THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

COE Undergraduate Research Program

Fall 2016

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

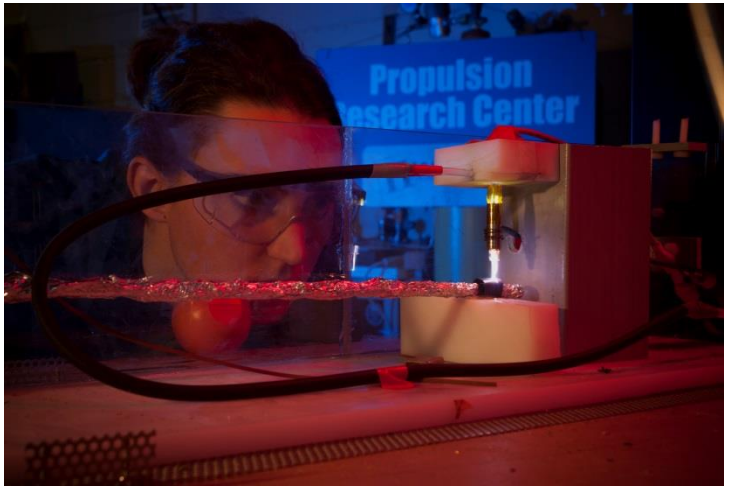
Contacts

- Gabe Xu (gabe.xu@uah.edu)
  - Assistant Professor, MAE
- Jennifer English (jennifer.english@uah.edu)
  - Associate professor, ECE
  - Associate Dean of Undergraduate Affairs
- Dave Cook (dac0010@uah.edu)
  - Student research coordinator
  - Academic Affairs/Honors College
- Bill Wilkerson (wilkerw@uah.edu)
  - Dean of Honors College

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Benefits of UR

- Exposure to new and advanced areas of science/engineering
  - Not taught in the classroom but advancing science and technology



- Hands-on experience tackling new problems
  - Builds critical thinking, how to learn, engineering judgement, how to fail forward
  - Critical skills grad schools and employers seek

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Benefits of UR

- Meaningful interactions with faculty
  - Gain a good reference who knows more than just your grade in a class
- Chance to write and present your work
  - Conference or journal papers and presentations
  - Technical communication skills
  - Meet professionals in your field

UAH students with former Astronaut Dr. Sandra Magnus at conference

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Goal of COE Program

- Inform students of the research being done by the faculty
  - What we do the other 30+ hours of week
- Provide students with opportunity to do independent research
  - Help energize your studies
  - See that your classes actually teach you things
  - Additional path to co-op and internship
- Improve student-faculty relations
  - We're people too!

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Involvement

- Multi-semester participation (2+)
- Recommended min 3.0 GPA
- Approx. 8 hours per week
  - Can vary by project
- Student expected to participate as a full member of the lab
  - Attend lab meetings
  - Be professional and work with other students, graduate and undergraduate
  - Key words are trust and dependability

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Structure

- Multi-semester research with faculty
  - Build skills and relationships
- 1st semester
  - Not expected to know anything about the project
  - Assist on projects
  - Observe, practice, and learn
- 2nd semester+
  - As gain more experience, take on more responsibility
  - Discuss with faculty about independent project

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Structure

- Technical elective credit if desired
  - Student research proposal approved by faculty and department
  - Must produce technical document at end of semester
    - Professional conference paper quality at minimum
    - Senior/Honor's thesis also counts

- Answer some questions at end of each semester to provide feedback to the college

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Stipend Opportunities

- Two UAH wide opportunities for paid summer research
  - Contact Dave Cook for more information on both
- Research and Creative Experience for Undergrads (RCEU)
  - 10-12 week summer program to do UR for 32-40 hr/week with faculty
  - Faculty propose projects, students apply for them
  - $3200 stipend
  - Poster at end of program
- Honors Capstone Research Summer Program
  - Exact same structure as RCEU, but for Honors College students
  - Must work with faculty to propose a project

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Example Projects

- List of research projects and contact information
- Students provide a resume with A# and contact information
  - 3 choices of project
- I'll distribute resumes to corresponding faculty
- Faculty review resumes and may conduct interviews
- Mutual agreement between student and faculty
  - Work times, deliverables, tasks, etc.
  - Minimum expectations and reporting as previously stated

Questions?

