Paul T. Coman
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Education

Dec 2013 - Feb 2017 Ph.D. in Engineering **University of Southern Denmark – Sønderborg, Denmark**
Ph.D. Dissertation: Modeling of Li-Ion Battery Packs as Basis for Design of Battery Thermal Management Systems
Specialized in: Thermodynamics, Modelling, Li-ion batteries

Sep 2010 – Jun 2012 M.Sc. in Mechatronics **University of Southern Denmark – Sønderborg, Denmark**
Master Thesis: Impact of Geometry on Two-Phase in a Danfoss Expansion Process - Experimental and Numerical
Specialized in: Thermodynamics, Process Design, Scientific Methods, Mathematical Modelling

Oct 2008 – Apr 2009 Erasmus EU Exchange Program **University of Campania "Luigi Vanvitelli" in Naples, Italy**
Department of Industrial and Information Engineering
Specialized in: Thermodynamics and Heat Transfer

Oct 2006 – Jul 2010 B.Sc. in Engineering **Technical University of Iasi, Romania**
Honor: Valedictorian (US-equivalent)
Faculty of Materials Science and Engineering
Bachelor Thesis: CFD Simulation of the Electrical Furnace for Medium Temperature
Specialized in: Thermodynamics, Materials Science, Mechanics, and Manufacturing

Professional Development

March 2023 – Present Research Associate Professor **University of South Carolina**
As a Research Associate Professor, one of my tasks is to bring the structural battery project to maturity, coordinate students and postdocs in the laboratory work and theoretically. I am also working on developing physics-based mathematical models for electrochemical systems, with focus on battery cells and packs. Additionally, I am working on assisting the design of safe battery packs, where other pack components such as bus-bars are included in the study.

September 2021 – March 2023 Research Assistant Professor **University of South Carolina**
As a Research Assistant Professor, I worked primarily on developing, optimizing and reducing physics-based mathematical models for thermal runaway in battery packs. Additionally, I have worked on formulating models for studying battery degradation, and other physics-based models for multifunctional structural batteries. I have started a new research group at UofSC focusing on the development of structural batteries. I supervise graduate students with their experimental work and develop physics-based models for structural batteries.

August 2018 – August 2021 Postdoctoral Fellow **University of South Carolina**
I joined USC as a postdoctoral fellow, where my general task was to develop mathematical models for different battery designs and chemistries. During the first year, I developed Li-ion plating models to study large NMC532 cells at very low temperatures and high currents. Later, I have worked on models for predicting the lifetime of small Li-ion cells and primary CF_x batteries used in medical devices. I also worked for developing electrochemical models for Lithium-sulfur cells modified to have a membrane for shielding the anode from polysulfides to improve the battery lifetime. I am currently working on developing models for estimating the lifetime of medical batteries for cardiac pacemakers and planning the work for new funded projects that aim to build and model structural batteries/cells and Lithium-Sulfur high-density cells.

March 2018 – July 2018
Wrote proposals for funding to the in Denmark to come to UofSC as an independent researcher and applied for battery jobs and internships.

January 2018 – March 2018 Research Engineer (Internship) **Banke A/S**
During my work at Banke, I performed experiments on large-scale Li-ion batteries for Hybrid trucks. My task was to identify the difference in performance between the battery cells that were installed in the trucks and the new batch which had higher capacity. Although more capacity was available, the capacity loss was higher. I used power supplies, electrical loads and internal resistance measurements at different state of charges in my experimental work. Prepared and participated in the Li-ion battery safety workshop at the European Union.

Sep 2017 –Jan 2018
Wrote proposals for funding to the in Denmark to come to UofSC as an independent researcher and applied for battery jobs and internships.

Feb 2017 – Aug 2017 Research Assistant **University of South Carolina – Columbia, SC, USA**
In February 2017, I joined SDU after my PhD as a research assistant. I continued working on optimizing the model developed during my Ph.D. project (together with the University of South Carolina) and publishing international journal results. In addition to this, I worked on building a small model for calculating the inductance of power electronics packaging designed by Fachhochschule Kiel, Germany.

