Project ID
lm_01_laracurzio

Materials Characterization Capabilities at the High Temperature Materials Laboratory and HTML User Program Success Stories

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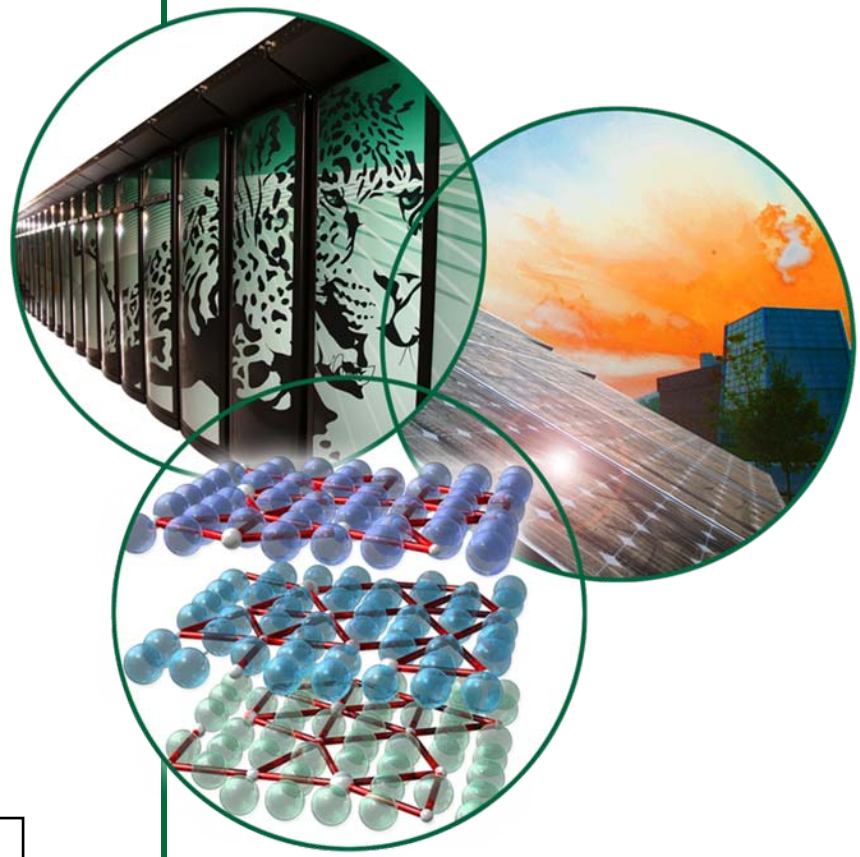
Oak Ridge National Laboratory
May 20, 2009



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U.S. DEPARTMENT OF ENERGY

OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

The HTML User Program - Objectives

- The HTML is a National User Facility that supports the missions of DOE, EERE and the Vehicle Technologies Program in particular, by working with industry, universities and other national laboratories to develop energy efficient technologies that will enable the U.S. to use less petroleum. The HTML User Program contributes to the achievement of all the goals of the materials Technologies subprogram by providing expert materials characterization and analysis equipment, expertise, and services.
- Access to the HTML is provided through the HTML User Program proposal process. Research proposals are reviewed by a committee and approved based on scientific merit, relevance of the proposed research to the mission of DOE's Vehicle Technologies Program, and feasibility. Research is completed within 24 months and normally involves one or more user visits to the HTML
- The HTML is organized into six user centers, which are clusters of highly skilled staff and sophisticated, often one-of-a-kind instruments for materials characterization.

The HTML User Program - Objectives

- During FY2008 53 different organizations participated in the HTML User Program on a total of 76 user projects. Projects were focused on characterization of:

- Li-ion battery materials
- Catalysts
- Thermoelectric materials
- Lightweight and structural materials
- Materials for propulsion and power generation
- Materials for thermal management
- Diesel particulate filters
- Functional materials
- Materials for H_2 production and fuel cells
- Wear and tribology
- Other

Details about all of these projects can be found in the FY2008 Annual report for the HTML User Program

Project ID: lm_01_laracurzio

Overview

Timeline

Project Start Date: 1987
Project End Date: -

Budget

The FY2008 budget for the HTML was $6,072,283 and was allocated as follows:

- $1,567,500 for capital equipment purchases
- $3,879,483 to support staff participation in user projects
- $626,000 for the operation of the user program

Users cost-share user projects through:

1) direct involvement with HTML staff members during the development of the user project;
2) funding their travel to the HTML to perform research;
3) costs of materials provided by the user and the research performed prior to the user project;
4) subsequent collaboration with HTML staff members to analyze and publish the results.

Barriers

HTML user projects address a wide range of technical and cost barriers through the use of advanced materials and advanced materials-based technologies

Partners

During FY2008, the HTML User Program managed 76 user projects from 53 different organizations. Organizations that participated in the HTML User Program are listed in the appendix.
The HTML also supports the education and preparation of a new generation of scientists and engineers. During FY2008, students and professors from 32 universities participated in the HTML User Program. Four of those students received their Ph.D. degree in FY2008 based in part on research performed through the HTML User Program

Performance Goals and Milestones

"By 2008, utilize HTML large specimen residual stress facilities (VULCAN beamline on the Spallation Neutron Source, the NRSF2 at High Flux Isotope Reactor, and/or the large specimen X-Ray Diffraction system) to perform a user project with an industrial partner to determine the origin of and techniques for minimizing residual stresses developed in an automotive engine or structural component made from a lightweight material such as Al, Ti, or Mg"	User projects with industrial partners (e.g., Metalsa, John Deere) were performed utilizing NRSF2 and the large XRD system to determine the origin of residual stresses in structural components

1. Launch commissioning of VULCAN 2. Study two experimental diesel NOx-reduction materials using a combination of HTML's ex-situ catalyst reactor for TEM specimens, and the imaging and spectroscopy of ACEM 3. Demonstrate utilization of SNS (VULCAN) for time-resolved in-situ characterization of hydriding-dehydriding of hydrogen storage materials 4. Correlate atomic-level structure of a hydrogen-storage material, determined by ACEM, with structural phenomena revealed using neutron beams, to elucidate storage mechanisms.	• Commissioning of Vulcan has been delayed due to programmatic and budget considerations (DOE's Office of Science). Commissioning date has been set for September 2009. • ACEM has been used to study NOx-reduction materials and materials for H_2 storage.

The HTML User Program - Approach

- Access to the HTML is provided through the HTML User Program proposal process. Research proposals are reviewed by a committee and approved based on scientific merit, relevance of the proposed research to the mission of DOE's Vehicle Technologies Program, and feasibility. Research is completed within 24 months and normally involves one or more user visits to the HTML.
- Both nonproprietary and proprietary research is conducted within the HTML User Program. There are generally no charges for nonproprietary research projects, and users conducting nonproprietary research must agree to submit research results for publication in the open, refereed literature. For proprietary research, the user owns the research data and all costs at the HTML are paid by the user based on DOE guidelines for ORNL costs. A nonproprietary project is complete when the results are published in the open literature and/or presented at a professional conference