Sample Fall 2016 Projects

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

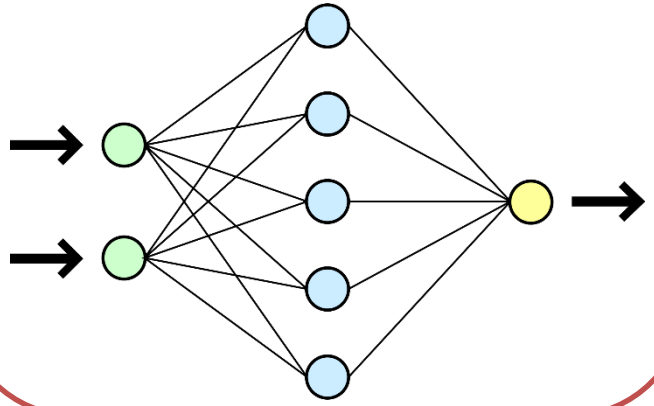
Systems Engineering Research

Project 1: Rotorcraft End-Users

Model human-computer interactions using simulators

Project 2: Optimal Predictive Controllers

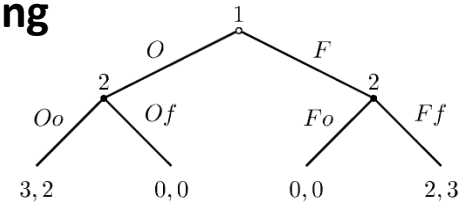
Work with aerospace company on neural networks



For Further Information:
Bryan.Mesmer@uah.edu

Project 3: Gamification in Systems Engineering

Investigate the use of games to drive adoption of new systems engineering principles



THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

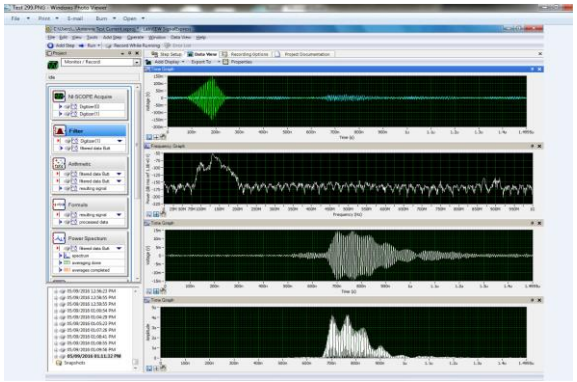
RF Location and Detection of Resonant Objects

Project 1: Concealed Carry Detection

Project 2: Powerline/Telephone Line Detection for Low-Flying Aircraft

Project 3: Landmine Detection

- Measure RF reflected power for simulated weapons and obstacles.
- Support test setup, testing, data analysis, documentation.
- Opportunity to gain proficiency in LabVIEW, RF hardware, etc.
- Student will be encouraged to obtain HAM Technician License



- U.S. Citizenship Required by Funding Organization
- Possible ITAR/Export Control Restrictions

For more information contact Jim Blackmon, Research Professor, PRC/MAE

- Email: blackmoj@uah.edu
- Office: THS 233

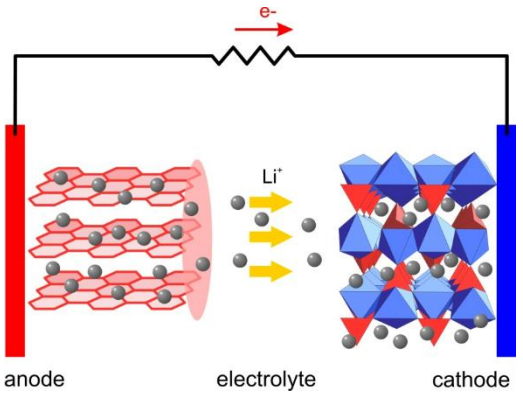
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Computational Materials Design

