

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

August 2026 – Present: Research Professor **University of South Carolina**
As a Research Professor, I continue to lead the development of reduced-order and full-order physics-based models for battery packs used in real-life applications in collaboration with national agencies. My research focuses on integrating battery models into digital twins to improve predictive capabilities and operational efficiency, while advancing structural batteries, solid electrolytes, and ultrasonic coating technologies. I supervise graduate students and postdoctoral researchers in developing robust physics-based models and conducting experimental research. As a project manager and Co-PI, I lead multidisciplinary collaborations with industrial partners and government agencies, oversee funded research projects, and contribute to the strategic direction of battery modeling and multifunctional energy storage research.

August 2023 – August 2026: Research Associate Professor **University of South Carolina**
In my current role, I am dedicated to advancing the development of reduced-order and full-order physics-based models for battery packs utilized in real-life applications, in collaboration with national agencies. My work also involves the integration of battery models into digital twins to enhance predictive capabilities and operational efficiencies. Furthermore, I am continuing my research on structural batteries and contributing to the development of solid electrolytes and ultrasonic coating methodologies. I supervise graduate students in their experimental work, ensuring the development of robust physics-based models for structural batteries. As a project manager and Co-PI, I also oversee and coordinate collaborative efforts with external industrial partners.

September 2021 – August 2023: Research Assistant Professor **University of South Carolina**
In my role as a Research Assistant Professor, I focused on the development and optimization of mathematical models for thermal runaway, battery degradation, and other physics-based models for multifunctional batteries. I established a new research group at UofSC dedicated to structural batteries, where I supervised graduate students in their experimental work and ensured the development of advanced physics-based models for these batteries. Additionally, as a project manager and Co-PI, I coordinated collaborative efforts with external industrial partners to drive research and development initiatives forward.

August 2018 – August 2021 Postdoctoral Fellow **University of South Carolina**

I joined USC as a postdoctoral fellow, where my primary 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 worked on models for predicting the lifetime of small Li-ion cells and primary CFx batteries used in medical devices. I also developed electrochemical models for Lithium-sulfur cells modified with a membrane to shield the anode from polysulfides to improve battery lifetime. I am currently working on models for estimating the lifetime of medical batteries for cardiac pacemakers and planning work for new funded projects aimed at building and modeling structural batteries/cells and high-density Lithium-Sulfur cells. I collaborated with the NASA safety team throughout the entire project, developing thermal runaway models with a constant focus on Li-ion battery safety.

Jun 2015 – Nov 2015 Visiting Scholar

University of South Carolina in 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.

Nov 2012 – Mar 2013 Research Assistant

University of Southern Denmark in Sønderborg, Denmark

Feb 2017 – Aug 2017

Before starting my Ph.D. project, I developed thermal models for prismatic Li-ion battery cells using COMSOL Multiphysics. The project was in collaboration with a Danish battery company Banke A/S from Nordborg, Denmark. In February 2017, I joined SDU again 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 NASA) and publishing international journal results. In addition to this, I have worked on building a small model for calculating the inductance of power electronics packaging designed by Fachhochschule Kiel, Germany.

Awards

Electrochemical Society (ECS) Battery Division Postdoctoral Associate Research Award

List of publications

Peer-Reviewed Articles

In Print

1. Giulio Siciliano, Bridgette Sims, Thomas Connor Burns, Wout De Backer, Paul Ziehl, Ralph E. White, Paul T. Coman, "Hybrid Graphitic-Carbon Fiber Anodes and NFM Cathodes for Structural Sodium-Ion Batteries", Solids, 7(1), 1, 2026
2. D. Petrusenko, T. Burns, P. Ziehl, R.E. White, Paul T. Coman, "Exploring Different Metal-Oxide Cathode Materials for Structural Lithium-Ion Batteries Using Dip-Coating," Energies, 18(16), 4354, 2025.
3. Paul T. Coman, Ralph E. White, "Modeling Self-Discharge in Li/S Batteries Through Electrochemical Anode Reactions: A Theoretical Perspective", Journal of Electrochemical Society, vol. 172, P. 070517, 2025
4. 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, vol. 172, P. 070519, 2025
5. 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. 172, p.060533, 2025
6. 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
7. 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

8. 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.
9. 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.
10. 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.
11. 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.
12. 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.
13. 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.
14. 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.
15. 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.
16. 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.
17. 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.
18. 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.
19. 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.
20. 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.
21. S. Gao, X. Feng, L. Lu, M. Ouyang, N. Kamyab, R.E. White, Paul Coman, "Thermal runaway propagation assessment of different battery pack designs using the TF5 draft as framework," *Journal of The Electrochemical Society* 166(8), A1653, 2019
22. 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.
23. 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.

24. 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.
25. 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.
26. 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.
27. 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.