Approach: Access to the HTML

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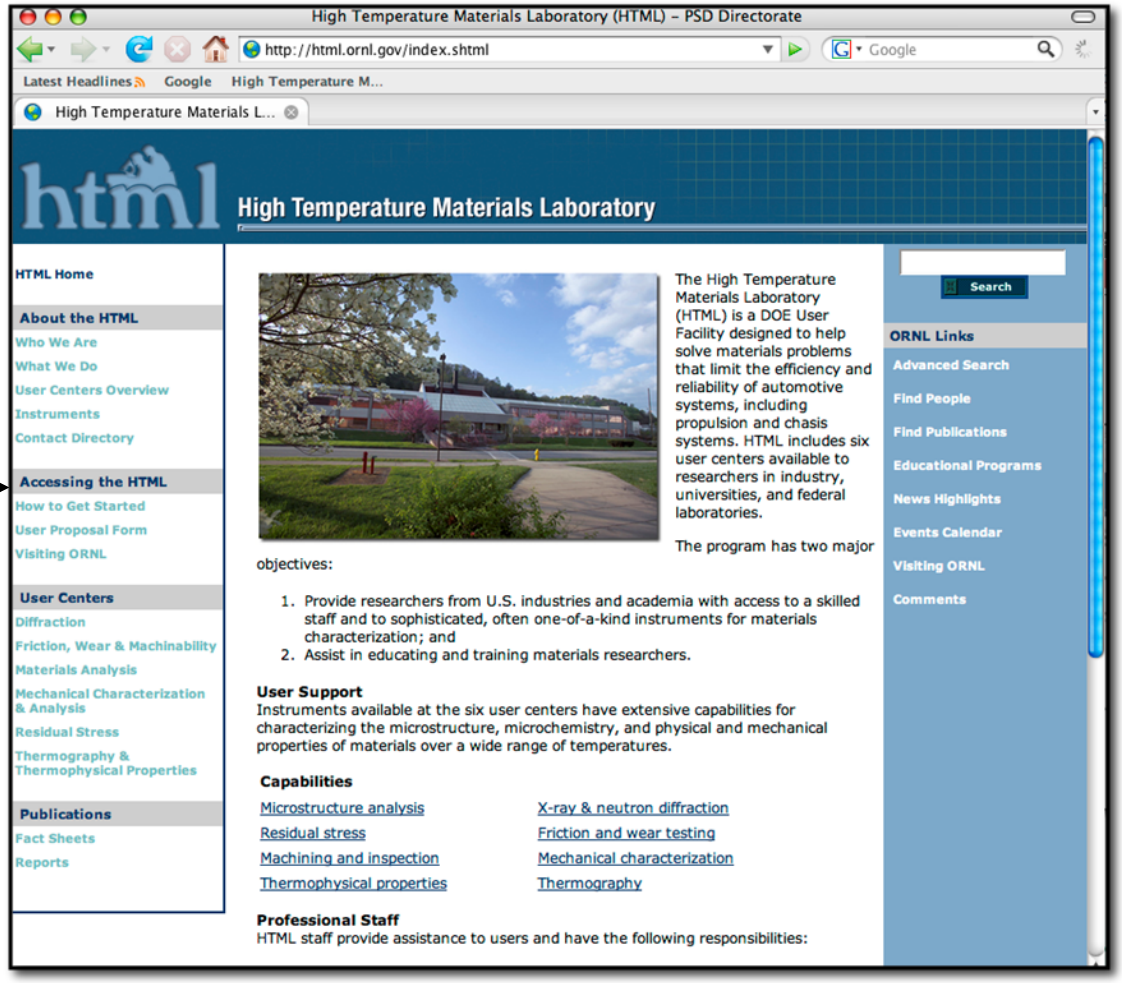
DIRECTIONS IN ENGINE-EFFICIENCY AND EMISSIONS RESEARCH CONFERENCE
U.S. DEPARTMENT OF ENERGY

SAE International

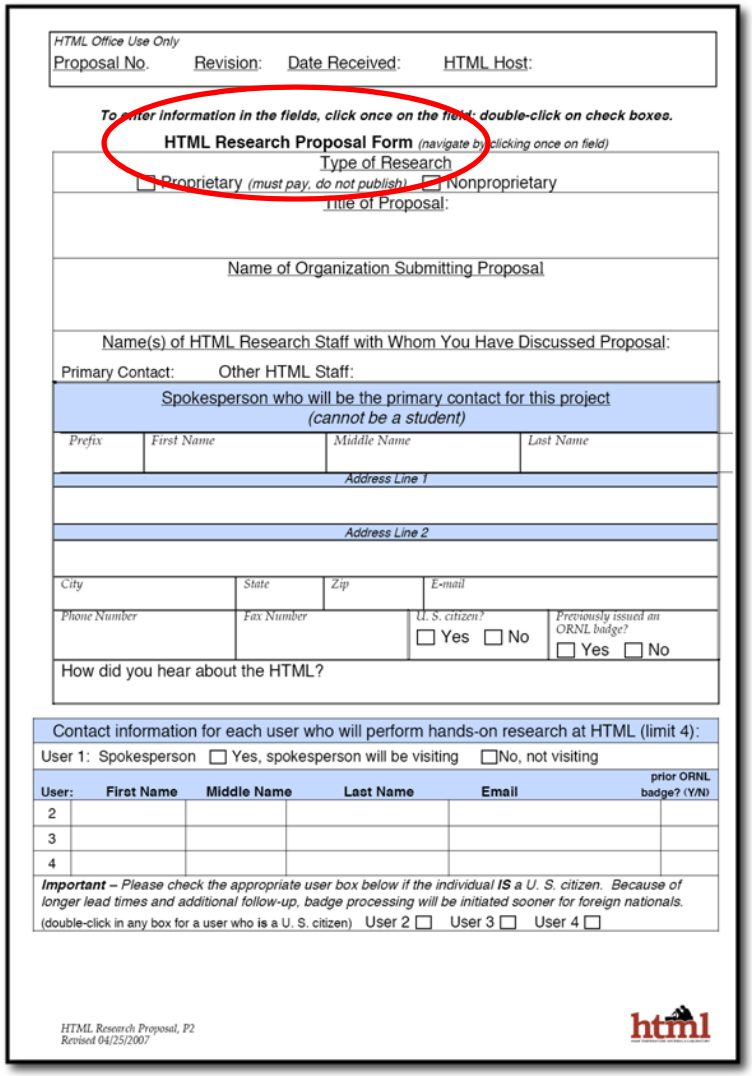
2009 U.S. Department of Energy Hydrogen Program and Vehicle Technologies Program
Annual Merit Review & Peer Evaluation Meeting
May 18-22, 2009 • Arlington, VA

Visits to VT partners



Project ID: lm_01_laracurzio

Approach: Access to the HTML



HTML Office Use Only
Proposal No. Revision: Date Received: HTML Host:

To enter information in the fields, click once on the field; double-click on check boxes.

HTML Research Proposal Form (navigate by clicking once on field)

Type of Research
☐ Proprietary (must pay, do not publish) ☐ Nonproprietary

Title of Proposal:

Name of Organization Submitting Proposal

Name(s) of HTML Research Staff with Whom You Have Discussed Proposal:

Primary Contact: Other HTML Staff:

Spokesperson who will be the primary contact for this project (cannot be a student)

Prefix	First Name	Middle Name	Last Name

Address Line 1

Address Line 2

City	State	Zip	E-mail

Phone Number	Fax Number	U. S. citizen?	Previously issued an ORNL badge?
		☐ Yes ☐ No	☐ Yes ☐ No

How did you hear about the HTML?