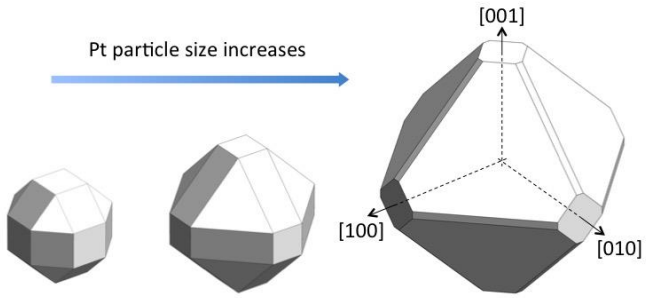
Material Design by

1) Developing quantum calculation methods
2) Employing the developed methods to elucidate the material behaviors

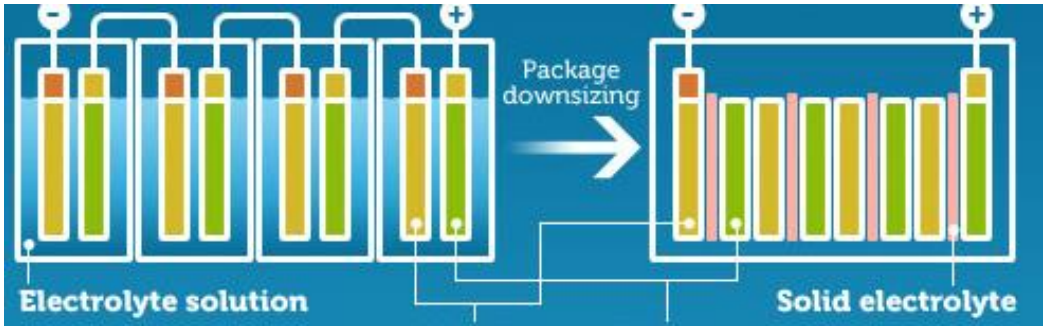
For further information, contact Eunseok Lee at **eunseok.lee@uah.edu or visit webpages.uah.edu/eunseoklee**



Magnetic Effects on Li-ion Battery Electrode Materials



Nucleation and Growth of Nanoparticles



Solid Electrolyte of All-solid-state Li-ion Batteries

Surface Science & Technology

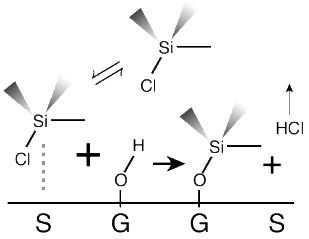
God made the bulk; surfaces were invented by the devil. — W. Pauli
From: https://en.wikiquote.org/wiki/Wolfgang_Pauli

Dr. Jeffrey J. Weimer
Associate Professor
Chemistry / Chemical & Materials Engineering
Materials Science
Jeffrey.Weimer@UAH.edu
MSB 125

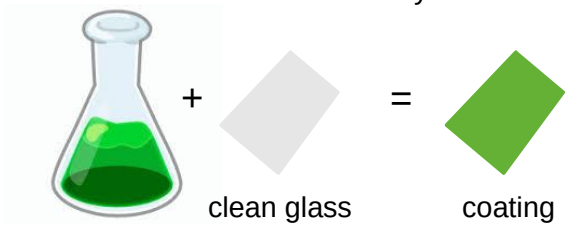
Functionalizing Glass-Based Surfaces

Engineering Need

We need to create a uniform surface chemistry regardless of the type of glass substrate



silane chemistry



clean glass coating

surface chemistry

coating integrity

Your Goal

Determine the optimal parameters to create a consistent surface chemistry on glass using silanes

Your Project

Prepare coated surfaces using wet-chemistry methods
Characterize their chemistry with a contact angle system
Image the coatings with optical microscopy

