Exponent®
Engineering & Scientific Consulting

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

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Professional Profile

A chemical engineer by training, Dr. Synodis specializes in the quality analysis, performance evaluation, and abuse testing of lithium ion batteries. He has extensive experience in fabrication and characterization of lithium ion cells, from both a structural and electrochemical perspective.

Dr. Synodis utilizes a diverse suite of technical capabilities in order to evaluate performance of batteries and investigate root causes of their failures. In addition, his skills include conducting abuse and safety testing for batteries across an array of applications, ranging from wearable technologies to electric vehicle (EV) scale. As a result, Dr. Synodis has expertise in coordinating, conducting, and analyzing data from cell level safety testing (e.g., thermal, electrical, or mechanical abuse tests), to module level propagation testing, or pack level thermal analysis, including UL 9450-style tests.

In addition to the skills required for test testing described above, Dr. Synodis has material characterization experience including optical microscopy (OM), scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDS), and focused ion beam milling (FIB). Further, Dr. Synodis has expertise in the utilization of several micro-fabrication technologies, including electrodeposition, sputter deposition, lithography, evaporative deposition, and laser micromachining.

Prior to joining Exponent, Dr. Synodis was a graduate research associate in the MicroSensors and MicroActuators laboratory 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. Additionally, his thesis contained work on developing optimized electro-polymerization conditions of conductive polymers for use laminated multilayer microstructures. As an undergrad at Bucknell University, Dr. Synodis also performed computational research in the field of solid oxide fuel cells, where he studied the effects of nickel current collector loading on electrical performance and triple phase boundary density in YSZ based anodes. 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

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

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

Licenses and Certifications

Professional Engineer Chemical, California, #7066

Prior Experience

Manufacturing, L'Oreal USA

Graduate Researcher, MicroSensors and MicroActuators Lab, University of Pennsylvania

Publications

Synodis, M. J., Porter, C. L., Vo, N. M., Reszka, A. J., Gross, M. D., & Snyder, R. C. (2013). A model to predict percolation threshold and effective conductivity of infiltrated electrodes for solid oxide fuel cells. Journal of The Electrochemical Society, 160(11), F1216-F1224.

Synodis, M. J., Kim, M., Allen, S. A. B., & Allen, M. G. (2018, January). MEMS enabled scalable fabrication of high performance lithium ion battery electrodes. In 2018 IEEE Micro Electro Mechanical Systems (MEMS) (pp. 600-603). IEEE.

Synodis, M., Pikul, J., Allen, S. A. B., & Allen, M. (2019, June). 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) (pp. 789-792). IEEE.

Synodis, M. J., Kim, M., Allen, M. G., & Allen, S. A. B. (2019). 3D lithium ion battery fabrication via scalable stacked multilayer electrodeposition. Journal of Micromechanics and Microengineering, 29(5), 055006.

Synodis, M., Pikul, J., Bidstrup Allen, S.A., Allen, M.G. (2020). Vertically Integrated High Voltage Zn-Air Batteries Enabled by Stacked Multilayer Electrodeposition. Journal of Power Sources, 449, 227566.

Synodis, M., Pyo, J. B., Kim, M., Oh, H., Wang, X., & Allen, M. G. (2020). Fully additive fabrication of electrically anisotropic multilayer materials based on sequential electrodeposition. Journal of Microelectromechanical Systems, 29(6), 1510-1517.

Synodis, M., Pyo, J. B., Kim, M., Wang, X., & Allen, M. G. (2020). Lithographically patterned polypyrrole multilayer microstructures via sidewall-controlled electropolymerization. Journal of Micromechanics and Microengineering, 31(2), 025008.

Peer Reviews

Journal of Micromechanics and Microengineering