Contact information for each user who will perform hands-on research at HTML (limit 4):

User 1: Spokesperson ☐ Yes, spokesperson will be visiting ☐ No, not visiting

User:	First Name	Middle Name	Last Name	Email	prior ORNL badge? (Y/N)
2					
3					
4					

Important *– Please check the appropriate user box below if the individual **IS** a U. S. citizen. Because of longer lead times and additional follow-up, badge processing will be initiated sooner for foreign nationals.*

(double-click in any box for a user who is a U. S. citizen) User 2 ☐ User 3 ☐ User 4 ☐

HTML Research Proposal, P2
Revised 04/25/2007

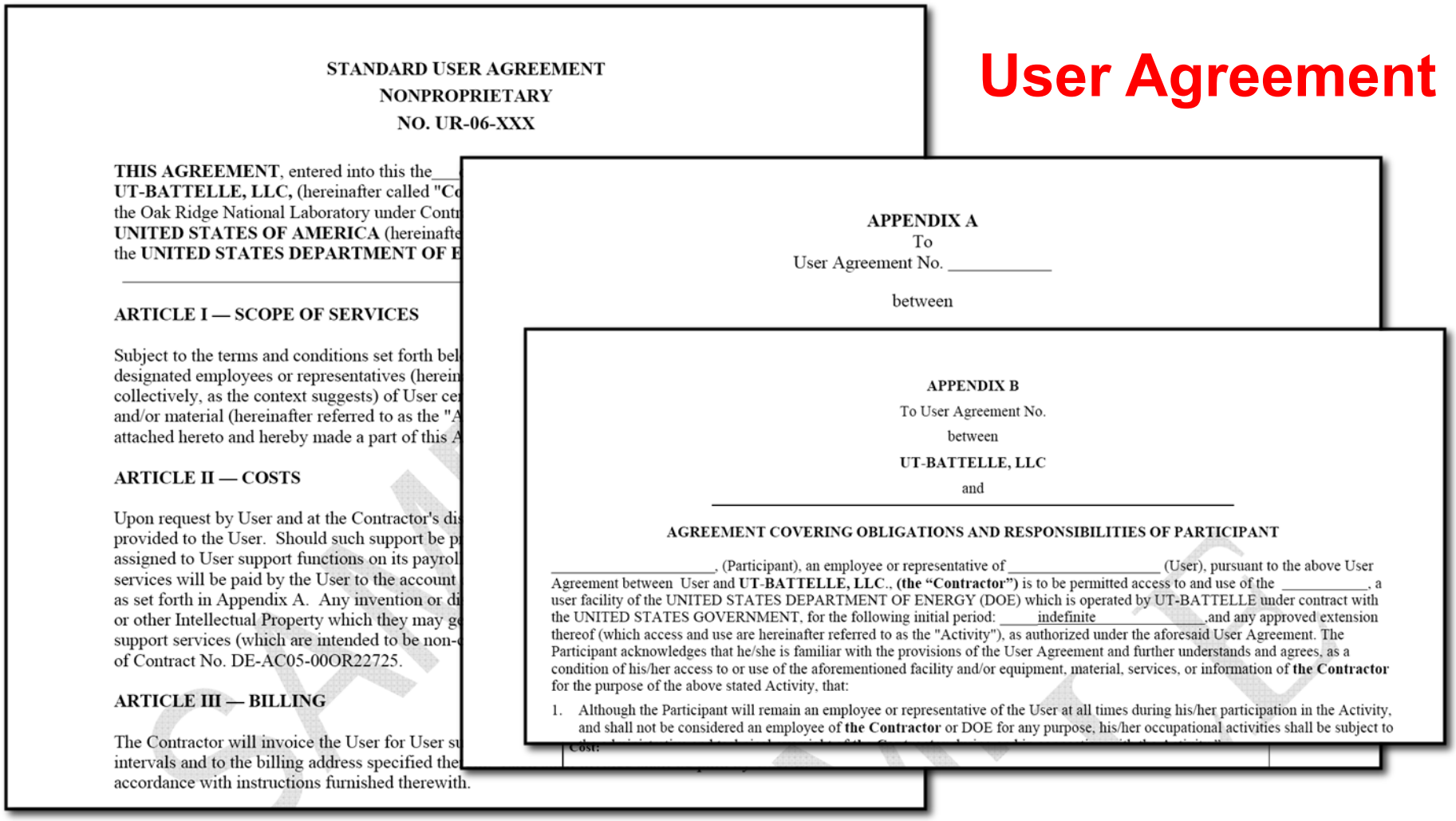
html

Proposals are approved based on:

- Relevance to the missions of VT, EERE and DOE
- Technical merit
- Non-competition with private industry
- Organization
- User agreement

Approach: Access to the HTML

User Agreement



STANDARD USER AGREEMENT
NONPROPRIETARY
NO. UR-06-XXX

THIS AGREEMENT, entered into this the___
UT-BATTELLE, LLC, (hereinafter called "Co
the Oak Ridge National Laboratory under Contr
UNITED STATES OF AMERICA (hereinafte
the **UNITED STATES DEPARTMENT OF E**

ARTICLE I — SCOPE OF SERVICES

Subject to the terms and conditions set forth bel
designated employees or representatives (herein
collectively, as the context suggests) of User ce
and/or material (hereinafter referred to as the "A
attached hereto and hereby made a part of this A

ARTICLE II — COSTS

Upon request by User and at the Contractor's dis
provided to the User. Should such support be p
assigned to User support functions on its payrol
services will be paid by the User to the account
as set forth in Appendix A. Any invention or di
or other Intellectual Property which they may g
support services (which are intended to be non-
of Contract No. DE-AC05-00OR22725.

ARTICLE III — BILLING

The Contractor will invoice the User for User su
intervals and to the billing address specified the
accordance with instructions furnished therewith.

APPENDIX A
To
User Agreement No. _____

between

APPENDIX B
To User Agreement No.
between
UT-BATTELLE, LLC
and

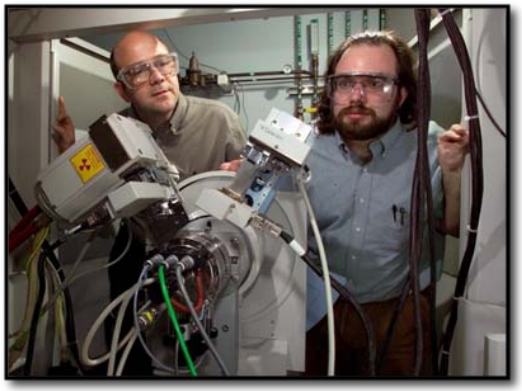
AGREEMENT COVERING OBLIGATIONS AND RESPONSIBILITIES OF PARTICIPANT

_____, (Participant), an employee or representative of _____ (User), pursuant to the above User Agreement between User and **UT-BATTELLE, LLC**., **(the "Contractor")** is to be permitted access to and use of the _____, a user facility of the UNITED STATES DEPARTMENT OF ENERGY (DOE) which is operated by UT-BATTELLE under contract with the UNITED STATES GOVERNMENT, for the following initial period: _____indefinite_____,and any approved extension thereof (which access and use are hereinafter referred to as the "Activity"), as authorized under the aforesaid User Agreement. The Participant acknowledges that he/she is familiar with the provisions of the User Agreement and further understands and agrees, as a condition of his/her access to or use of the aforementioned facility and/or equipment, material, services, or information of **the Contractor** for the purpose of the above stated Activity, that:

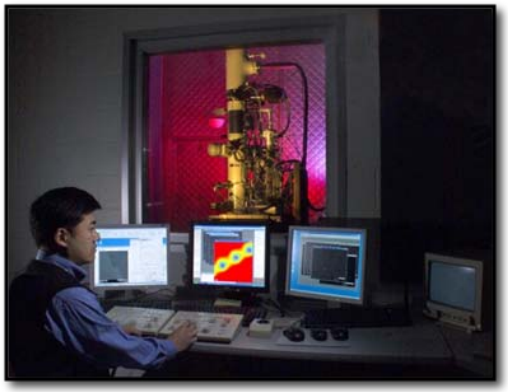
1. Although the Participant will remain an employee or representative of the User at all times during his/her participation in the Activity, and shall not be considered an employee of **the Contractor** or DOE for any purpose, his/her occupational activities shall be subject to

Approach

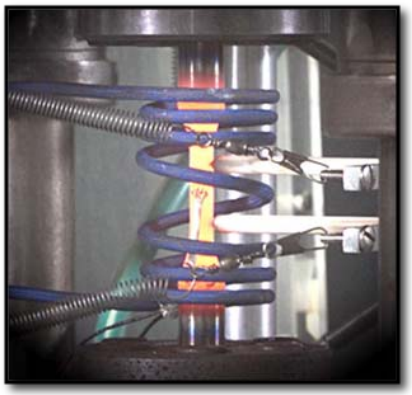
The HTML is organized into 6 User Centers