Anticipated Outcomes

You will learn how to

- clean and coat surfaces using wet-chemistry methods
- measure contact angles and image with optical microscopy
- apply engineering analysis to large collections of data
- create publication-ready results from experimental data
- interpret contact angles as a indication of surface chemistry

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Lei Research Group


Celebrating Mar's PhD defense

1: Catalyst

Work-horse of chemical industry, used in 90% of processes

2: Battery

Provide alternative energy storage solution for energy independent

In collaboration with Mechanical engineering

3: Clean Water

Develop effective and in-expensive methods to purify water

In collaboration with environmental engineering

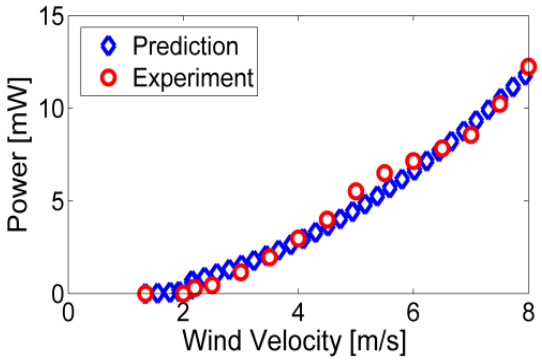
For more visit:
http://leilab.uah.edu/

- An exciting research group driven by curiosity
- Comprised of 3 PhD, 3 Master's and 5 undergraduate researchers
- Undergraduate Anderson White co-authored a peer-reviewed paper published at a high-impact journal *Nanoscale*
- Undergraduate Hayden Fowler is going to present her poster in a professional conference in Asheville, TN, in September 2016

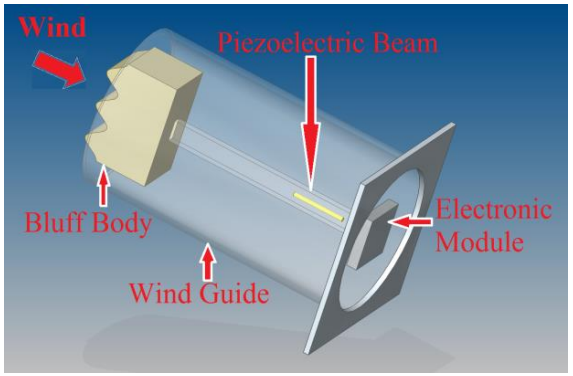
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Adaptive Structures Laboratory

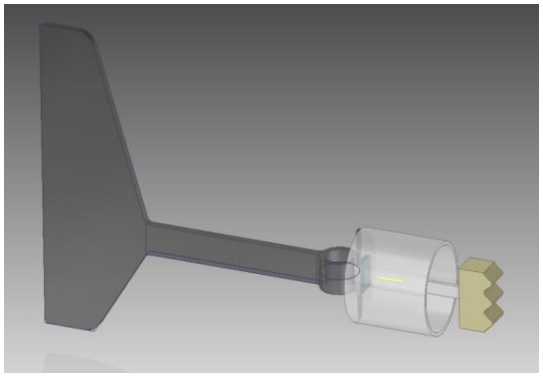
Project 1: Piezoelectric airflow sensor characterization



