



Exponent®

Engineering & Scientific Consulting

Matevz Frajnkovic, Ph.D.

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Professional Profile

Dr. Frajnkovic specializes in thermodynamics, heat transfer, computational fluid dynamics, and transport phenomena in complex electrochemical systems. Dr. Frajnkovic has also performed experimental and numerical analysis of advanced electrochemical energy storage systems. He has experience with measuring the heat generation rate during cycling of batteries and capacitors via isothermal operando calorimetry technique.

Dr. Frajnkovic has experience with experimental techniques such as galvanostatic cycling (GC), cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS), galvanostatic intermittent titration technique (GITT), and isothermal operando calorimetry. These techniques can be used to investigate the charge/discharge mechanisms of electrochemical energy storage systems and monitor the generated heat rate during their operation. He also has extensive experience with computational fluid dynamics (CFD) modeling and finite element method (FEM) simulation using commercial software packages, such as Star-CCM+, Ansys CFX and Fluent, Comsol, Simulia Abaqus, and LAMMPS, as well as 3D-CAD modeling software packages such as Catia and SolidWorks. Examples of project work include performance evaluation of internally finned heat exchangers and modeling steam release through pressure relief valves (PRVs).

Prior to joining Exponent, Dr. Frajnkovic was a research assistant at University of California, Los Angeles (UCLA) where he carried out his doctoral work. His focus was on measuring and identifying the thermal signature of physicochemical phenomena occurring in hybrid supercapacitors during cycling. Dr. Frajnkovic also used numerical simulations to develop expressions for irreversible heat generation rates which exceeds Joule heating in hybrid supercapacitors. Moreover, he measured entropic potential evolution to elucidate the kinetics and structural evolution of novel battery electrode materials.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, University of California, Los Angeles (UCLA), 2022

M.S., Mechanical Engineering, University of Maribor, Slovenia, 2017

B.S., Mechanical Engineering, University of Maribor, Slovenia, 2015

Zois Fellowship for Academic Excellence at University of Maribor, Slovenia, 2012-2017

The Sole Recipient of the Best Student Award, University of Maribor, Slovenia, 2017

The Frank Kerze and Therese Kerze-Cheyovich Research Assistantship for the Study of Transport

Phenomena in Complex Systems, UCLA, Los Angeles, California, 2017-2022.

Licenses and Certifications

40-Hour Hazardous Waste Operation and Emergency Response Certification (HAZWOPER) (CA)

Certified Forklift Operator for Sit-Down Counterbalanced Forklifts (CA)

FAA Part 107 Certified Commercial Drone Pilot

Professional Affiliations

American Society of Mechanical Engineers (ASME)

National Fire Protection Association (NFPA)

The Electrochemical Society (ECS)

American Chemical Society (ACS)

Publications

Likitchatchawankun A, DeBlock RH, Whang G, Munteshari O, Frajnkovic M, Dunn B, Pilon L. Heat generation in electric double layer capacitors with neat and diluted ionic liquid electrolytes under large potential window between 5 and 80 °C. *Journal of Power Sources* 2021; 488:229368.

Baek SW, Wyckoff KE, Butts DM, Bienz J, Likitchatchawankun A, Preefer MB, Frajnkovic M, Dunn BS, Seshadri R, Pilon L. Operando calorimetry informs the origin of rapid rate performance in microwave-prepared TiNb₂O₇ electrodes. *Journal of Power Sources* 2021; 490:229537.

Baek SW, Preefer MB, Saber M, Zhai K, Frajnkovic M, Zhou Y, Dunn BS, Van der Ven A, Seshadri R, Pilon L. Potentiometric entropy and operando calorimetric measurements reveal fast charging mechanisms in PNB₉O₂₅. *Journal of Power Sources* 2022; 520:230776.

Zhou Y, Le Calvez E, Baek SW, Frajnkovic M, Douard C, Gautron E, Crosnier O, Brousse T, Pilon L. Effect of particle size on thermodynamics and lithium ion transport in electrodes made of Ti₂Nb₂O₉ microparticles or nanoparticles. *Energy Storage Materials* 2022; 52:371-385.

Frajnkovic M, Likitchatchawankun A, Douard C, Zhou Y, Baek SW, Catton I, Crosnier O, Brousse T, Pilon L. Calorimetry can detect the early onset of hydrolysis in hybrid supercapacitors with aqueous electrolytes. *Journal of Power Sources* 2022; 548:232069.

Conference proceedings:

Adanic L, Frajnkovic M, Necemer B, Belsak A, Ren Z. Split-Hopkinson pressure bar (SHPB) test apparatus. *Kuhljevi dnevi* 2015; 1-8.

Ivanic A, Frajnkovic M, Adanic L, Lubej S. Comparison of various techniques for flexural strengthening of thin concrete members using continuous carbon fibers. *Kuhljevi dnevi* 2016; 75-81.

Frajnkovic M, Catton I, Fisher TS. Melting of Nitrogen-Deuterium mixtures. *Kuhljevi dnevi* 2019; 33-40.

Peer Reviews

Journal of Electrochemical Energy Conversion and Storage

Heat Transfer Engineering Journal

International Society of Offshore and Polar Engineers (ISOPE)