Materials Science and Technology Division

OVERVIEW OF S&T PROGRAM

The Materials Science and Technology Division is unique within the Department of Energy (DOE) System with mission goals that extend from fundamental materials science to applied materials science and technology. One key component of the division is a strong Basic Energy Sciences (BES) portfolio that pushes the frontiers of materials theory, synthesis characterization, and discovery. Work for BES includes the development of new materials theory and modeling approaches targeted at unprecedented accuracy for structural, functional and nuclear materials. The theory effort is integrated with materials characterization and synthesis programs that are pioneering new approaches for materials capable of operating in extreme environments and/or with new functionality. Nuclear materials are another key component of the division portfolio and research in this area is targeted at extending and predicting the useful lifetime of the existing fleet of reactors, developing novel accident tolerant fuels, and providing the materials underpinning for fusion energy. The nuclear materials program leverages off both fundamental and applied capabilities within the division. The largest part of the division is devoted to applied research including research sponsored by the DOE Office of Energy Efficiency and Renewable Energy and the Office of Fossil Energy. Key areas of strength include alloys by design, novel carbon fiber processing, high-temperature mechanical and corrosion tolerant, advanced manufacturing, processing, and compositing technologies, and energy storage, fuel cell, and thermoelectric research. The vision and historic strength of the division is in translating fundamental insights into real world applications.

CORE CAPABILITIES

- Targeted theory and modeling efforts with thrusts in defect physics and Quantum Monte-Carlo designed to increase model size, time scales and fidelity
- Quantitative Electron Microscopy including sub angstrom resolution instrumentation, in-situ stages, and advanced detectors
- Single crystal synthesis with capabilities for growing crystals for research in our laboratories, at the SNS, and worldwide and for radiation detection applications
- Novel thin film deposition methods including Pulsed Laser Deposition/ Epitaxy and pioneering High T_c superconductivity deposition capabilities
- Comprehensive and novel x-ray and neutron characterization methods including subgrain and large-sample residual stress measurements and measurements of lattice dynamics
- Extensive alloy design, corrosion, creep, and joining expertise and facilities
- Novel processing equipment and expertise, including carbon fiber processing from lab scale to pre-production scale, fabrication and joining of iridium, production of battery cells, magnetic field processing, specialized rolling technologies, additive manufacturing, etc
- Laboratories for comprehensive evaluations of low-level radioactive materials

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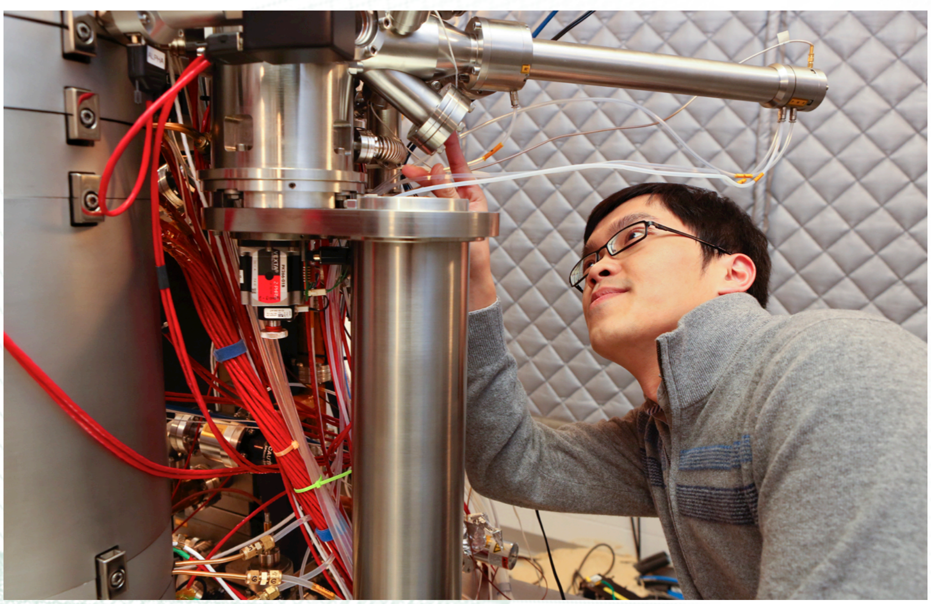
HIGHLY SPECIALIZED EQUIPMENT OR RESOURCES

- Laboratory scale to preproduction scale carbon fiber processing lines
- Suite of aberration corrected and other microscopes including a Nion ultraSTEM
- Special instrumentation for textured substrate synthesis and characterization
- One-of-a-kind corrosion and loss-of-coolant characterization facilities
- Specially-designed pulsed laser epitaxy and single-crystal growth instruments
- Neutron/x-ray residual stress and x-ray microtomography instrumentation
- Friction stir welding and extrusion instruments
- State-of-the-art additive and processing equipment
- Unique mechanical properties instrumentation

Felix Paulauskas, preparing a carbon precursor for processing



Wigner Fellow – Wu Zhou

2015 Early Career Award Winner – Valentino Cooper