Jun 2015 – Nov 2015 Visiting Scholar **University of South Carolina – Columbia, SC, USA**
During this exchange, my task was to develop fundamental thermodynamics and electrochemical mathematical models using COMSOL to understand thermal runaway behavior in Li-ion cylindrical cells. This pioneering work led to my most cited articles and opened a new way of modeling the complex thermal runaway phenomenon using a lumped model.

Mar 2013 - Dec 2013 Research Assistant **University of Southern Denmark, Denmark**
In March 2013 I was accepted to work at the Southern Denmark University, where my task was to build the first mathematical models for Li-ion batteries. During this period, I have worked with building electrochemical models for studying the electrochemical performance of Li-ion battery cells and packs for the first version of the hybrid trucks at Banke. During this stage I have worked also with thermal modeling of battery packs and wrote one journal paper and received funding to start my Ph.D.

Jul 2012 – Mar 2013 **Lean Energy Cluster and SDU, Denmark**
After my Masters Degree, I was applying for jobs and got two internships to continue the work on thermal modeling at Lean Energy Cluster (now Clean Cluster Denmark) and the University of South Denmark. During internships I was working on modeling of Phase Change Materials.

Scholarships
Bitten and Mads Clausen Foundation Scholarship for my master's degree studies

Affiliations
Danish Battery Society
Engineers without Borders Denmark (2013-2015)
VedvarendeEnergi Sønderborg (Renewable Energy Organization) (2013-2015)
The Electrochemical Society

Language proficiency
Romanian - Proficient;
English - Proficient;
Danish - Intermediate;
Italian – Intermediate;
Spanish – Beginner.

Computer Skills
Engineering Software:

Autodesk AutoCAD/Inventor (advanced)
Engineering Equation Solver (advanced)
SolidWorks (advanced)
Dymola Modelica (intermediate)
Adobe Inventor (Intermediate)
Siemens NX (Intermediate)
MATLAB (intermediate) + App Development
Simulink (Intermediate) + App Development

Design software:

Adobe Photoshop (advanced)
Adobe Illustrator (advanced)

App development and Programming:

COMSOL Multiphysics App Development (advanced)
MATLAB and Simulink App Development (advanced)
Android Studio (Intermediate)
JavaScript (intermediate)

Awards

Battery Division Postdoctoral Associate Research Award

List of Research-related activities and funding

Funding and Research

2025

- ***Advanced Sodium Technologies for Robust Aerospace Structures (A.S.T.R.A.)***
  Status: Pending | Source: NASA | Amount: $58,550
- ***Magellan: Carroll: Analysis of commercial and structural batteries...***
  Status: Funded | Source: USC Office of the Vice President for Research | Amount: $1,000.00
- ***Investigation of electrochemical performance for Structural Batteries with Ultrasonic Coating***
  Status: Funded | Source: College of Charleston/SC Space Grant/NASA | Amount: $32,000.00
- ***Early EIS-based Thermal Runaway Detection***
  Status: Pending | Source: Analog Devices | Amount: $926,245.00
- ***Digital Engineering for Army Battery Design and Manufacturing***
  Status: Pending | Source: Army/DOD | Amount: $2,520,000.00
- ***Cyber-Physical Uncertainties in Forecasting and Decision Making for Digital Twins...***
  Status: Pending | Source: NSF | Amount: $599,996.00

2024

- **Navy Battery Modeling and Simulation Support**
  Status: Funded | Source: NSWC Crane / DOD | Amount: $673,937.00
- **Investigation of electrochemical performance for Na-ion Structural Batteries**
  Status: Funded | Source: College of Charleston/SC Space Grant/NASA EPSCOR | Amount: $23,500.00
- **Advanced Controls and Decision Aids Based on Digital Twins for Power and Energy Systems**
  Status: Funded | Source: ONR / DOD | Amount: $11,893,714.00
- **Engineering Hybrid Solid Polymer Electrolytes for Structural Batteries...**
  Status: Funded | Source: NASA / SC Space Grant / CofC | Amount: $35,000.00
- **Multifunctional Structural Batteries: A Path to Real-World Implementation**
  Status: Rejected | Source: DOD | Amount: $5,095,159.00
- **REU Site: Electrochemical and Chemical Energy Storage**
  Status: Canceled | Source: NSF | Amount: $452,915.00

