NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Composites Manufacturing Education and Technology Facility Expedites Manufacturing Innovation

The Composites Manufacturing Education and Technology facility (CoMET) at the National Wind Technology Center at the National Renewable Energy Laboratory (NREL) paves the way for innovative wind turbine components and accelerated manufacturing.

Available for use by industry partners and university researchers, the 10,000-square-foot facility expands NREL's composite manufacturing research capabilities by enabling researchers to design, prototype, test, and manufacture composite wind turbine blades and other components in one location. Designed to work in conjunction with NREL's design, analysis, and structural validation capabilities, the CoMET facility expedites manufacturing innovation.

The result of a funding partnership involving NREL, the Institute for Advanced Composites Manufacturing Innovation (IACMI, which is funded by the U.S. Department of Energy's Advanced Manufacturing Office), and the State of Colorado, the CoMET facility's primary focus is on creating megawatt-scale wind turbine blade components, such as root inserts, spar caps, trailing-edge reinforcements, and blade skin laminates. The facility's specialized wind research abilities include:

- Rapid prototyping of new blade materials utilizing full-scale component tooling
- Expediting the development of new turbine components and production methods
- Manufacturing techniques, such as vacuum-assisted resin transfer molding, that facilitate research into renewable and recyclable materials
- Manufacturing simulations and structural validation of the strength and safety of each component.

The Composites Manufacturing Education and Technology facility expedites manufacturing by enabling researchers to design, prototype, test, and manufacture composite wind turbine blades and other components in one location.
Photo by David Snowberg, NREL/41769

CoMET Facility Capabilities

- Full-scale blade component tooling and fixtures (root, spar cap, tip, shear web)
- Rapid prototyping of novel blade materials and production methods
  - Materials such as polyester, vinyl-Esther, epoxy, and thermoplastic resin systems, as well as fiberglass and carbon fiber
  - Manufacturing techniques such as vacuum-assisted resin transfer molding, hand lay-up for small parts, and integration of pultruded spar caps into blade structures
- Molding, assembly, bonding, and finishing
- Use of segmented 3-D-printed blade tooling
- Composite material mixing and dispensing equipment
- Simulations and modeling for manufacturing
- Structural characterization of coupons, components, and joints
- Composites industry workforce development and training.

**NREL is a national laboratory of the U.S. Department of Energy,
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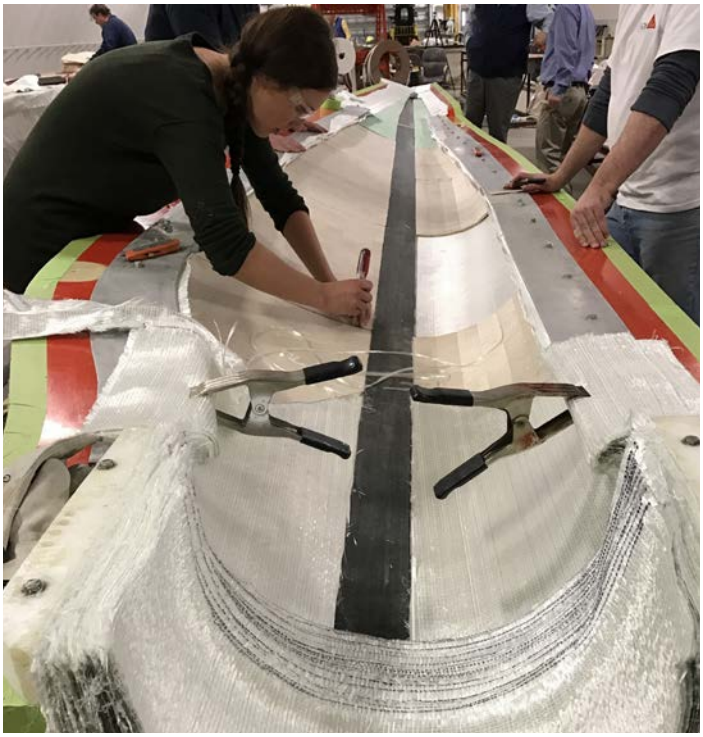

Composite manufacturing technicians work on a wind turbine blade mold at the Composites Manufacturing Education and Technology facility. The facility helps pave the way for developing innovative wind turbine components and accelerated manufacturing, while at the same time serving as a workforce development resource for a growing composite manufacturing industry. *Photo by Samantha Rooney, NREL/41767*

The CoMET facility also offers workforce development and training for the composite manufacturing industry. Rapid growth in Colorado's composite industry requires an expanded workforce, and workers with the related skillsets are highly competitive in aerospace and construction—in addition to the booming wind industry.

Partner with Us

The CoMET facility's manufacturing capabilities and highly trained staff are available to industry, manufacturers, and universities for research and development, processing trials, testing and validation, and materials and manufacturing innovation. Contact Derek Berry, *derek.berry@nrel.gov*, for more information.

CoMET Facility Materials

Thermoplastic resin. Thermoplastic resin (TPR) could replace thermoset resins, such as epoxy, which are traditionally used to build megawatt-scale wind turbine blades. Unlike thermosets, which cannot be thermally formed, TPR is a fully recyclable material that allows manufacturers to recover expensive components like carbon fiber and resin for use in other products. To demonstrate TPR's commercial feasibility, CoMET researchers will assess the material's cost, processing variables, cycle time, material properties, and impact on labor and capital costs in developing a structurally verified thermoplastic blade component. The CoMET facility staff is working with IACMI partner Arkema on processing trials of their Elium thermoplastic resin system.

Specialized fiberglass sizing. Part of the challenge of manufacturing wind turbine blades with thermoplastic resin systems is ensuring that the reinforcements used in the process have the proper characteristics to bond to the novel resin systems. IACMI partner Johns Manville has developed a specialized fiberglass sizing compatible with TPR systems. The CoMET facility staff is utilizing this innovative fiberglass in thermoplastic processing trials.

Pultruded carbon fiber spar caps. To improve quality, reduce cycle time, and increase blade structural properties, blade designers and manufacturers have been evaluating the use of pultruded carbon fiber or glass fiber spar caps in wind turbine blades. NREL has partnered with Oak Ridge National Laboratory and IACMI members Huntsman, Strongwell, and Chomarat to develop a new, polyurethane-based, low-cost carbon fiber spar cap to be integrated into structural blade skins.

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