

## **Battery Fast Charging for Affordable and Sustainable Electrification**

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Faculty host: Todd Kingston

**Seminar on March 26<sup>th</sup>, 2024 at 11:00 AM in 2004 Black Engr.**

### **Abstract**

Smaller, faster-charging batteries are the answer for affordable and sustainable electric vehicles for everyone, everywhere. The ability to quickly refill energy is profoundly important in order to reduce EV cost and demand for critical minerals. In this talk I will present asymmetric temperature modulation (ATM) approach to enabling 10-minute fast charging of energy-dense Li-ion batteries in any temperatures (even at  $-50^{\circ}\text{C}$ ) while still delivering remarkable cycle life. A novel cell structure capable of thermal stimulation is introduced. Recent disastrous events at EV charging stations caused by an arctic blast in Chicago will be given as an example of the dire need for quick energy refill in the extreme cold. Battery fast charging must also work in hot summers along with high-temperature stability of cycling and storage. We shall present novel thermal management concepts for extreme fast charging in both extreme cold and hot conditions. Overall, our development points to a new paradigm of battery design and thermal management without having to trade-off among fast charge, safety, lifetime, and cost.

**Dr. Chao-Yang Wang** is William E. Diefenderfer Chair Professor of Mechanical Engineering and Professor of Chemical and Materials Science & Engineering at the Pennsylvania State University. He has 230+ journal publications and an H-index of 114. He holds over 140 patents and has published two books, “Battery Systems Engineering” by Wiley and “Modeling and Diagnostics of Polymer Electrolyte Fuel Cells” by Springer. Dr. Wang is known for his innovative research on batteries and fuel cells; particularly for pioneering a new battery paradigm with modulatory states and interfaces. The all-climate battery (ACB) he invented was adopted by 2022 Winter Olympics as well as commercialized by several carmakers. His latest invention on fast charging batteries was named as one of 10 biggest science stories in 2022 by the Guardian. He is a Fellow of U.S. National Academy of Inventors (NAI) and American Society of Mechanical Engineers (ASME) and a speaker of many public forums such as 2021 Tencent WE Summit alongside two Nobel Laureates, 2022 Distinguished Transport Lecture at Hong Kong University, 2023 Hawkins Lecture at Purdue University, and 2024 PAIR Distinguished Lecture at PolyU of Hong Kong. Dr. Wang’s expertise covers the transport, materials, manufacturing and modeling of batteries and fuel cells.

***This seminar counts towards the ME 600 seminar requirement for Mechanical Engineering graduate students.***

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