FUNCTIONAL MATERIALS TEAM

The Department of Energy's (DOE) National Energy Technology Laboratory's (NETL) Materials Engineering and Manufacturing (MEM) Core Competency Directorate is internationally recognized for its expertise in designing, developing, and deploying advanced structural materials and tailored functional materials for use in energy applications and extreme service environments. The MEM Directorate is organized into three teams that collectively maintain NETL's applied materials science and engineering competency: 1) Structural Materials Team, 2) Functional Materials Team, and 3) Materials Characterization Team.

NETL

NATIONAL ENERGY TECHNOLOGY LABORATORY

FUNCTIONAL MATERIALS TEAM

The Functional Materials Team (FMT) seeks to design, develop, and deploy advanced materials needed to enable efficient and sustainable carbon management surrounding modern energy platforms. These efforts focus on the design, synthesis, physical characterization, and performance testing of nanomaterials, polymers, porous sorbents, ionic liquids, catalysts, membranes, and electro-ceramics required for the next generation of carbon capture, gas separation, hydrogen production, carbon dioxide conversion, chemical looping, solid oxide fuel cells, chemical sensing, fuel processing, and carbon materials technologies. The Functional Materials Team is supported by a full complement of chemical synthesis laboratories; vapor-phase deposition equipment for materials growth; crystallographic and electronic structure characterization tools; surface science, imaging, and analysis instrumentation; mineral processing and separation laboratories; membrane manufacturing and testing facilities; and sensor manufacturing and testing facilities.

FUNCTIONAL MATERIALS TEAM

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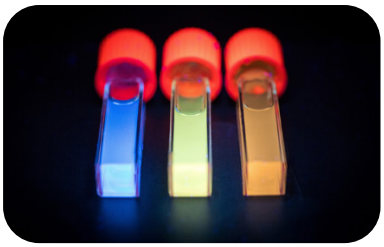
CAPABILITIES

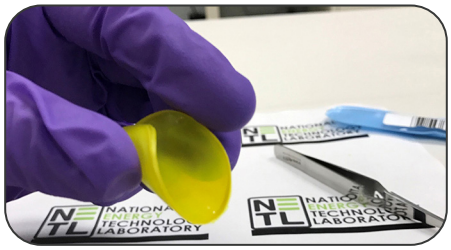
The FMT provides expertise in the design, synthesis, characterization, and performance testing of carbon materials, catalysts, nanomaterials, polymers, solvents, sorbents, membranes, single-crystal optical fibers, functional sensor materials, and electro-ceramics. These materials enhance the performance and reduce the costs of:

- **Mineral, coal, and natural gas processing**
- **Combustion and gasification processes for generating power and heat**
- **Solid oxide fuel cells (SOFC) for generating electricity**
- **Separation/purification technologies for water, power plant, and mineral processing applications**
- **Magnetic alloys for power converters and the electrical grid**

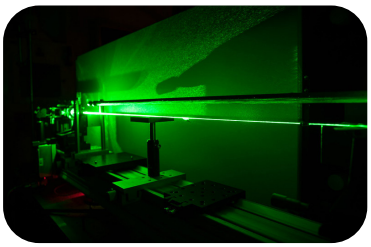
ON-SITE RESEARCH



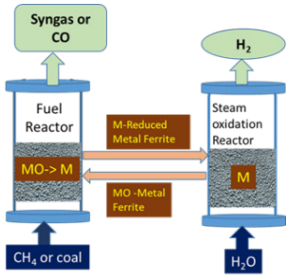
High value carbon products from coal and natural gas feedstocks for converting into high value carbon materials, characterizing performance and costs, and integrating into innovative products.



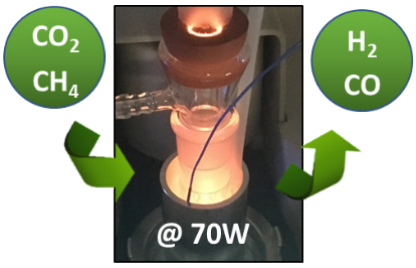
Membranes, sorbents, and solvent materials development for gas- and liquid-solid separation for applications such as pre- and post-combustion CO_2 capture, rare earth elements from coal and coal by-products, and water purification.



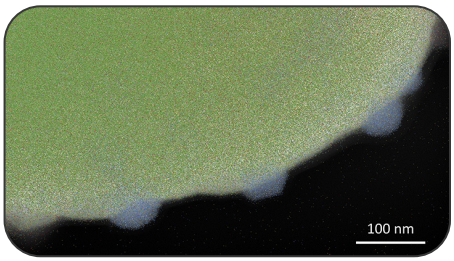
Harsh environment sensors for providing customized state of the art sensor solutions to customers in the fossil energy, nuclear, and industrial sectors.



