INNOVATIONS IN MANUFACTURING

CARBON FIBER TECHNOLOGY FACILITY

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

Oak Ridge National Laboratory is home to the Department of Energy's (DOE) new Carbon Fiber Technology Facility (CFTF)—a 42,000 ft^2 innovative technology facility. The CFTF offers a highly flexible, highly instrumented carbon fiber line for demonstrating advanced technology scalability and producing market-development volumes of prototypical carbon fibers, and serves as the last step before commercial production scale.

The CFTF serves as a national testbed for government and commercial partners to scale-up emerging carbon fiber technology. As part of ORNL's DOE-funded Manufacturing Demonstration Facility, the CFTF serves as a hub for public–private partnerships in the emerging national network for innovations in manufacturing. One such partnership consisting of more than forty companies, the Oak Ridge Carbon Fiber Composites Consortium, has formed in Oak Ridge, Tennessee. The mission of the Consortium 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 polyolefins 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.

Contact

Lee McGetrick
Director, Carbon Fiber Technology Facility
(865) 574-6549
mcgetricklb@ornl.gov

Craig Blue, Ph.D.
Director, Manufacturing Demonstration Facility
(865) 574-4351
blueca@ornl.gov

Facility Capabilities

The Carbon Fiber Technology Facility, with its 390-ft. long processing line, is capable of custom unit operation configuration and has a capacity of up to 25 tons per year, allowing industry to validate conversion of their carbon fiber precursors at semi-production scale.

Melt-Spun Precursor Fiber Production

- Rated capacity 65 tonnes/year based on polyolefins
- Spins most melt-stable polymers, specifically including polyolefins 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, polyolefins, 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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