R & D facts

U.S. Department of Energy
Office of Fossil Energy
National Energy Technology Laboratory

Materials Science

08/2008

NETL's Onsite Research

As the lead field center for the DOE Office of Fossil Energy's research and development program, the National Energy Technology Laboratory 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 – 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.

Researchers in NETL's Office of Research and Development perform onsite R&D in support of NETL's technology lines and for external government and industry customers. In addition, NETL's onsite research pursues knowledge, science, and technology with broad societal and industrial interest. NETL onsite R&D helps industrial and academic partners solve 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. The Office of Research and Development provides DOE's Fossil Energy 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 Systems, and Materials Science.

Materials Science Focus Area

The Materials Science Focus Area specializes in life cycle research starting with the formulation, characterization, and melting of most metals, alloys, and ceramics; casting and fabrication, prototype development; and the recycling and remediation of waste streams associated with these processes.

Focus Area Research

Materials Performance research runs the gamut from defining and understanding the basic mechanisms of wear and corrosion, and the synergy between them; to providing input on materials performance and specifications for specific operating environments; to developing methodologies for real-time materials performance monitoring in the field. Researchers work closely with industry, academia, and government agencies to ensure that the research is relevant and effective in addressing materials performance needs that can assure current- and next-generation energy reliability.

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Researchers specialize in the understanding and assessment of materials performance issues, including:

- Materials Selection and Specifications for High-Temperature, Erosive and Corrosive Environments
- Real-Time Materials Performance Monitoring
- Corrosion and Wear Mechanisms
- Lifetime Predictions

Process Development research targets the development of processes to:

- Model, formulate, and produce high temperature alloys for use in high temperature environments;
- Efficiently produce prototype parts, castings, and/or plate or sheet from ferrous, non-ferrous, and refractory alloys;
- Recover or recycle valuable materials from wastes;
- Improve material production by melting or smelting;
- Sequester greenhouse gas emissions; and
- Improve efficiencies of high temperature melting or smelting systems.

Research facilities include the Severe Environment Corrosion Erosion Research Facility (SECERF) for assessing materials performance in a variety of simulated high-temperature environments typical of fossil energy systems; a complete laboratory for the small-scale production and characterization of refractory ceramic materials; a range of tests simulating erosive and abrasive wear, as well as impact damage; a variety of laboratory and field tests for aqueous corrosion; and an analytical physics laboratory for assessing microstructural response to severe environments.

Facilities allow researchers to melt, alloy, cast, forge, roll, and heat treat materials from a few grams up to 100s of kilograms. A complete feed preparation facility capable of crushing, grinding, sizing, mixing, and agglomerating feed in batches from a few kg up to 1,000s of kg is available. For melting and smelting experimentation, a state-of-the-art facility allows for laboratory scale (a few kg) up to pilot scale (500 to 1,000 kg per hour of product) experimental trials that can be designed to last from a few seconds to more than 100 hours of continuous operation.

The extremely creative, versatile, and multi-disciplined staff includes materials engineers, metallurgists, ceramists, chemists, chemical engineers, and mechanical engineers.