Galloping piezoelectric energy harvester performance



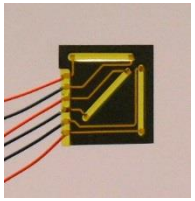
Single-axis assembly



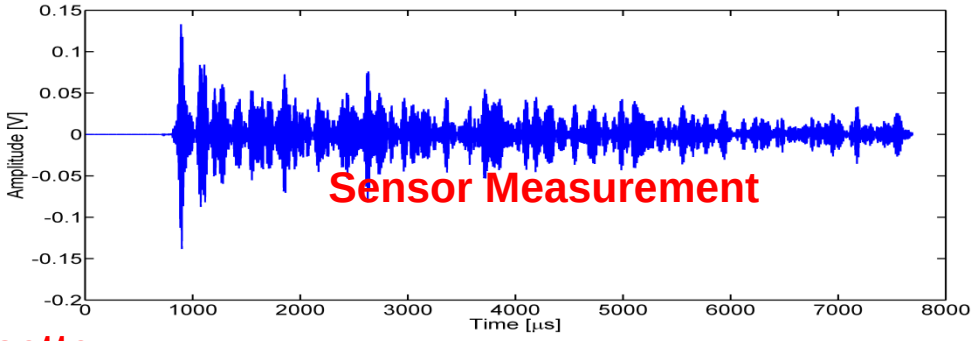
Hybrid design

Project 2: Piezoelectric sensor array for structural health monitoring

In-house Poled PZT Fiber



PZT Fiber Rosette



Sensor Measurement

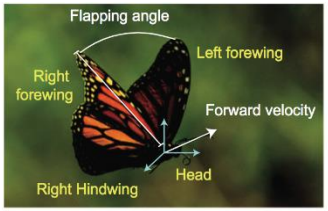
More Information:
http://webpages.uah.edu/~gw0005/news.html or contact Dr. Wang at Gang.Wang@uah.edu

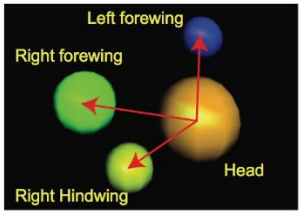
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

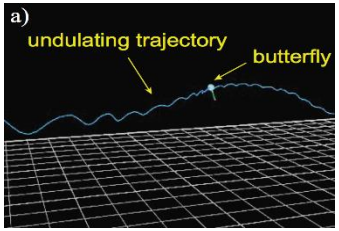
Butterfly Aerodynamics

Project 1: Flight of Butterflies

- Measure the wing kinematics and trajectory
- Improve the experimental methodology