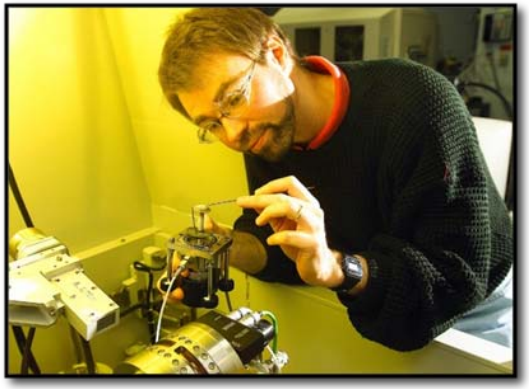
Diffraction



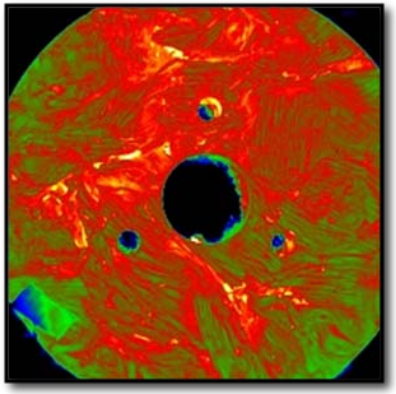
Materials Analysis



Mechanical Characterization



Residual Stresses



Thermography & Thermophysical Properties

Tribology Research

The HTML User Program - Accomplishments

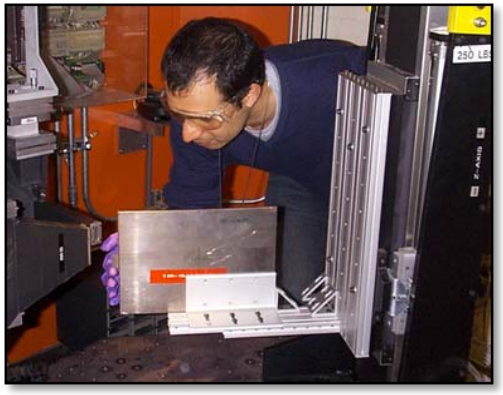
HTML User Program
FY2008 Annual Report

Metalsa characterizes residual stresses from hole-cutting process in truck frame rail sides

(Image courtesy of Metalsa)

Research problem: Metalsa is seeking to reduce the weight of structural components for heavy trucks. Specifically they want to correlate hole-cutting manufacturing processes and choice of steel for heavy trucks rail sides, with the magnitude of residual stress and fatigue life.

- Distribution of residual stress extends from the edge of the hole out to ~ 8 mm. Highest residual stress values are in the hoop direction for all hole-cutting processes.
- Residual stresses from plasma cutting are highest in HSLA steels, while laser cut stresses are higher in heat-treated materials.
- Thermal processes (plasma and laser) result in higher values of residual stress than drill or punch methods.
- The weight of frame rails can be reduced by as much as 200 lbs per truck. **This represents as much as 30,000,000 lbs of steel savings per year for Metalsa**.



Dr. Villlasana of Metalsa mounts a plate test specimen for through thickness strain mapping at NRSF2

John Deere studies residual stress distribution in welded structures

Research problem: To determine the impact of residual stresses on the fatigue life of welded structures.

Eric Johnson of John Deere positioning a welded "T" plate for neutron diffraction at NRSF2.

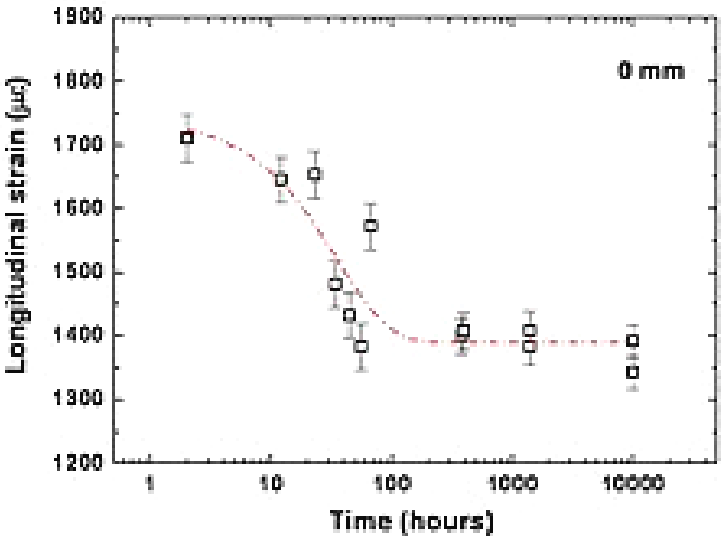
- Life prediction models currently available for welded structures neglect crack propagation.
- It is estimated that by taking into account crack propagation in life prediction models, it is possible to reduce the thickness (weight) of many components at least by 10%.

welded structures are used in scraper tractors
(Image courtesy of John Deere)

- Comparison of fatigue data and life prediction models incorporating residual stresses and crack propagation is in progress. The validation of such models will enable their use to design lighter and more durable welded structures and components for on- and off-highway vehicles.

Time-dependent residual stresses in friction stir welds of 6061-T6 alloy

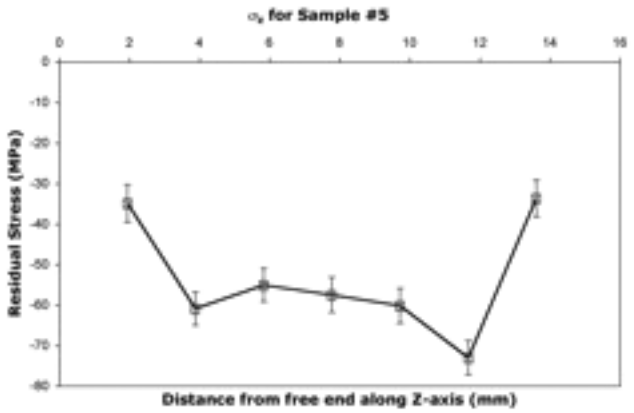
Research problem: To correlate residual stress changes with the evolution of long-term microstructure (e.g. precipitation) in friction stir welded aluminum alloys



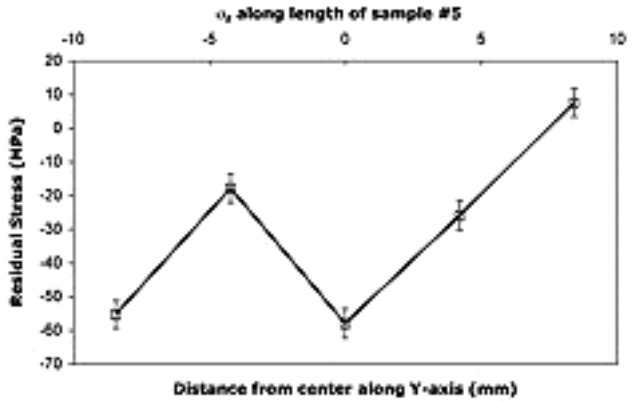
Change in longitudinal residual strain in center of stir zone

- Using neutron diffraction techniques, it was found that residual stresses following friction stir welding do not age after about 80 hours. This assures that friction stir welding can be used in vehicle assembly processes without concern for detrimental long-term aging and changes in mechanical and fatigue properties
- Controlling aging behavior and reduction of residual stresses due to friction stir welding (FSW) would accelerate the use of light-weight aluminum alloys in auto body structures and lead to greater energy savings.

Mississippi State Measures Residual Stresses in LENS-deposited SS410 thin wall plates



σ_z mapped perpendicular to the deposition direction from top edge of sample towards substrate.



σz mapped parallel to the deposition direction at mid height.

