

INNOVATIONS IN MANUFACTURING

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Carbon Fiber Technology Facility

Demonstrating Innovative Low-Cost Carbon Fiber for Energy and National Security Applications

Oak Ridge, Tennessee, is home to Oak Ridge National Laboratory's new Carbon Fiber Technology Facility (CFTF). This 42,000 ft² innovative technology facility offers a highly flexible, highly instrumented carbon fiber line for demonstrating advanced technology scalability and producing market-development volumes of prototypical carbon fibers.

The CFTF serves as a national testbed for the Oak Ridge Carbon Fiber Composites Consortium, a public-private partnership enabling a national network for innovations in manufacturing. The consortium's mission is to forge industry-government collaborations to accelerate the development and deployment of lower-cost carbon fiber materials and processes and create a new generation of strong, lightweight composite materials that will improve America's competitiveness.

Thermal (Conventional) Conversion

The thermal conversion line is rated for 25 tonnes/year of polyacrylonitrile (PAN)-based fiber and can convert both melt-spun and solution-spun precursors. It is baselined for standard modulus PAN but designed with the flexibility to accommodate lignin, polyolefin, and pitch precursors and can be readily upgraded to convert rayon and high-modulus PAN precursors. It is designed to process materials in either tow or web forms.

Melt-Spun Precursor Fiber Production

The melt-spinning line is rated at 65 tonnes/year of polyethylene fiber and is designed to also spin lignin and pitch-based precursors in either tow or web forms. It is upgradable to melt-spin PAN when the technology is sufficiently developed.

Advanced Technology Conversion

Advanced conversion technology based on microwave and plasma processing technology is currently under development at ORNL. Provisions have been made for the future construction of an advanced technology conversion line, similar in scale to the conventional conversion line, when the advanced conversion technologies are sufficiently mature for semiproduction-scale demonstration.



Capabilities

Melt-Spun Precursor Fiber Production

- Rated capacity 65 tonnes/year based on polyethylene
- Spins most melt-stable polymers, specifically including polyethylene and lignin; upgradable for melt-spun PAN
- Tow production up to 2,000 m/min winding speed
- Melt-blown web production up to 300 mm width, packaged or direct-fed to carbon fiber line; upgradable to include spun-bond
- Homo- and bicomponent filament production; upgradable to tricomponent
- 450°C temperature rating
- Corrosion-resistant wetted surfaces
- Extrusion screw L/D 30:1; upgradable to 40:1

Carbon Fiber Production

- Rated capacity 25 tonnes/year based on 24k PAN tows
- Designed for PAN, polyethylene, lignin, and pitch precursors; upgradable for rayon and high-modulus carbon fibers
- Designed for 3k to 80k tows and web up to 300 mm wide x 12.7 mm loft
- Oxidation temperature up to 400°C with airflow configurable to be parallel, cross, or downflow
- Low-temperature carbonization up to 1000°C with capability to produce structural or micro/nanoporous fibers
- High-temperature carbonization to 2000°C
- Posttreatment system designed for compatibilizing fibers with performance or commodity resins

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The CFTF is an integral part of ORNL's broader initiatives in advanced manufacturing technologies falling under the umbrella of the Manufacturing Demonstration Facility.