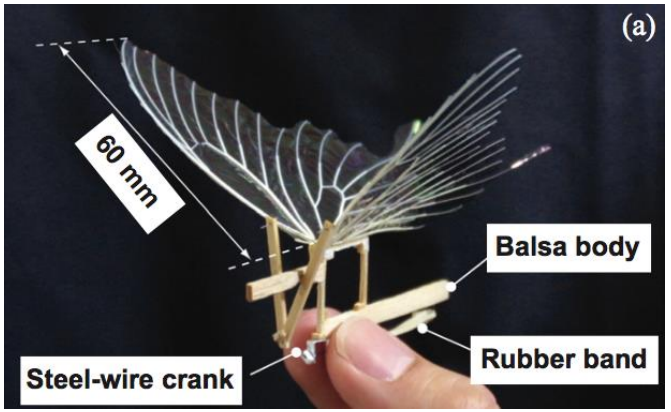






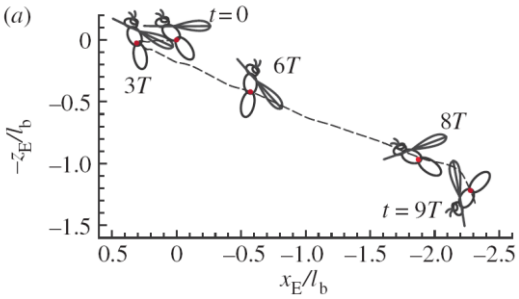
Project 2: Artificial Butterfly

- Develop an artificial mechanical butterfly

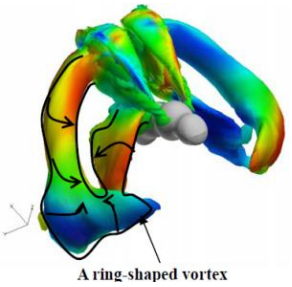


Project 3: Dynamics of a flapping flyer

- Numerically study the dynamics of flappers



Hovering fruit fly



Hovering bee

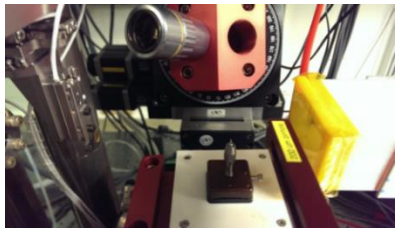
More information

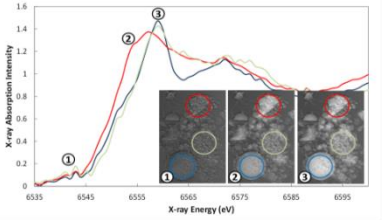
- Website: http://kanglab.uah.edu
- Email: chang-kwon.kang@uah.edu
- Office: THN 266

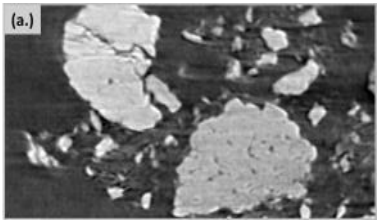
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

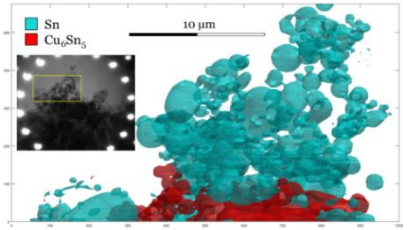
Multiscale Transport and Energy Conversion