2023

- **Fraunhofer: High Fidelity Digital Twins for Large Scale Energy Storage Batteries -- Dept. of Commerce**
  Status: Funded | Source: SC Fraunhofer USA Alliance / SC Dept. of Commerce | Amount: $636,474.00

- **A Coupled Experimental and Mechanistic Modeling Approach to Virtual Prototyping Lithium-Sulfur Batteries**
  Status: Funded | Source: US DOE | Amount: $1,580,020.00
- **Fraunhofer: High Fidelity Digital Twins for Large Scale Energy Storage Batteries -- Pomega**
  Status: Funded | Source: Pomega Energy Storage Technologies, Inc | Amount: $136,474.00
- **Magellan - King - Physics-Based Electrochemical-Thermal-Electromagnetic Coupled Model...**
  Status: Funded | Source: USC Office of the Vice President for Research | Amount: $2,500.00
- **Palmetto Academy: Structural Batteries Demonstrators for Aerospace Applications**
  Status: Funded | Source: College of Charleston/SC Space Grant/NASA | Amount: $32,000.00
- **SC NASA EPSCoR: Electrochemical-Mechanical Analysis of Structural Batteries**
  Status: Rejected | Source: NASA/SC Space Grant/ CofC | Amount: $35,000.00
- **SCSG REAP: Development and testing of Structural Batteries with different active materials**
  Status: Rejected | Source: SC Space Grant/NASA EPSCoR | Amount: $20,000.00
- **Virtual Battery for Large-Scale Energy Storage with Aluminum Smelter...**
  Status: Rejected | Source: DOE | Amount: $300,000.00

2022

- **Engaging Underrepresented Graduate Students in State-of-the-Art Battery Research**
  Status: Funded | Source: EPSCoR | Amount: $10,000.00
- **Battery Cell High Frequency Electrochemical Impedance Spectroscopy (EIS) Measurement and Model Development**
  Status: Funded | Source: GM | Amount: $239,784.00
- **Modeling and Coin Cell Development of Structural Batteries for Aerospace Applications**
  Status: Funded | Source: College of Charleston/SC Space Grant/NASA | Amount: $46,000.00
- **Battery Cell High Frequency Electrochemical Impedance Spectroscopy (EIS) Measurement and Model Development**
  Status: Funded | Source: General Motors (GM) Holdings LLC | Amount: $239,784.00
- **Creating a multi-user COMSOL Simulation Lab Cluster at UofSC**
  Status: Rejected | Source: ASPIRE III | Amount: $100,000.00
- **Appendix B: Thermal Conductivity Heat Transfer of Porous TPS Materials**
  Status: Rejected | Source: NASA EPSCoR R3 CAN | Amount: $88,035.00
- **Building Structural Battery Demonstrators**
  Status: Rejected | Source: NASA SC Space Grant Consortium | Amount: $20,000.00
- **Comprehensive Safety Assessment Suite for Next Generation EV Batteries during Fast-Charging across a wide Temperature Range**
  Status: Rejected | Source: ARPA-E | Amount: $3,305,338.00
- **Pre-Proposal: Multifunctional Structures for Energy Storage – Modeling and Prototyping**
  Status: Rejected | Source: NASA EPSCoR | Amount: $750,000.00
- **Development of composite structural batteries for zero-emission aviation**
  Status: Rejected | Source: NASA ULI | Amount: $8,000,000.00
- **Battery Design Center**
  Status: Rejected | Source: USC Office of the Vice President for Research | Amount: $2,000,000.00
- **Investigation of Carbon Fiber Coating Homogeneity and Solid Electrolyte...**
  Status: Rejected | Source: National Science Foundation | Amount: $252,969.00

2021

- **Structural Batteries for Lightweight Aerospace and Aeronautic Applications**
  Status: Rejected | Source: NASA EPSCoR; SC Space Grant Consortium & SC NASA EPSCoR | Amount: $100,000.00
- **Predictive Performance and Life Modeling of Implantable Medical Batteries 2021**
  Status: Funded | Source: EaglePicher | Amount: $43,336.00
- **On the Road to Prototyping and Understanding Structural Batteries for Energy Storage through Modeling and Experimentation**
  Status: Funded | Source: ASPIRE II | Amount: $99,663.00