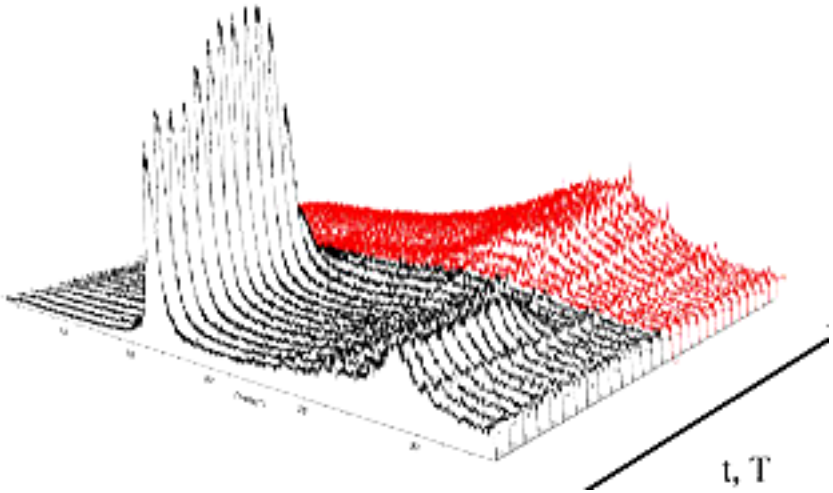
Research problem: Find strategies to minimize residual stresses in LENS components to achieve high ductility and strength

- Laser Engineered Net Shaping (LENS) is a rapid fabrication technique of fully dense steel components.
- Neutron residual stress mapping at ORNL's NRSF-2 was used to characterize the through thickness stresses in a series of SS410 thin walled plates and correlate residual stresses with laser power, laser speed, and powder flow rate.
- Increasingly compressive stress σ_z were found along the height of the deposit. Stresses parallel to the deposition direction were found to fluctuate randomly likely due to localized changes in laser power absorption and deposition temperature.
- By establishing correlations between laser power, laser speed and powder flow rate and the resulting state of residual stresses it will be possible to optimize the mechanical properties of LENS-made components

Project ID: lm_01_laracurzio

In situ monitoring of carbon fiber morphology during stabilization and carbonization

Research problem: To determine the range of conversion parameters where critical morphological changes occur during various steps of carbon fiber production using low-cost precursors



Morphological evolution determined by X-ray diffraction during heat treatment of as-spun PAN-based fibers under controlled thermal and environmental conditions

- Replacement of steel and aluminum body panels and chassis components with structurally equivalent carbon fiber-reinforced composites offers up to 68% weight reductions and 40% fuel savings.
- The effect of applied tensile stress during conversion on the morphological evolution of polymeric carbon precursors is being investigated.
- Results from this project will help identify the optimum carbon fiber processing space, and enable the commercialization of low-cost carbon fibers.

Evaluation of Recycled Carbon Fibers

Research problem: valuate strength retention of carbon fibers recovered from scrapped or recycled composite pieces

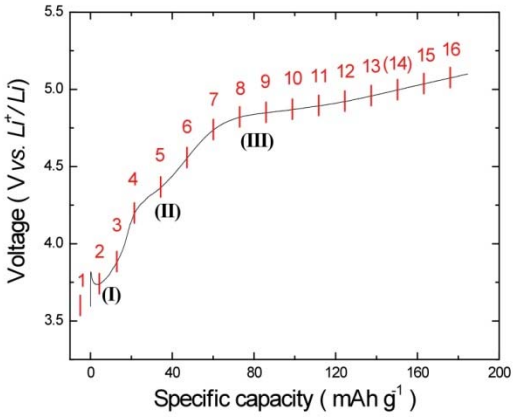
David Haack testing recycled single carbon fiber in tension

- Materials Innovation Technologies is developing processes to recover carbon fibers from scrapped and recycled composites.
- Materials Innovation Technologies estimates its process can recover and reprocess carbon fibers for less than 50% of the cost of virgin fibers.
- User activities at the HTML have been focused on the tensile evaluation of single fibers, according to ASTM test method C1557 and on the characterization of the fibers' surface and fracture surface using an environmental scanning electron microscope.
- Successful recovery of carbon fibers from rejected or recycled parts could help reduce the cost of carbon fibers.

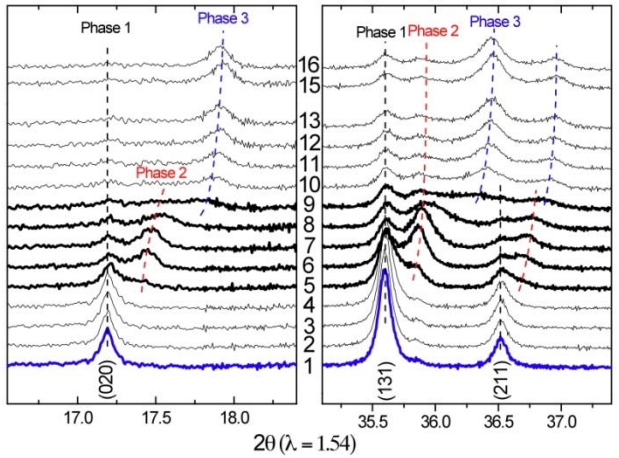
BNL studies electronic and crystal structure of cathodes for Li-ion batteries

Research problem: To investigate the changes in electronic and crystal structures for both uncoated and carbon coated $LiFe_{1/4}Mn_{1/4}Co_{1/4}Ni_{1/4}PO_4$ cathode materials during charge-discharge cycling

- Upon charging (i.e., Li deintercalation), the reflections of the new intermediate phase 2 appeared at slightly higher 2θ; then the structure transformed to the final phase 3 of the fully delithiated compound.
- While the position of reflections from phase 1 does not change noticeably, the reflections from phase 2 and 3 are clearly moving toward higher angles, indicating a solid solution region.



First charge curve of carbon-coated $LiFe_{1/4}Mn_{1/4}Co_{1/4}Ni_{1/4}PO_4$

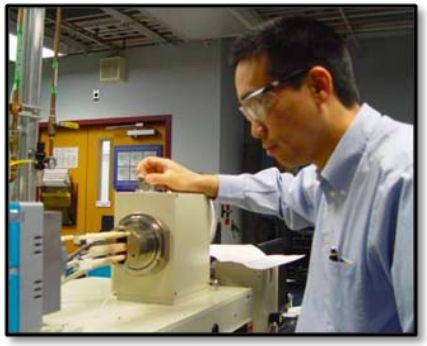


In situ synchrotron x-ray diffraction (XRD) patterns of the carbon coated $LiFe_{1/4}Mn_{1/4}Co_{1/4}Ni_{1/4}PO_4$ for the 2θ angle range which included the (020), (131), and (211) reflections. The numbers marked beside the patterns correspond to the scan numbers marked on the charge curve

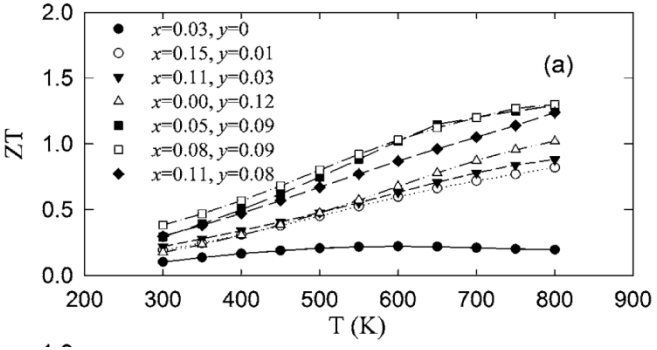
- Detailed structure analysis about these phase transitions is in progress. Temperature-dependent XRD studies will also be conducted at different charge states.
- This EERE-funded work at BNL will enable the development of safer lithium-ion batteries for EVs and PHEVs.

