

COMPOSITES

THE
SCIENCE
OF
SCALE-UP



Comprehensive Composites Manufacturing from Precursor to Part

Composites are high performance lightweight materials that exhibit great stiffness or strength and are capable of withstanding high temperatures or absorbing energy. These properties make composites an ideal choice for manufacturing products such as vehicles, satellites, and wind turbine blades. Many applications increasingly leverage bio-based materials and recycling processes for sustainability.

Oak Ridge National Laboratory (ORNL) composites researchers focus on creating an innovation bridge between an idea and implementation for industrial applications. ORNL serves as the single point of contact for composites research and development by providing comprehensive capabilities ranging from precursor formulation to additive manufacturing and spanning bench scale to industry relevant scale.

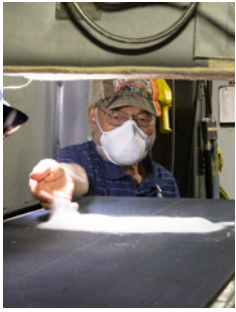


Unique User Facilities

The Department of Energy's Manufacturing Demonstration Facility at ORNL creates and accelerates next-generation advanced manufacturing technologies, where materials, processes, and systems are holistically integrated to strengthen the U.S. manufacturing base.



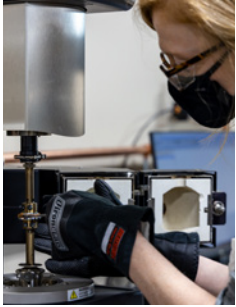
The Department of Energy's Carbon Fiber Technology Facility at ORNL assists industry with overcoming the barriers associated with cost and technology scaling of low-cost fibers and associated composites, including product and market development.



Advanced Fibers

Advanced fibers utilizes the resources of the Carbon Fiber Technology Facility, the Department of Energy's only designated user facility focused on advanced fiber innovation.

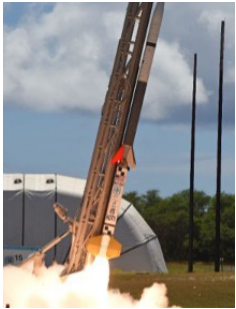
Capabilities include melt spinning and blowing, large-scale components, silicon carbon fiber, pultrusion, fiber chopping, textile fiber winding, large-scale additive manufacturing, precursor chemistry development, filtration efficiency, and physical and mechanical fiber testing.



Composites Innovation

State-of-the-art composites manufacturing focuses on integrating data-driven processes within advanced manufacturing to create multifunctional objects with highly tailored performance. These objects are used in the automotive industry, mold production, building and infrastructure, marine industry hydropower, and urban air mobility.

Capabilities include large-scale additive manufacturing, extrusion compression molding, continuous fiber printing, injection molding, thermoforming, filament winding, sheet molding compound, and pultrusion.



Extreme Environment Materials

Developing advanced manufacturing techniques for new materials that can withstand high-temperature environments is the primary focus of researchers specializing in extreme materials. Scientists work to understand how materials can handle environments that are radioactive and corrosive, specifically. Applications for these materials include thermal protection systems, heat exchangers, brakes, turbine, and engine components.

Existing materials and applications can benefit from the low cost and data-driven production researchers enable while discovering new materials and applications. Research supports the production and testing of carbon and ceramic composites and focuses on utilizing additive manufacturing techniques to improve scalability, for full size components and prototyping.



Sustainable Manufacturing

Design for sustainability is achieved by reducing dependence on fossil fuels and developing circular economies for advanced manufacturing. Applications for sustainable manufacturing include mold fabrication, marine components, wind energy, automotive industry, building and construction, advanced recycling, and next-generation additive manufacturing.

Sustainable manufacturing utilizes new design methods and large-scale additive manufacturing techniques and works with natural fiber composites, cellulosic materials, mechanical recycling, and waste upcycling to promote industrial decarbonization. Development of locally-sourced, high-value biomaterials and viable processes for composite creation is vital for a sustainable future.

Working with ORNL

ORNL provides industry with access to unique research facilities such as the Department of Energy's Manufacturing Demonstration Facility and the Carbon Fiber Technology Facility. By partnering with industry, ORNL helps reduce risk for adopting cutting-edge manufacturing technologies. The laboratory has decades of experience working with industry through a variety of business agreements and recognizes the importance of protecting intellectual property. For more information on how to work with ORNL, visit www.ornl.gov/partnerships.

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