Submitted

1. Mohamed Atwair, Hunter A McRay, Paul Coman, Golareh Jalilvand, Ralph E. White, *Electrochemical Modeling of Commercial LiFePO₄ Cathodes: Role of Particle Size Distribution and Variable Solid phase diffusion coefficient (2025) (Under review)*

Refereed Conference Articles

In Print

1. 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.
2. 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.
3. 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.

Abstracts

In print

1. Mohamed Atwair, Paul Coman, Ralph E White, "Role of Anode Reactions in Li/S Battery Self-Discharge: A Physics-Based Modeling Approach", *Electrochemical Society Meeting Abstracts*, 248, (8), 3499, 2025
2. Mohamed Atwair, Paul Coman, Ralph E White, "Understanding the Influence of Silicon Content on Silicon-Graphite Composite Electrodes: A Voltage Hysteresis-Inclusive Model", *Electrochemical Society Meeting Abstracts*, 248, (54), 2639, 2025
3. Paul T. Coman and Ralph E. White, "Optimizing and Modeling Passive Propagation Resistant Battery Packs: A Novel Design for Silicon-Based Anode Batteries", *Power Sources Conference*, 2025
4. Paul Coman, Ralph E White, "(Invited) Reduced Order Modeling of Li-Ion Battery Systems - from Fundamentals to Real-Life Applications", *Electrochemical Society Meeting Abstracts*, Prime2024, (26), 2071, 2024
5. Paul Coman , (Battery Division Postdoctoral Associate Research Award Sponsored by MTI Corporation and the Jiang Family Foundation) Thermal Runaway Modeling of Li-ion Batteries – From Fundamental Modeling to Real-Life Applications, *Electrochemical Society Meeting Abstracts*, 242, (3), 213, 2022
6. Benjamin Ng, Paul T Coman, Saheed A Lateef, William E Mustain, Ralph E White, "Low Temperature Li Plating and Corrosion Safety Hazard in Li-Ion Batteries", *Electrochemical Society Meeting Abstracts*, 237, (2), 405, 2020
7. Benjamin Ng, Paul T Coman, William E Mustain, Ralph E White, " Experimental Validation of a Simplified Electrochemical-Thermal Model for a NCM532 Large Format Battery Cell", *Electrochemical Society Meeting Abstracts*, 236, (5), 340, 2019

Presentations

Invited Presentations at Professional Meetings

1. Paul T. Coman, Ralph E. White, "Modeling and Optimizing Busplates for Improved Li-ion Battery Pack Performance", at COMSOL Webinar, February 20th, 2026
2. Paul T. Coman, "Digital Twins in Batteries" at UL Research Institutes Annual Research Symposium, July 21-23, Washington DC, 2025
3. P. Coman and R. E. White, "Reduced Order Modeling of Li-Ion Battery Systems - from Fundamentals to Real-Life Applications," PRiME 2024, October 6-11, Honolulu, HI, 2024
4. 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.

Contributed Presentations

1. M. Atwair, Paul Coman, R.E. White, "Understanding the Influence of Silicon Content on Silicon-Graphite Composite Electrodes: A Voltage Hysteresis-Inclusive Model," 248th ECS Meeting (Oct 12–16, 2025).
2. 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.
3. 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.
4. 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, Huntsville, AL, 2024
5. D. Petrushenko, P. Coman, J. Trillo, B. Esparza, R. White, E. Darcy, J. L. Moyer, J. R. Izzo, T.E. Adams and J. H. Fontaine, "Scale-up for PPR Battery Design for 21700 format Cells", NASA Aerospace Battery Workshop, Huntsville, AL, 2023
6. David Petrushenko, Paul Coman, Jesus Trillo, Jacob Darst, Ralph White, Eric Darcy, Jacob L. Moyer, John R. Izzo, Thomas E. Adams, Joe H. Fontaine, "M3 PPR Battery Development" NASA Aerospace Battery Workshop, Huntsville, AL, 2022
7. Paul Coman, Ralph White, David Petrushenko, Jacob Darst, Jesus Trillo, Eric Darcy, "Thermal Analysis Projections for Scale-up from 18650 to 21700" NASA Aerospace Battery Workshop, Huntsville, AL, 2022
8. 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.
9. 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.
10. 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.
11. Paul Coman, "Session 3: Thermal Runaway Initiation Methods, Fit-For-Purpose Testing Related To External And Internal Abuse Triggers (Session Chair), JRC exploratory research workshop: Safer Li-ion batteries by preventing thermal propagation, JRC Petten, Netherlands, 8-9 March 2018
12. 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.
13. Paul T. Coman, Sean Rayman, Ralph White "Modeling Venting of Ejecta and Electrolyte during Thermal Runaway of a cylindrical LCO cell", NASA Aerospace Battery Safety Workshop, 2015

14. 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.
15. 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.
16. 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.