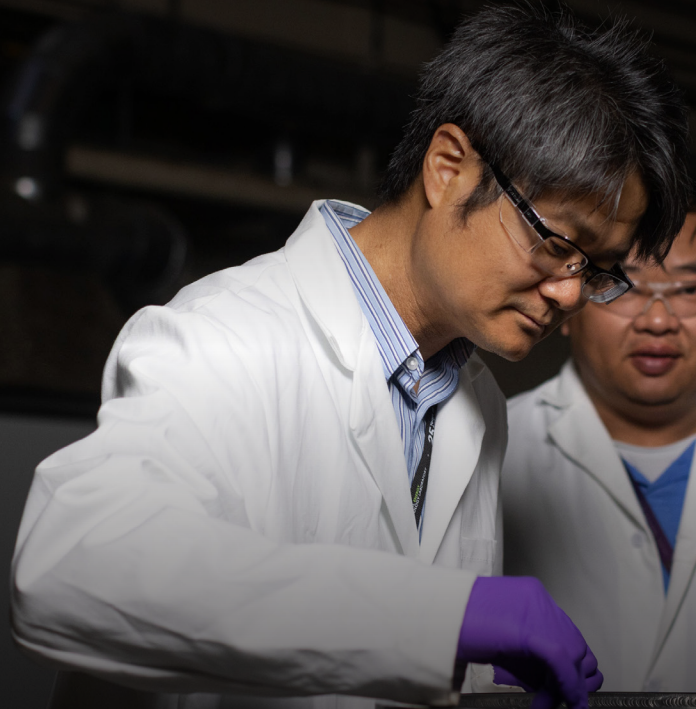


CARBON MATERIALS MANUFACTURING



NETL's Carbon Materials Manufacturing Facility (CaMMF) was designed to produce relatively large volumes (~kg/hour) of carbon materials that internal and external collaborators can use for performance testing in a variety of end use applications. Specific capabilities include wet chemical synthesis, mechanical processing, thermal processing up to 2800 °C, filtration processing, battery and supercapacitor fabrication and testing and general materials characterization.

R&D225, March 2026

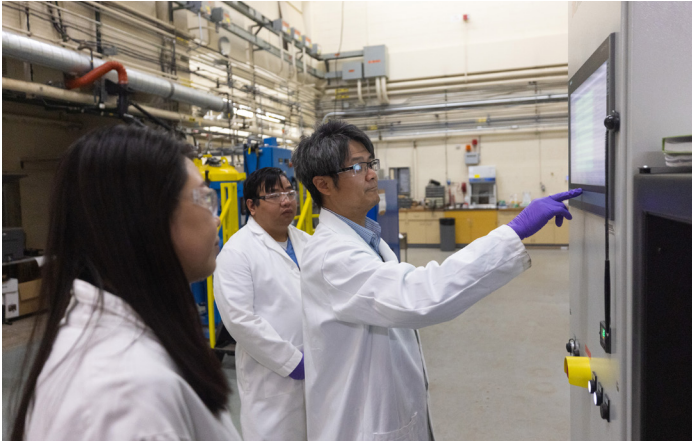


OVERVIEW

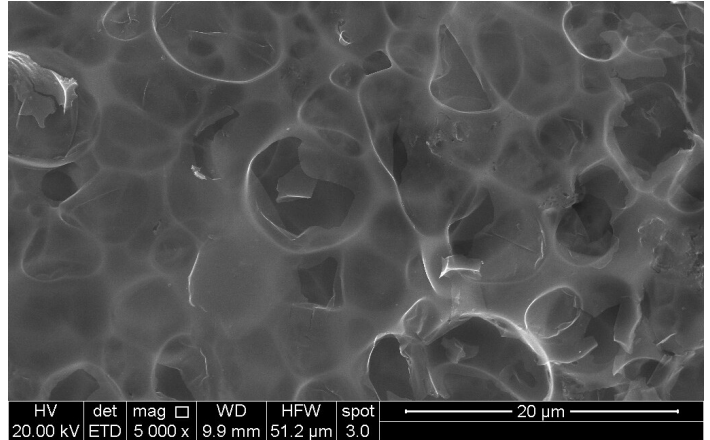
Carbon is a unique material that exists in several forms, from the graphite in pencil leads to the diamonds in jewelry. The primary difference between these materials is the arrangement of individual carbon atoms and the specific types of chemical bonds between these atoms, which gives graphite its black color and ability to be used as a lubricant, while those in diamonds give rise to their beautiful optical luster and unsurpassed hardness. Controlling the arrangement of atoms and chemical bonds in carbons offers unique opportunities to engineer these materials for new, high-tech applications.