Project ID: lm_01_laracurzio

GM characterizes filled skutterudite materials for waste heat recovery applications



GM's Dr. Jihui Yang using ORNL's ULVAC system



ZT of double-filled n-type skutterudites ($Ba_xYb_yCo_4Sb_{12}$), showing improved properties over single-filled structures

Research problem: To determine the thermophysical and transport properties of filled skutterudites as a function of temperature. Assess the effect of double- and triple-filling on properties

- Double-filling leads to a significant reduction in thermal conductivity without deterioration of power factor
- Values of thermophysical properties obtained at the HTML for thermoelectric materials synthesized by General Motors are comparable to values obtained by the University of Michigan for the same materials.
- Will utilize HTML's aberration-corrected electron microscope (ACEM)) to image with sub-Angstrom resolution the crystal structure of skutterudites.
- The transport properties obtained through this user project have helped the GM team to select materials for waste heat power generators

Project ID: lm_01_laracurzio

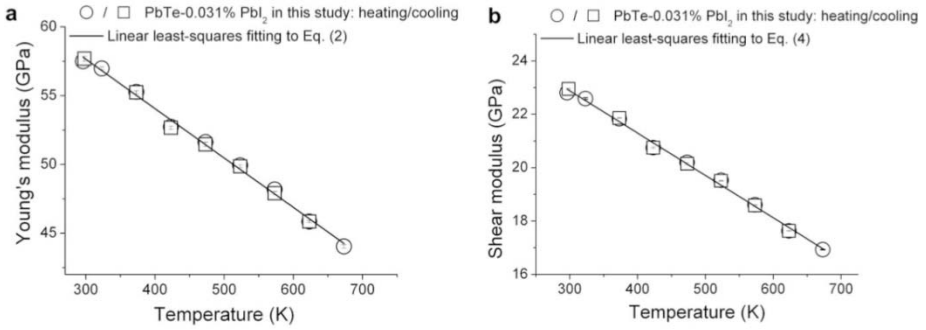
MICHIGAN STATE UNIVERSITY

Effect of thermal cycling on the mechanical properties of LAST and LAST-T thermoelectrics

Research problem: To characterize the physical and mechanical properties of lead-antimony-silver-tellurium (LAST) and lead-antimony-silver-tellurium-tin (LAST-T) thermoelectric materials. To assess the effect of thermal cycling on those properties.

Graduate student Jennifer Ni uses the infrared (IR) set-up to thermal cycle thermoelectric materials.

- Resonant Ultrasound Spectroscopy was used to determine the elastic constants of LAST materials as a function of temperature. Measurements were performed
- The results of this investigation will provide valuable design information to minimize thermal stresses and enable the development of durable and reliable thermoelectric generators to produce electricity from waste heat.



Temperature dependence of Young's and Shear Modulus for PbTe thermoelectric materials

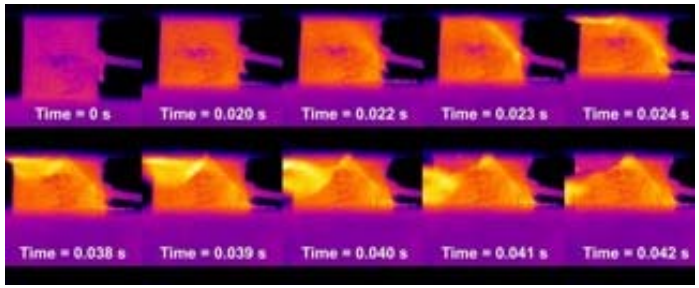
Project ID: lm_01_laracurzio

OAK RIDGE National Laboratory

Mississippi State measures temperature increase during deformation of magnesium alloys

Research problem: To develop models of the plastic behavior of a wrought magnesium alloy by understanding the thermodynamics of the deformation processes

Matt Tucker adjusts high-speed infrared camera

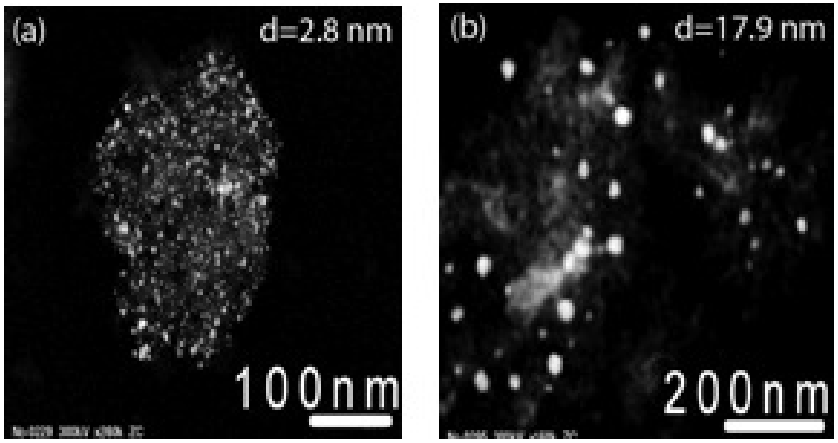


Infrared image of test specimen during loading in compression

- Accurate models for dynamic events (e.g., manufacturing processes and crashing events) are needed for magnesium.
- Modeling of magnesium alloys is difficult because of their highly anisotropic behavior.
- The effect of loading rate on the compressive behavior of AZ31B (in rolling and normal directions) was investigated. Twinning was found to be the dominant deformation mechanism in the rolling direction; slip was the dominant deformation mechanism in the normal direction.
- Heat generation was anisotropic and localized temperature increase was observed at the onset of failure resulting from shear concentration.

NTRC and UT-K investigate the effect of aging on fully-formulated NOx trap catalysts

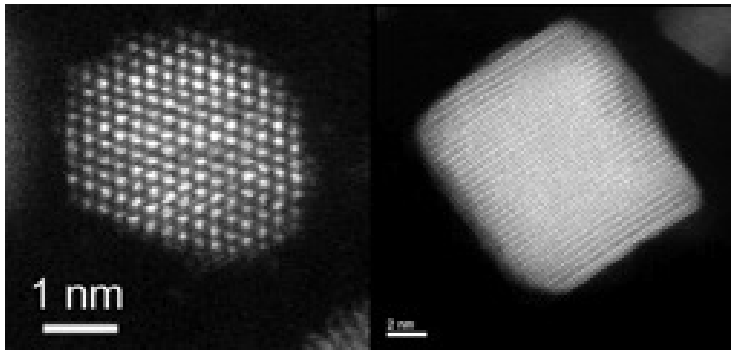
Research problem: To analyze the size and structural change in lean NOx trap catalysts after aging at elevated temperatures



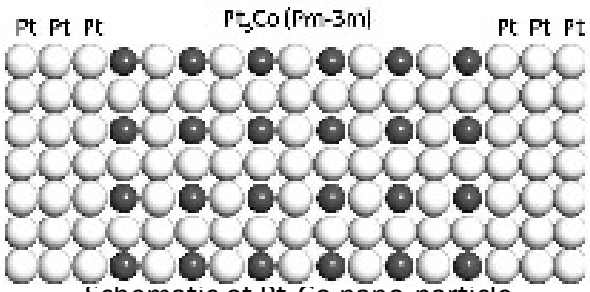
Z-contrast STEM images of (a) fresh and (b) aged LNTs show sintering of Pt particles with aging

- Study of thermal deactivation mechanisms in lean NOx trap (LNT) catalysts when aged by lean/rich cycling in simulated diesel exhaust gases at 700, 800, 900, and 1000°C
- Platinum sintering increases with increasing aging temperature and number of aging cycles. Particle growth is already significant at an aging temperature of only 700°C. The average size of Pt increases from 2.8 nm to 17.9 nm after aging at 700°C.
- The reduction in NOx conversion after aging at temperatures >900°C appears to be primarily a result of surface area loss, with Pt sintering and loss of active storage sites also contributing.

Surface segregation and ordering in Pt-Co fuel cell catalyst nanoparticles



(left) Dark-field ACEM image of Pt_3Co acid- leached nanoparticle; (right) Dark-field ACEM image of Pt_3Co nanoparticle following heat treatment at 1000K.