Materials with long term chemical and mechanical stability for catalytic and non-catalytic processes for economically converting natural gas or coal to hydrogen and high-value carbon materials to achieve a commercially viable process.



New CO_2 utilization technologies for converting carbon dioxide into industrially relevant chemicals and fuels and producing carbon-neutral products.



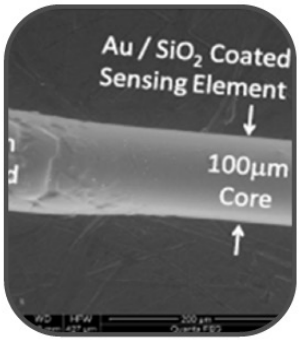
Rational catalyst design, synthesis, and testing allows selective chemical reactions resulting in improved energy efficiency and reduced precious metal requirements.

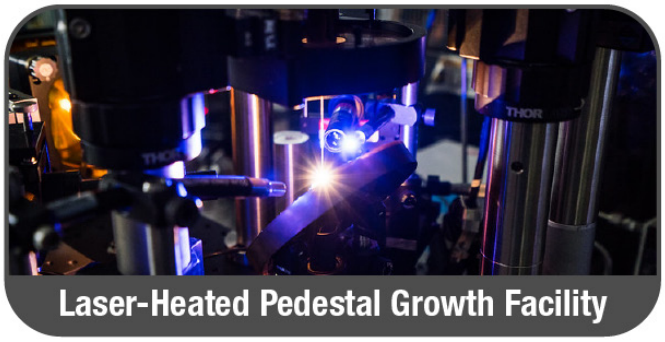
ON-SITE FACILITIES

The functional materials capability houses a full complement of chemical synthesis laboratories; vapor-phase deposition equipment for materials growth; crystallographic and electronic structure characterization tools; surface science, imaging, and analysis instrumentation; mineral processing and separation laboratories; membrane manufacturing and testing facilities; and sensor manufacturing and testing facilities. Key facilities and equipment include:

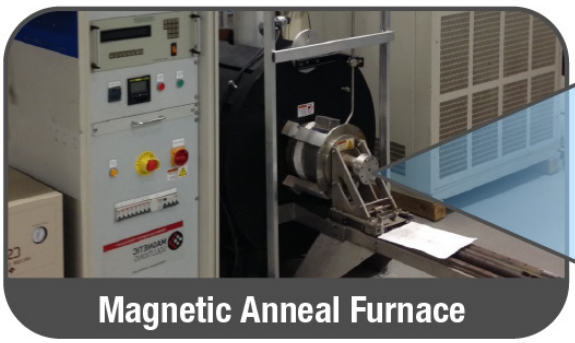
- Functional Materials Synthesis Laboratory, a fully equipped wet chemistry facility with over 4000 square feet of space
- Full suite of testing facilities for evaluating separations materials, catalysts, and sensor materials under ideal and real conditions
- Microwave reactor facilities for catalytic reactions and materials processing
- SOFC testing laboratory
- World-class laser-heated pedestal growth facility for growing optical fibers of unlimited length
- Power electronics/magnetic materials component fabrication and testing facilities
- Surface Chemical Analysis and Scanning Probe Microscopy Facilities

Hollow Fiber Spinning Apparatus

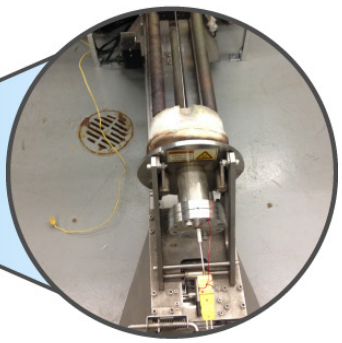




Laser-Heated Pedestal Growth Facility



Magnetic Anneal Furnace



NETL is a U.S. Department of Energy national laboratory that drives innovation and delivers technological solutions for an environmentally sustainable and prosperous energy future. By leveraging its world-class talent and research facilities, NETL is ensuring affordable, abundant and reliable energy that drives a robust economy and national security while developing technologies to manage carbon across the full life cycle enabling environmental sustainability for all Americans.

One of the most rewarding aspects of NETL's research is that our innovations and our technologies have the potential to improve people's lives in meaningful ways. Our work to advance functional materials research in the energy sector to enable its deployment in support of our nation's ambitious carbon management goals is a powerful example of this kind of impact.

Contacts

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