- **AccelNet-Design: An International Network-to-Network Approach to Building an International Li-ion Battery Safety Network (LIBS-NT)**
  Status: Rejected | Source: NSF | Amount: $250,000.00
- **Pre-Proposal: Multifunctional Structures for Energy Storage – Modeling and Prototyping**
  Status: Rejected | Source: NASA EPSCoR | Amount: $750,000.00

Publications:

2025

1. **Paul T. Coman***, Ralph E. White, "Modeling Self-Discharge in Li/S Batteries Through Electrochemical Anode Reactions: A Theoretical Perspective", Journal of Electrochemical Society, 2025 (Revised and waiting for Technical Editor)
2. Mohamed Atwair, **Paul Coman***, Ralph E. White, "Modeling the influence of silicon content on electrochemical performance of silicon-graphite blended electrodes considering voltage hysteresis", Journal of Electrochemical Society, 2025 (Revised and waiting for Technical Editor)
3. Matthew King, **Paul T Coman***, Rafid Mollah, Rayhan Khan, Saranraj Karuppuswami, Taylor R Garrick, Ralph White, "High-Frequency Impedance Spectroscopy: Measurement Reproducibility, Electromagnetic, and Ionic Effects in Cylindrical Lithium-Ion Cells", *Journal of The Electrochemical Society*, vol. xx, No. xx, p.. 2025 (Accepted Manuscript)
4. Thomas Burns, Liliana DeLatte, Gabriela Roman-Martinez, Kyra Glassey, Paul Ziehl, Monirosadat Sadati, Ralph E White, **Paul T Coman***, "Ultrasonic Spray Coating of Carbon Fibers for Composite Cathodes in Structural Batteries", *MDPI Electrochem*, vol. 6, Issue. 2, Page 13, 2025 (Accepted and Published)
5. Kyra Elle Glassey, Gabriela Roman-Martinez, Thomas Burns, Liliana DeLatte, Monirosadat Sadati, **Paul T Coman***, Ralph White, "Probing Ion-Blocking Electrode Rigs for Ionic Conductivity in Hybrid Solid Polymer Electrolytes", *Journal of the Electrochemical Society*, vol. 172, 020523, 2025 (Accepted and Published)

2024

6. D. Petrushenko, **P. Coman**, J. Trillo, B. Esparza, R. White, E. Darcy, "Optimizing Gravimetric Energy Density in PPR Battery Packs by Integrating Spine Heat Sinks with 21700 Cells", *NASA Aerospace Battery Workshop, Hunstville, AL, 2024* (Presented at Conference)
7. K. Glassey, **P. Coman***, and M. Sadati, "Engineering Solid Polymer Electrolytes for Structural Batteries with Enhanced Mechanical and Electrochemical Performances," *2024 AIChE Annual Meeting, San Diego, CA*, 2024. (Presented at Conference)
8. D. Pinegar, **P. Coman***, and R. White, "Using Physics Based Models to Predict the Conductivity of Solid Polymer Electrolytes," *2024 AIChE Annual Meeting*, *San Diego, CA*, 2024. (Presented at Conference)
9. **P. Coman*** and R. E. White, "(Invited) Reduced Order Modeling of Li-Ion Battery Systems - from Fundaments to Real-Life Applications," *PRiME 2024*, October 6-11, Honolulu, HI, 2024 (Presented at Conference)
10. A. Quinn, J. Darst, M. Keyser, **P. T. Coman**, T. P. Barrera, P. R. Shearing, et al., "Achieving Passive Thermal Runaway Propagation Resistance in Li-ion Battery Packs," *The Electrochemical Society Interface*, vol. 33, no. 3, pp. 55, 2024. (Accepted and Published)
11. **P. T. Coman***, A. Weng, J. Ostanek, E. C. Darcy, D. P. Finegan, and R. E. White, "Modeling of Li-ion Battery Thermal Runaway: Insights into Modeling and Prediction," *The Electrochemical Society Interface*, vol. 33, no. 3, pp. 63, 2024. (Accepted and Published)
12. N. Nikfarjam, **P. T. Coman**, C. Free, P. Ziehl, M. Sadati, and R. E. White, "Advancing ionic conductivity in solid electrolytes: Insights from polymerization-induced phase separation and microstructural optimization," *Journal of Energy Storage*, vol. 93, pp. 112287, 2024. (Accepted and Published)
13. **P. T. Coman***, D. Petrushenko, E. C. Darcy, and R. E. White, "Electrical-thermal modeling and electrical design optimization of fuses in a nickel bus-plate for a Li-ion battery pack," *Journal of Energy Storage*, vol. 86, pp. 111226, 2024. (Accepted and Published)