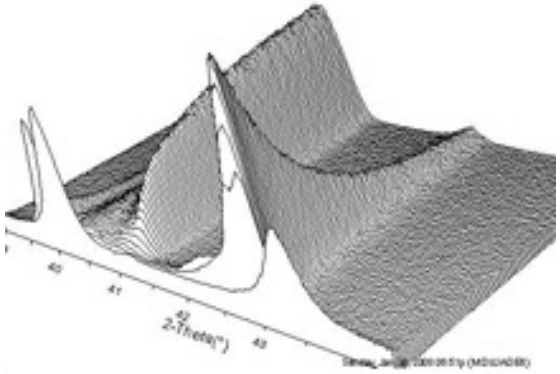


Schematic of Pt_3Co nano-particle after annealing at 1000K.

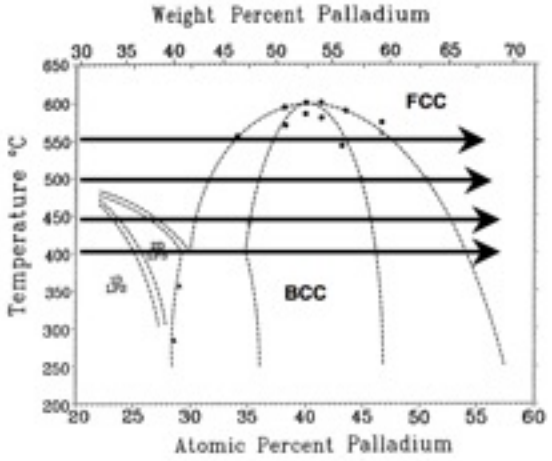
Research problem: To characterize the microstructure and thermal stability of Pt-Co nanoparticles used in fuel cell catalyst applications

- Pt-based alloys such as Pt_3Co are promising candidates as catalysts for fuel cells because they exhibit higher catalytic activity than pure Pt and reduce the use of expensive Pt
- Using ORNL's ACEM Pt_3Co nanoparticles were characterized after acid leaching and heat treatments in vacuum at 1000K
- This is the first time that Pt segregation has been observed to occur on the surface of Pt_3Co nanoparticles of ~5nm upon annealing at 1000K
- Understanding the origins of enhanced surface activity of Pt_3Co nanoparticles vs. pure Pt may lead to further improvements in affordable fuel cell catalysts

Formation of Palladium-copper alloys for H_2 separation studied by in situ x-ray diffraction



X-ray scans of Cu-Pd bilayer film as a function of time and temperature



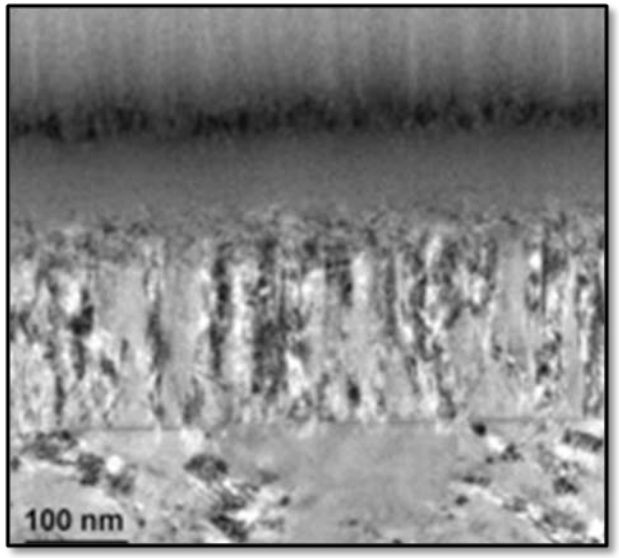
The Cu-Pd phase diagram indicating the progression from a Cu-rich surface layer to a fully evolved 60%Pd-40%Cu alloy.

Research problem: To better understand the formation of palladium-copper alloys, which have been proposed as a more sulfur-tolerant alloy for hydrogen separation from syngas

- This project focused on understanding the conversion from a Cu-plated Pd film to the fully reacted Pd-Cu alloy film
- The unique *in situ* high-temperature XRD instruments at the HTML enabled quantitative analysis of time-resolved data collected as Cu + Pd precursor films reacted at high temperature to form the hydrogen separation membrane alloy.
- By understanding the kinetics of formation of Pd-Cu alloys it will be possible to optimize the design of membranes for hydrogen separation, which are essential to the success of the proposed “hydrogen economy”.

Timken investigates rolling contact fatigue wear modes for nanocomposite tribological thin films

Research problem: To improve the performance of wear-resistant coating based upon a clear understanding of its microstructure

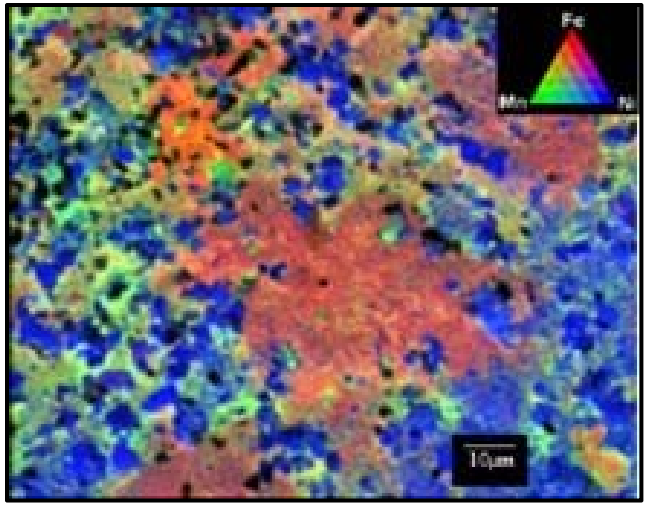


A micrograph of multilayered WC/a-C:H coating on steel.

- Coating samples were fabricated using a plasma discharge vapor deposition process at either Timken's Technology Center or a scaled-up production facility.
- A TEM analysis revealed that the microstructure and architecture of coatings synthesized according to the scaled-up processes were similar to those synthesized in the laboratory.
- Coatings were found to have excellent adhesion to the substrate under high contact stresses.
- The durability of mechanical component tribological surfaces can be improved by reducing friction and improving wear resistance

Capstone characterizes microturbine hot section components

Research problem: Determine the detrimental effect of microturbine operating conditions on the HR-120 alloy recuperator core and stainless steel components



Elemental mapping of HR-120 alloy recuperator core sample showing mixed oxides of Fe, Mn, and Ni.

- Capstone has tested HR-120 alloy samples from a microturbine operating at ~100°F above the specified Turbine Exit Temperature (TET). Samples are removed from the engine approximately every 1,500 hours for characterization at the HTML.
- Specimens that had accumulated ~17,500 hours of exposure and were examined using electron microprobe elemental mapping. It revealed the presence of mixed oxides of Fe, Mn, and Ni
- The availability of durable microturbine components will enable their widespread use in transportation applications. ECOSaver IV hybrid buses equipped with Capstone turbines exhibit up to a 100% improvement in fuel economy over a traditional diesel bus, which equates to annual fuel savings of up to 6,000 gallons per vehicle

Project ID: lm_01_laracurzio

User Project with GEO2 Technologies

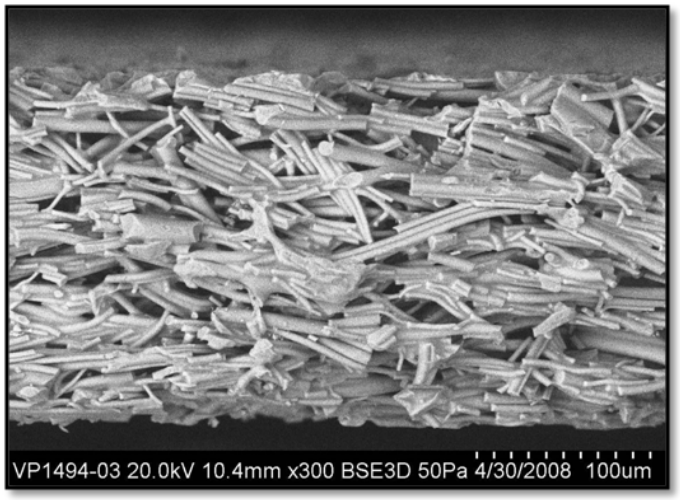
Research problem: To understand the relationship between the microstructure and mechanical and thermal properties of fibrous diesel particulate filter materials (SiC, mullite).

