.analchem.8b05115

*Denotes equal contribution

Google Scholar: https://bit.ly/3c9oQqC List of Publications