2023

14. D. Petrushenko, **P. Coman**, J. Trillo, B. Esparza, R. White, E. Darcy, J. L. Moyar, J. R. Izzo, T.E. Adams and J. H. Fontaine, "Scale-up for PPR Battery Design for 21700 format Cells", *NASA Aerospace Battery Workshop, Hunstville, AL, 2023* (Presented at Conference)
15. **P. T. Coman**, R. Mollah, N. Irish, S. Karuppuswami, S. T. Dix, W. Johnson, et al., "Electrochemical-electromagnetic coupled physics-based mathematical modeling of Li-ion batteries: A theoretical proof of

concept," *Journal of The Electrochemical Society*, vol. 170, no. 12, pp. 120528, 2023. (Accepted and Published)

2022

16. D. Petrushenko, Z. Rahmati, D. Barazanchy, W. De Backer, W. E. Mustain, Ralph E White, Paul Ziehl, **Paul T Coman**, "Dip-coating of carbon fibers for the development of lithium iron phosphate electrodes for structural lithium-ion batteries," *Energy & Fuels*, vol. 37, no. 1, pp. 711-723, 2022. (Accepted and Published)
17. **P. Coman**, "(Battery Division Postdoctoral Associate Research Award Sponsored by MTI Corporation and the Jiang Family Foundation) Thermal Runaway Modeling of Li-ion," *Electrochemical Society Meeting Abstracts*, vol. 242, pp. 213-213, 2022. (Presented at Conference)
18. **P. T. Coman**, E. C. Darcy, and R. E. White, "Simplified thermal runaway model for assisting the design of a novel safe li-ion battery pack," *Journal of The Electrochemical Society*, vol. 169, no. 4, pp. 040516, 2022. (Accepted and Published)

2021

19. **P. T. Coman**, E. C. Darcy, B. Strangways, and R. E. White, "A reduced-order lumped model for Li-ion battery packs during operation," *Journal of The Electrochemical Society*, vol. 168, no. 10, pp. 100525, 2021. (Accepted and Published)

2020

20. N. Kamyab, **P. T. Coman**, S. K. M. Reddy, S. Santhanagopalan, and R. E. White, "Mathematical model for Li-s cell with shuttling-induced capacity loss approximation," *Journal of The Electrochemical Society*, vol. 167, no. 13, pp. 130532, 2020. (Accepted and Published)
21. B. Ng, **P. T. Coman**, S. A. Lateef, W. E. Mustain, and R. E. White, "Low Temperature Li Plating and Corrosion Safety Hazard in Li-Ion Batteries," *Electrochemical Society Meeting Abstracts*, vol. 237, pp. 405-405, 2020. (Presented at Conference)
22. B. Ng, **P. T. Coman**, E. Faegh, X. Peng, S. G. Karakalos, X. Jin, W. E. Mustain, et al., "Low-temperature lithium plating/corrosion hazard in lithium-ion batteries: electrode rippling, variable states of charge, and thermal and nonthermal runaway," *ACS Applied Energy Materials*, vol. 3, no. 4, pp. 3653-3664, 2020. (Accepted and Published)
23. B. Ng, **P. T. Coman**, W. E. Mustain, and R. E. White, "Non-destructive parameter extraction for a reduced-order lumped electrochemical-thermal model for simulating Li-ion full-cells," *Journal of Power Sources*, vol. 445, pp. 227296, 2020. (Accepted and Published)
24. S. Gao, L. Lu, M. Ouyang, Y. Duan, X. Zhu, C. Xu, Benjamin Ng, Niloofar Kamyab, Ralph E White, **Paul T Coman**, "Experimental study on module-to-module thermal runaway-propagation in a battery pack," *Journal of The Electrochemical Society*, vol. 166, no. 10, pp. A2065, 2019. (Accepted and Published)