Approach: Utilized techniques developed at the HTML to prepare test specimens of porous materials and determine their fracture toughness and thermal conductivity. Utilized scanning electron microscopy to characterize the microstructure of these materials.

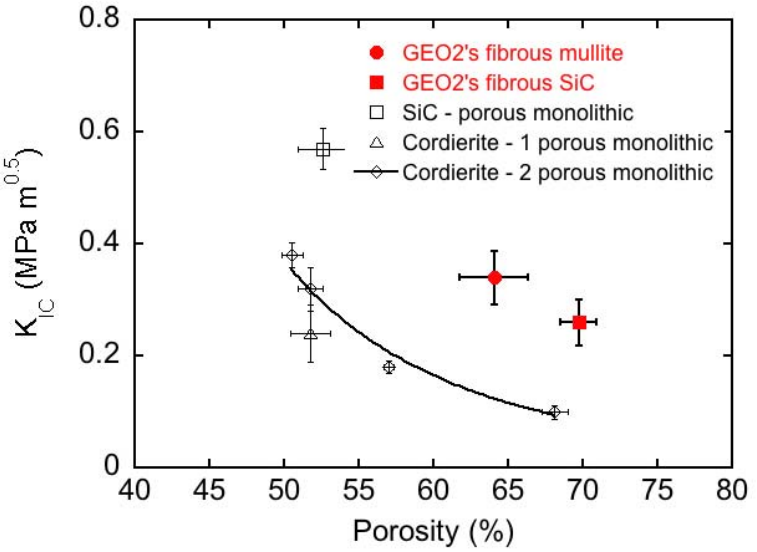
Implications: The development of tough, cost-effective diesel particulate filters with lower pressure drop for higher engine efficiency.

Tim Gordon of GEO2 Technologies sets up a fracture mechanics test at the HTML.

User Project with GEO2 Technologies
Accomplishments



The unique fibrous Cross-Linked Microstructure (CLM™) of the GEO2 substrate is evident on the fracture surface of a mullite test specimen.



A comparison of the fracture toughness of GEO2's fibrous materials and commercially available porous monolithic ceramic DPF substrates.

GEO2 fibrous substrates exhibit high fracture toughness even at high levels of porosity.

User Project with the University of Utah

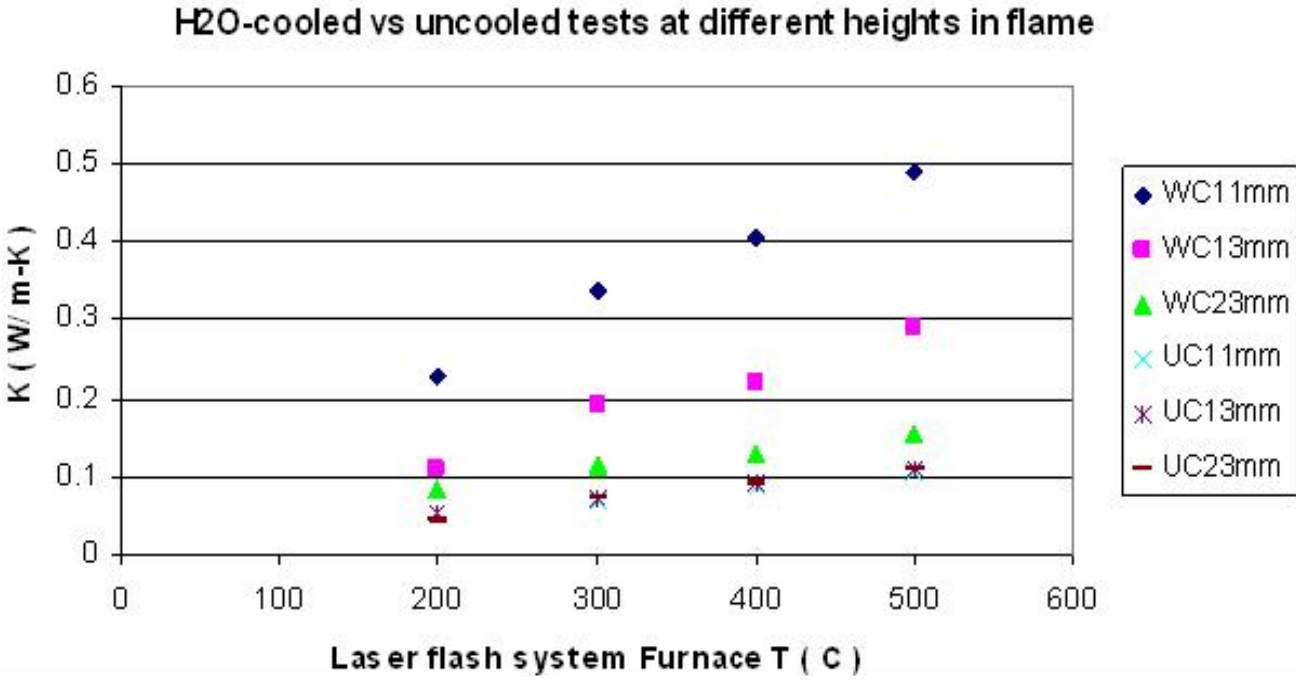
Research problem: To characterize the thermophysical properties of soot deposits from various fuels (e.g., diesel, JP-8).

Approach: Used laser flash thermal diffusivity and differential scanning calorimetry to determine the thermal diffusivity and specific heat of soot deposits as a function of deposition temperature.

Implications: The experimental results will support the development of models to understand the effect of deposits in combustion engines.

University of Utah graduate student Ignacio Preciado adjusts settings for a calorimetry test.

User Project with University of Utah
Accomplishments



Thermal conductivity for water-cooled (WC) and uncooled (UC) tests at different heights in the flame.

THE UNIVERSITY OF UTAH

The thermophysical properties of soot deposits were determined as a function of deposition temperature.

Project ID: lm_01_laracurzio

Future Work

Continue working with industry and universities to support the mission and goals of the Vehicle Technologies Program

Milestones for FY09

Milestone. Complete the installation of new state-of-the-art laser flash thermal diffusivity apparatus and differential scanning calorimeter to determine the physical properties of materials. — On Track

Milestone. Complete three user projects dealing with characterization of materials for Li-ion batteries. — On Track

Milestone. Develop capabilities to perform in situ microstructural observations of materials for energy (e.g.- thermoelectrics, Li-ion batteries) using electrons, X-rays and neutrons . — On Track

Summary

- The HTML is a National User Facility that supports the missions of DOE, EERE and the Vehicle Technologies Program in particular, by working with industry, universities and other national laboratories to develop energy efficient technologies that will enable the U.S. to use less petroleum. The HTML User Program contributes to the achievement of all the goals of the materials Technologies subprogram by providing expert materials characterization and analysis equipment, expertise, and services.
- During FY2008 the HTML User Program managed 76 user projects with 53 different organizations (industry, universities, national laboratories). The projects addressed a wide range of materials technologies including materials for lithium-ion batteries, thermoelectric materials, catalysts, lightweight and structural materials, diesel particulate filters, materials for H_2 separation, H_2 production and fuel cells, materials for thermal management, materials for propulsion and power generation, functional materials and wear and tribology.
- The HTML User Program and the capabilities at the HTML (highly skilled staff and sophisticated, often one-of-a-kind instruments for materials characterization) are a tremendous National asset. The HTML User Program aspires to be an integral part of the success of the Vehicle Technologies Program.