

Exponent®
Engineering & Scientific Consulting

Michael Synodis, Ph.D., P.E., CFEI

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Professional Profile

Dr. Synodis is an experienced chemical engineer that specializes in energy storage and battery powered systems. At Exponent, he leads a team that focuses on the failure analysis, safety testing, and quality analysis of lithium-ion batteries and investigates complex technical issues involving battery safety and performance. He supports clients across a range of sectors, including electric vehicles, micromobility, residential and utility energy storage systems, as well as consumer electronics and wearables.

As a professional engineer (PE) and a Certified Fire and Explosions Investigator (CFEI), Dr. Synodis has led numerous product liability litigation investigations. He has conducted dozens of scene and laboratory inspections related to battery failures and fires, and he is experienced with a range of failure analysis techniques, including utilizing X-ray imaging, computed tomography (CT) scanning, cell teardowns, cryo-resistance, optical microscopy and scanning electron microscopy.

In the transportation space, Dr. Synodis has led fire investigations spanning single vehicle incidents to issues impacting large electric bus fleets, and he has supported clients through product recall scenarios and communications with regulatory agencies such as NHTSA. He also has experience in the micromobility space, where he has assessed e-bike and e-scooter battery packs in the context of product development, insurance claims, and litigation. He has performed battery pack design reviews, manufacturing quality evaluations, and cell quality assessments.

Dr. Synodis is skilled at performing large-scale battery abuse testing to identify potential failure mechanisms, assess risk, and offer guidance to help clients design for prevention of hazards in the field. He has performed customized abuse tests as well as standards-guided testing (e.g., UL 1642, SAE J2464, UL 2580).

Prior to joining Exponent, Dr. Synodis was a graduate research associate at the University of Pennsylvania, where he completed his PhD. In his time at Penn he developed processes based on MEMS techniques for the fabrication of micro-lithium-ion and micro-zinc-air batteries for use in high rate and on-chip power applications. Dr. Synodis has expertise with micro-fabrication technologies, including electrodeposition, sputter deposition, lithography, evaporative deposition, and laser micromachining. His thesis contained work on developing optimized electro-polymerization conditions of conductive polymers for use laminated multilayer microstructures.

Dr. Synodis also previously worked in manufacturing for L'Oreal USA in Piscataway, NJ, where he focused on optimizing line efficiencies and improving supply chain flexibility.

Academic Credentials & Professional Honors

Ph.D., Chemical & Biomolecular Engineering, University of Pennsylvania, 2019

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M.S., Chemical & Biomolecular Engineering, University of Pennsylvania, 2017

B.S., Chemical Engineering, Bucknell University, 2013

Licenses and Certifications

Professional Engineer Chemical, California, #7066

Professional Engineer Chemical, Massachusetts, #59631

Professional Engineer Chemical, New York, #110464

Certified Fire and Explosion Investigator (CFEI)

Prior Experience

Manufacturing, L'Oreal USA

Graduate Researcher, MicroSensors and MicroActuators Lab, University of Pennsylvania

Professional Affiliations

National Association of Fire Investigators

NattBatt Battery Safety Committee

American Institute of Chemical Engineers

Publications

Synodis M, Pyo JB, Kim M, Wang X, Allen MG. Lithographically patterned polypyrrole multilayer microstructures via sidewall-controlled electropolymerization. Journal of Micromechanics and Microengineering 2020; 31(2):025008.

Synodis M, Pyo JB, Kim M, Oh H, Wang X, Allen MG. Fully additive fabrication of electrically anisotropic multilayer materials based on sequential electrodeposition. Journal of Microelectromechanical Systems 2020; 29(6):1510–1517.

Synodis M, Pikul J, Bidstrup Allen SA, Allen MG. Vertically integrated high voltage Zn-air batteries enabled by stacked multilayer electrodeposition. Journal of Power Sources 2020; 449:227566.

Synodis MJ, Kim M, Allen MG, Allen SAB. 3D lithium ion battery fabrication via scalable stacked multilayer electrodeposition. Journal of Micromechanics and Microengineering 2019; 29(5):055006.

Synodis MJ, Porter CL, Vo NM, Reszka AJ, Gross MD, Snyder RC. A model to predict percolation threshold and effective conductivity of infiltrated electrodes for solid oxide fuel cells. Journal of The Electrochemical Society 2013; 160(11):F1216–F1224.

Presentations

Synodis M, McGann J, Thompson B. When EVs go dark: failure modes in electric vehicle and micromobility packs. American Bar Association TIPS Motor Vehicle Conference 2025, April 2025.

Synodis M, Warden DJ, Schuh Brandon. Burning Concerns: A Micromobility Battery Safety Roadmap.

Micromobility America 2024, November 2024.

Synodis M, Pikul J, Allen SAB, Allen M. Integrated fabrication of serially connected high voltage microbatteries via multilayer electrodeposition. In 2019 20th International Conference on Solid-State Sensors, Actuators and Microsystems & Eurosensors XXXIII (TRANSDUCERS & EUROSENSORS XXXIII), IEEE, June 2019.

Synodis MJ, Kim M, Allen SAB, Allen MG. MEMS enabled scalable fabrication of high performance lithium ion battery electrodes. In 2018 IEEE Micro Electro Mechanical Systems (MEMS), IEEE, January 2018.

Peer Reviews

Journal of Micromechanics and Microengineering