Department of Advanced Design and Systems Engineering
香港城市大學
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Thermal Solutions for Extreme Fast Charging of Batteries

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Abstract

The US Department of Energy has identified extreme fast charging (XFC) as a major barrier for the wide adoption of electric vehicles (EVs) and the reduction of transportation carbon emission. In existing mainstream EVs, the well-known range anxiety largely comes from the long charge time, i.e., >30 min for recharging to 80% state of charge. For a comparable refueling experience as gasoline cars, XFC with a large charge current can reduce the charge time to <15 min. However, long XFC cycle life cannot be achieved in existing high-energy-density batteries. Lithium plating and thermal management are regarded as the two challenges for XFC, as a result of the nonuniformity of mass and heat transport during XFC. Thus, understanding and manipulating the mass and heat transport is critical to realizing XFC. In this talk I will first present our work on the development of thermal sensor for quantifying the nonuniform lithium distribution during XFC. I will further discuss our device-level thermal switching solution for realizing long XFC cycle life without any modification of commercial battery materials or internal structures. In the second part, I will focus on tuning thermal transport in thermally conductivity thin films for system-level thermal management. In summary, my research at all stages has been devoted to developing thermal sensing and management solutions for modern devices including electrochemical and microelectronic devices.

About the Speaker

Dr. Yuqiang Zeng received a B.S. in Thermal Energy and Power Engineering from Huazhong University of Science and Technology in 2013, and a PhD in Mechanical Engineering at Purdue University in 2018. His dissertation focused on thermal conduction in thin films for microelectronics. He is now working as a postdoctoral associate at the Lawrence Berkeley National Laboratory where his research interests lie in developing thermal sensing and management solutions for extreme fast charging of batteries. He has co-authored 11 journal papers in top journals such as Nature Energy and Joule.

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