2019

25. E. Darcy, J. Darst, W. Walker, K. Yowtak, J. Nunez, J. Rogers, Minh N Tran, Sam Russell, Alex Quinn, **Paul Coman**, Ralph White, Gary Bayles, Brad Strangways, Den Pounds, Ben Alexander, Michael Mo, "Safe, high power/voltage battery design challenges," *NASA Aerospace Battery Workshop*, 2019. (Presented at Conference)
26. B. Ng, **P. T. Coman**, W. E. Mustain, and R. E. White, "Experimental Validation of a Simplified Electrochemical-Thermal Model for a NCM532 Large Format Battery Cell," *Electrochemical Society Meeting Abstracts*, vol. 236, pp. 340-340, 2019. (Presented at Conference)
27. E. Darcy, J. Darst, W. Walker, S. Nogrady, J. Rogers, M. N. Tran, Sam Russell, Alex Quinn, **Paul Coman**, Ralph White, Gary Bayles, Brad Strangways, Den Pounds, Ben Alexander, "Safe, High Power/Voltage Battery Module Design Challenges," *More Electric Aircraft Europe*, 2019. (Presented at Conference)
28. S. Gao, X. Feng, L. Lu, N. Kamyab, J. Du, **P. Coman**, and R. E. White, "An experimental and analytical study of thermal runaway propagation in a large format lithium ion battery module with NCM pouch-cells in parallel," *International Journal of Heat and Mass Transfer*, vol. 135, pp. 93-103, 2019. (Accepted and Published)

2017

29. **P. T. Coman**, E. C. Darcy, C. T. Veje, and R. E. White, "Numerical analysis of heat propagation in a battery pack using a novel technology for triggering thermal runaway," *Applied Energy*, vol. 203, pp. 189–200, 2017. (Accepted and Published)

30. **P. T. Coman**, S. Mátéfi-Tempfli, C. T. Veje, and R. E. White, "Modeling vaporization, gas generation and venting in Li-ion battery cells with a dimethyl carbonate electrolyte," *Journal of The Electrochemical Society*, vol. 164, no. 9, pp. A1858, 2017. (Accepted and Published)
31. **P. T. Coman**, E. C. Darcy, C. T. Veje, and R. E. White, "Modelling Li-ion cell thermal runaway triggered by an internal short circuit device using an efficiency factor and Arrhenius formulations," *Journal of The Electrochemical Society*, vol. 164, no. 4, pp. A587, 2017. (Accepted and Published)

2016

32. **P. T. Coman**, S. Rayman, and R. E. White, "A lumped model of venting during thermal runaway in a cylindrical Lithium Cobalt Oxide lithium-ion cell," *Journal of Power Sources*, vol. 307, pp. 56–62, 2016. (Accepted and Published)
33. S. L. Rickman, R. J. Christie, R. E. White, B. L. Drolen, M. Navarro, and **P. T. Coman**, "Considerations for the thermal modeling of lithium-ion cells for battery analysis," *46th International Conference on Environmental Systems*, 2016. (Presented at Conference)

2014

34. **P. T. Coman** and C. T. Veje, "Modeling Temperature Development of Li-Ion Battery Packs Using Phase Change Materials (PCM) and Fluid Flow," *Engineering Systems Design and Analysis*, vol. 45851, pp. V003T12A002, 2014.
35. **P. T. Coman** and C. T. Veje, "Modeling temperature development of Li-Ion battery packs in hybrid refuse truck operating at different ambient conditions," *Fourteenth Intersociety Conference on Thermal and Thermomechanical Phenomena*, 2014. (Presented at Conference)

2013

36. **P. T. Coman** and C. Veje, "Analysis and modeling of heat generation in overcharged Li-ion battery with passive cooling," *International Journal on Heat and Mass Transfer*, vol. 7, no. 2, 2013. (Accepted and Published)
37. **P. T. Coman** and C. Veje, "Numerical Model and Analysis of Peak Temperature Reduction in LiFePO4 Battery Packs Using Phase Change Materials," *Proceedings of the 8th International Conference on Multiphase Flow*, 2013. (Accepted, Presented and Published)

*Patents***:** Invention Disclosure for dip-coating mechanisms for carbon fibers for structural batteries (USC ID No. 1607)