the ENERGY lab

R&D FACTS

Materials Science and Engineering

Materials Science and Engineering Onsite Research

As the lead laboratory for the Department of Energy Office of Fossil Energy (DOE-FE) research and development (R&D) program, the National Energy Technology Laboratory (NETL) has established a strong onsite research program conducted by Federal scientists and engineers who work closely with employees of contractor organizations and researchers from universities. Onsite R&D—managed by NETL's Office of Research and Development (ORD)—makes important contributions to NETL's mission of implementing a research, development, and demonstration program to resolve the environmental, supply, and reliability constraints of producing and using fossil resources.

NETL-ORD researchers perform on-site R&D in support of NETL's technology lines and external government and industry customers. In addition, NETL's on-site research pursues knowledge, science, and technology with broad societal and industrial interest. NETL onsite R&D assists industrial and academic partners in solving problems that would otherwise become barriers to commercializing power systems, fuels, and environmental and waste management technologies. NETL uses a variety of partnership mechanisms to conduct R&D of mutual interest with academic and private-sector organizations.

NETL-ORD provides the DOE-FE program an onsite "corporate laboratory" at NETL. The onsite R&D efforts utilize state-of-the-art capabilities and facilities in Morgantown, West Virginia; Pittsburgh, Pennsylvania; and Albany, Oregon. About one-fourth of NETL's approximately 1,100 Federal and contractor employees are involved with onsite research activity. NETL is DOE's only government-owned, government-operated national laboratory; the onsite research program has a core group of about 150 Federal scientists and engineers. Supplemental site support comes from contractors who are selected through a competitive process, as well as research fellows and associates at the faculty, postdoctoral, graduate, and undergraduate levels.

Onsite research is conducted in four primary focus areas: Computational and Basic Sciences, Energy System Dynamics, Geological and Environmental Sciences, and Materials Science and Engineering.

CONTACTS

OFFICE OF RESEARCH AND DEVELOPMENT

Science & Engineering To Power Our Future

Cynthia Powell
Director
Office of Research and Development
412-386-7386
304-285-4536
541-967-5803
cynthia.powell@netl.doe.gov

David Alman
Acting Focus Area Lead
Materials Science and Engineering
Division Director
Structural Materials Development Division
541-967-5885
david.alman@netl.doe.gov

Mary Anne Alvin
Division Director
Functional Materials Development Division
412-386-5498
maryanne.alvin@netl.doe.gov

John Baltrus
Acting Division Director
Molecular Science Division
412-386-4570
john.baltrus@netl.doe.gov

Paul Turner
Division Director
Materials Characterization Division
541-967-5944
paul.turner@netl.doe.gov

NATIONAL ENERGY TECHNOLOGY LABORATORY

Albany, OR • Anchorage, AK • Morgantown, WV • Pittsburgh, PA • Sugar Land, TX

Website: www.netl.doe.gov

Customer Service: 1-800-553-7681

U.S. DEPARTMENT OF ENERGY

Materials Science and Engineering Focus Area

The Materials Science and Engineering Focus Area specializes in the design, development, and deployment of advanced materials for use in the extreme service environments. NETL accelerates the development of enabling material solutions through an integrated R&D approach leveraging multi-scale, multi-discipline computational and experimental techniques. These techniques encompass the materials development continuum ranging from atomic-level design through pilot-scale evaluation. NETL compliments this approach with advanced tools, unique facilities, and **broad expertise across a variety of materials classes, including alloys, polymers, polymer-composites, and ceramics** for diverse applications found in advanced energy systems.

Focus Area Research

Functional Materials are being developed for a wide range of advanced technologies including carbon capture, chemical looping, solid oxide fuel cell, and polygeneration (fuel processing). Researchers specialize in the design, fabrication, characterization, and testing of:

- Polymers, polymer composites, ionic liquids, and functional alloys for gas separation applications
- Electro-ceramics and glasses for electronic, magnetic, and sensors applications
- Nano-engineered materials for catalysis

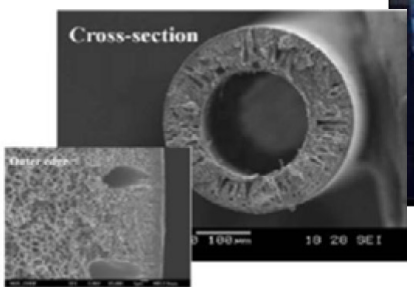
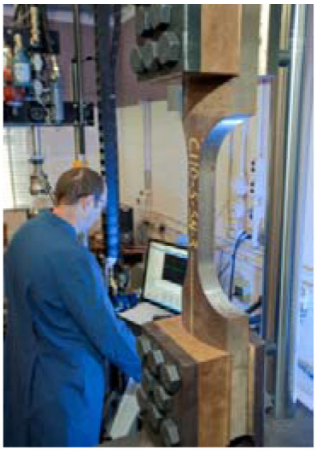
Research laboratories are available for:

- Production and characterization of solvents, solid sorbents, and membrane (mixed matrix, hollow fiber, and supported liquid) structures
- Separation materials evaluation in simulated flue/fuel gas conditions. Continuously stirred tank reactors for liquid solvents, fixed fluidize bed reactors for solid sorbents, isochoric and isobaric permeance testing for membranes
- Synthesis of metal, semi-conductor and oxide nanoparticles, nano-composites, and thin-films
- Solid-oxide-fuel cell performance evaluation under simulated coal derived fuel conditions
- NETL's Fuel Processing Laboratory for catalysts performance evaluation
- Sensor materials performance evaluation under simulated subsurface and power generation conditions

Structural Materials are being developed for use in extreme environments for combustion, turbine, gasification, drilling, and other applications. Researchers specialize in the design, fabrication, characterization, and testing of:

- Heat resistant stainless steels and nickel superalloys
- Corrosion and wear resistant alloys
- Refractory ceramics for environmental protection

Research facilities include:

- NETL's Severe Environment Corrosion Erosion Research Facility (SECERF) and related laboratories for assessing materials performance in simulated fossil fuel environments at high-temperature and high pressure
- Capabilities for fatigue and creep testing
- Laboratories for small-scale production and evaluation of refractory ceramic materials
- Facilities for melting, casting, forging, rolling, and heat-treating materials from a few grams to 100 kilograms

Materials Characterization: A full spectrum of analytical techniques are available onsite for determining chemical composition, microstructure, and surface analysis, including: optical microscopy, Scanning Electron Microscopy (SEM) (including an environmental SEM), Transmission Electron Microscopy (TEM), X-ray diffraction (XRD), Wavelength Dispersive X-ray Fluorescence (WDXRF), Inductively Coupled Plasma (ICP), Laser Ablation Mass Spectroscopy (LA-MS), Fourier Transform Infrared Spectroscopy (FTIR), Raman Scanning Tunneling Microscopy (STM), Atomic Force Microscopy (AFM), Scanning Tunnel Spectroscopy (STS), X-ray Photoelectron Spectroscopy (XPS) (with reaction chamber), Brunauer-Emmett-Teller (BET), Thermogravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC), Laser Flash Diffusivity (LFA), Dilatometry, and Computed Tomography (CT) Scanning.