

DEPARTMENT OF MECHANICAL ENGINEERING

WILLIAM MAXWELL REED SEMINAR SERIES

“Deformation of Lithium Ion Batteries under Mechanical Loading”

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Abstract: I report on an experimental and numerical study of deformation in cell/string/module of a lithium ion battery under mechanical loading. I performed compression tests on individual components of the battery cell, such as anode, cathode and separator, and used the results to calibrate the specific material models for these components. Indentations tests were performed on individual battery cells. During the indentation test, load, voltage and temperature of the cell were measured. We also studied the evolution of deformation in various components of the cell in order to understand the mechanisms of failure in separator, which could result in an electrical short and thermal runaway of the battery. A finite element model (FEM) in which several layers are fully resolved and the remaining components are homogenized was developed for different cell combinations. In FEM maximum strain criterion in separator was used for element deletion and failure at short circuit.. I will demonstrate the advantages of this approach by comparing the load displacement curve and the nature of deformation obtained from simulations to those obtained from experiments. I will also talk about a new finite element method that is used to model the deformation in the battery.

Bio: Abhishek Kumar is working as an Assistant Teaching Professor in Northeastern University since January 2017. Abhishek completed his Postdoc from Oak Ridge National Laboratory (ORNL), his research in ORNL is focused on safety of Lithium Ion batteries. He has worked to create a simulation tool to predict how these batteries behave under different impact conditions. He received his PhD in Aerospace Engineering from University of Michigan, Ann Arbor in 2014. During PhD he developed finite element code based on crystal plasticity formulation to quantify relationship between process and properties for different alloys. He did his internship at Toyota Technical Center working on modeling of composite materials. He completed his MS from University of South Florida in 2007 and B-Tech in Mechanical Engineering from Indian Institute of Technology in 2004.

Date: March 8, 2018

Place: RMB 323

Time: 3PM

Contact: Dr. Alexandre Martin 257-4462

Meet the speaker and have refreshments
Attendance open to all interested persons