NETL's Carbon Materials Manufacturing (CaMM) program is developing new processing methods to convert coal, coal refuse, sulfur-laden petroleum coke, biomass waste and many other unconventional manufacturing feedstocks into high-value and high-tech carbon products. The results include new technologies and inventions used in lithium-ion battery electrodes, electric arc furnace electrodes, computer microelectronics, supercapacitors and other products critical for our economy.





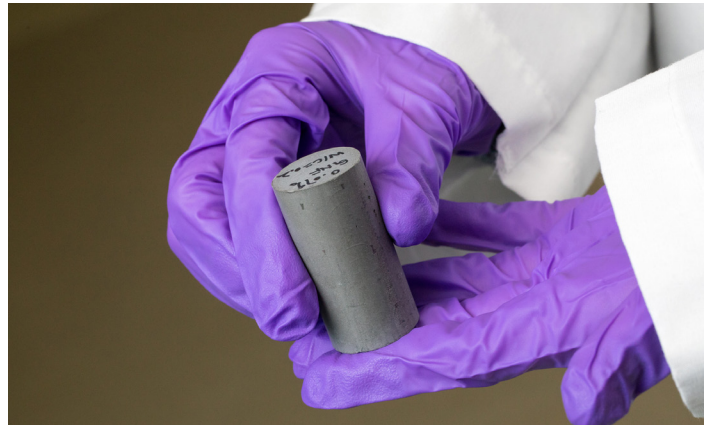
GRAPHITE MANUFACTURING: NETL uses a unique, patent-pending catalytic graphitization method to produce battery-grade graphite with reduced processing temperature, time and costs relative to commercial methods. This method also enables researchers to use high-mineral and high-sulfur unconventional manufacturing feedstocks, including petroleum coke, coal, coal mining waste, plastics, tires and biomass.



ENERGY STORAGE MATERIALS: NETL researchers are developing high-surface area, porous carbon materials for electrochemical energy storage (EES) devices. These electrode materials, with controlled morphologies and nanometer to micron pore-size distributions, enhance performance in devices such as conventional supercapacitors, zinc-ion hybrid capacitors or next-generation metal-halogen and metal-sulfur batteries.



CARBON MICROELECTRONICS: NETL develops carbon nanomaterials that improve the performance, efficiency, miniaturization and cost of microelectronic devices. An NETL-led team used coal fines to fabricate atomically thin 2D carbon films for memristor resistive random-access memory (RRAM) devices and field-effect transistors — the first time coal-derived materials were utilized in advanced microelectronics.



STRUCTURAL MATERIALS: NETL researchers are creating carbon additives for carbon-cement composites and carbon-metal composites with unconventional feedstocks, such as charred coal waste. These additives are utilized with traditional and additive manufacturing approaches to produce more durable, lower cost composites with improved mechanical properties and durability.

NETL is a U.S. Department of Energy (DOE) national laboratory dedicated to innovating and accelerating the nation's energy solutions in hydrocarbon, geothermal energy and critical minerals production. With research sites in Albany, Oregon; Morgantown, West Virginia; and Pittsburgh, Pennsylvania, NETL operates as one laboratory to create advanced energy technologies that support DOE's mission and enable affordable, reliable and secure energy to fuel human prosperity.

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