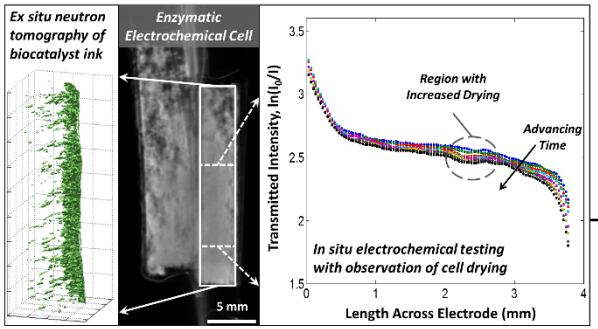
X-ray and Neutron Imaging



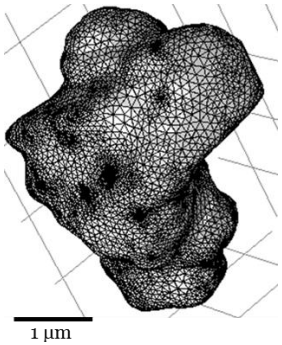


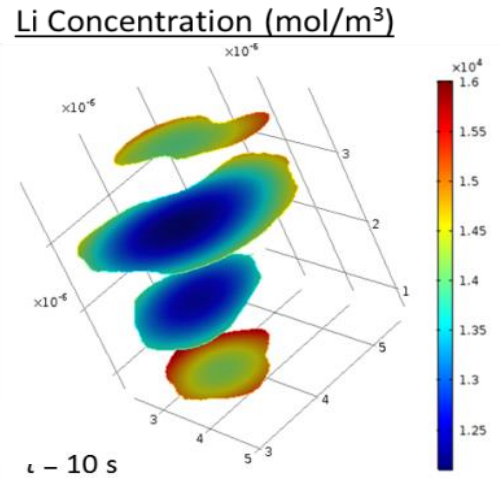


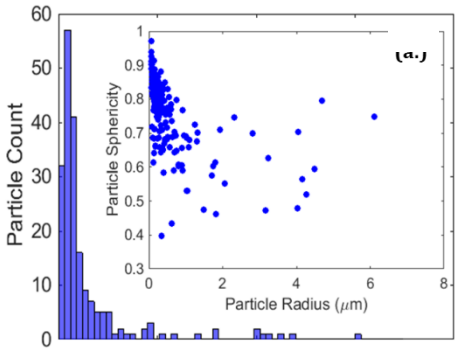


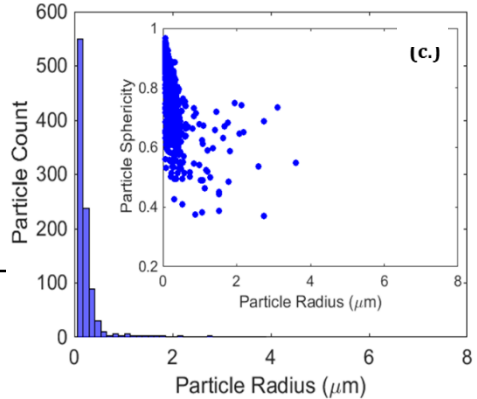


3D Data Analysis & Multiphysics Modeling









Projects include:

- 3D image processing
- Microstructural analysis
- Multiphysics FEA
- Device testing
- Materials synthesis

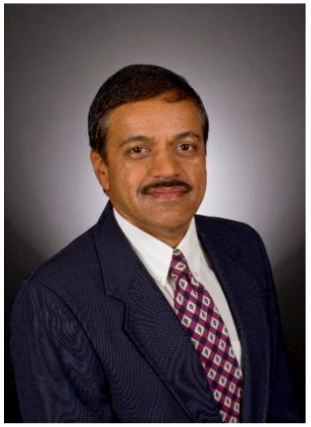
Further details:

george.nelson@uah.edu
http://mtec.uah.edu

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Power System Dielectrics laboratory

- Study insulator material properties for power delivery systems
- Undergraduate student research opportunities
  - Work with graduate students on various experiments
  - Learn about high voltage safety
  - Getting familiar with modern methods of data acquisition
  - non-destructive testing for equipment diagnostics
  - Technical writing
- Interested students should make appointment in ENG 272



Contact: Dr. R. Gorur
ravi.gorur@uah.edu

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Data Acquisition and Analysis

- Use LABVIEW to build customized data acquisition for experiments
- Process data for meaningful analysis
- Use data to correlate with experimental results
- Learn hands-on programming with latest tools used in industry

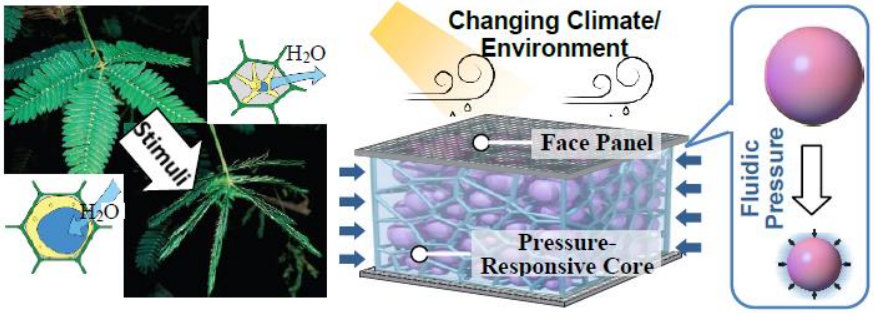
Contact: Dr. R. Gorur
ravi.gorur@uah.edu

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Energy Efficiency & Multi-hazard Resilience of Infrastructures

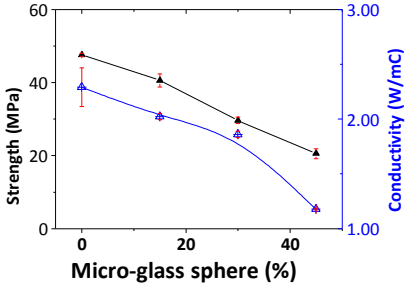
Project 1: Thermally Activated Structures

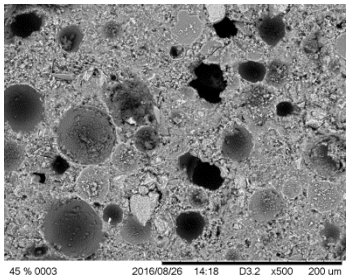
- Structures that can change thermophysical properties in response to ambient environments
- Additive manufacturing in Civil Engineering



