

Advanced Battery Production and Testing Facility Strengthens Skills of Engineering Students in Vehicle Electrification

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Abstract

Lithium-ion batteries have been widely used for vehicle onboard electric energy storage of battery electric vehicles. The performance, efficiency, safety, service life, and cost of electric vehicles significantly depend on the onboard lithium-ion battery systems. Battery testing is important for battery research/development. The testing data is essential for battery characterization, standardization, simulation, and validation. Battery testing data is also critical for the design of the Battery Management System (BMS). Additionally, cost of lithium-ion batteries significantly depends on their raw materials and manufacturing processes. Properties of lithium-ion batteries can also be altered by varying the ratio of each raw material used in battery production. As electrification is the future for the automotive industry, familiarization with battery testing and production is needed for engineers. To strengthen the skills of students in vehicle electrification, Ferris State University is establishing the Center for Applied Battery Production and Testing. This center features industrial-scale battery charge/discharge units, environmental temperature chambers, Universal Testing Machine (UTM), thermal cameras, and small-scale battery manufacturing equipment. By using the above equipment, engineering technology students at Ferris State University can perform different battery charging/discharging tests, battery thermal tests, battery aging tests, and battery safety tests (including battery deformation and foreign object penetration). Students can also make their own small-scale lithium-ion battery cells with different cathode, anode, electrolyte, and separator materials. The Center for Applied Battery Production and Testing at Ferris State University is training engineering technology students with highly demanded skill sets for the electrification trend of the automotive industry.

Keywords

Engineering Education, Battery Testing, Battery Production, Vehicle Electrification.

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Biographies

Nicci VandeVeegaete is the Faculty Program Coordinator and Advisor for the Bachelor of Applied Science in Industrial Technology & Management and the Lean Technology certificate programs at Ferris State University. She earned B.S. in Manufacturing Systems Engineering from GMI Engineering and Management Institute (now Kettering University), and Master's in Industrial Operations from Lawrence Technological University. Prior to working in higher education, she had an accomplished engineering career with a major automotive manufacturer.

Yiqun Liu is an assistant professor and the director of the Center for Applied Battery Production and Testing at Ferris State University. He earned B.S. in Mechanical Engineering from University of Kentucky, Masters in

Electric-drive Vehicle Engineering from Wayne State University, and PhD in Mechanical Engineering from Wayne State University. Dr. Liu's research focuses on lithium-ion battery modeling and simulation and electrified powertrain optimization. He has authored and co-authored over 30 publications in the areas of battery aging, battery safety, battery low-temperature performance, vehicle electrification, internal combustion engine, and alternative fuels. Dr. Liu is an active member of SAE and IEEE VTS.

Russell A. Leonard, Jr., PhD is a professor of automotive engineering in the School of Automotive and Heavy Equipment, College of Engineering Technology at Ferris State University and is the faculty advisor for the Ferris State University SAE Baja team. Russell is also the grant director and PI for the Michigan Economic Development Corporation (MEDC) Talent Action Team (TAT) EV and Mobility Strategic Investments Program. Russell worked as an engineer in the automotive industry for over 20 years. He is a retired Army Reserve instructor and light wheeled vehicle mechanic and is also an ASE master certified automobile technician. Additionally, Russell has worked as a subject matter expert for automotive class action and patent litigation. Russell's research interests are Electric Vehicle (EV) battery chemistry and EV battery recycling.