Project 2: Mesostructured concrete

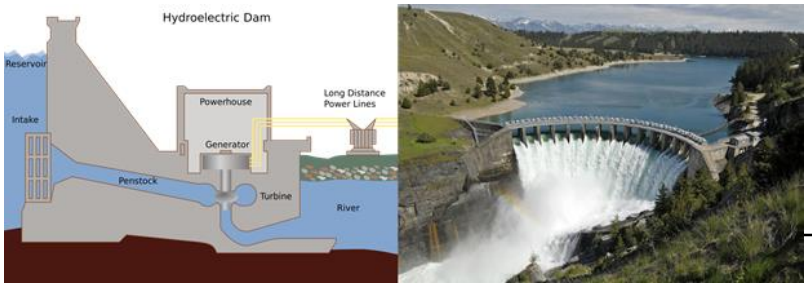
- Develop mesostructured concrete that have tightly controlled thermal and mechanical properties.





Project 3: Cyber-physical Security

- Cyber-physical security of critical infrastructures



More information

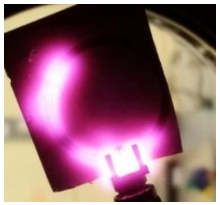
- Website: shm-im.uah.edu
- Email: hongyu.zhou@uah.edu
- Office: OKT S244

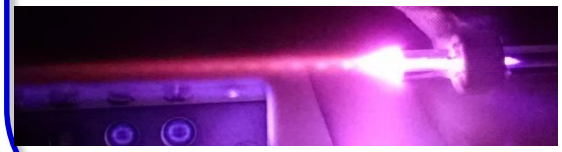
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Plasma and Electrodynamics Lab

Project 1: Microplasma cathode for ion engines

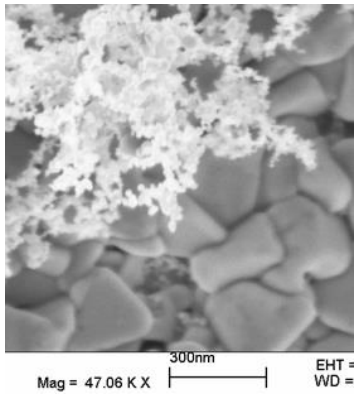
- Assist with test of different cathode designs





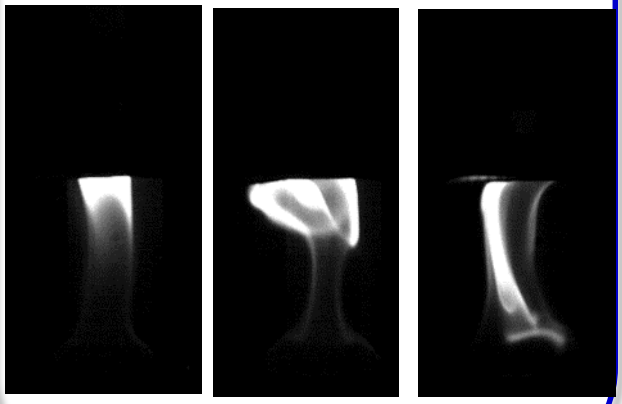
Project 2: Plasma for Nanomaterial Synthesis

- Diagnostics of particles and plasma



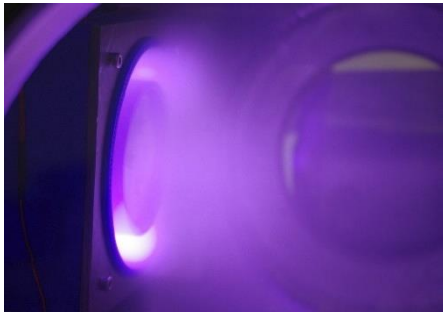
Project 3: Plasma assisted combustion of rocket injector

- Help run experiments
- Collect and analyze data



Project 4: 3D printed Hall thruster

- Help run experiments
- Magnetic field modeling of small thurster



More Information:
www.uah.edu/perl
Gabe.xu@uah.edu