UNIVERSITY OF DELAWARE
CENTER FOR
COMPOSITE MATERIALS

2026

# ENERGY SCIENCE AND ENGINEERING

The University of Delaware Center for Composite Materials (UD-CCM) has a long history of research in recycling and remanufacturing of composite materials, dating back to Dr. Richard Wool's pioneering work in bio-derived resins and composites in the 1990s. As the need for domestic sources of critical materials continues to grow, UD-CCM remains committed to advancing technologies that enhance supply chain stability and resilience.

Dr. Joseph Deitzel's recent appointment as UD-CCM's inaugural Assistant Director of Sustainability highlights the center's emphasis on this critical area. Deitzel has identified ongoing research in closed-loop recycling of composites, high-performance polymer development, and AI-guided composite design and processing as key to establishing UD-CCM as a leader in composite materials innovation.

**Closed Loop Recycling**

Recycling and remanufacturing of composite materials play a crucial role in reducing US dependence on internationally sourced virgin materials, securing a stable domestic supply of critical resources such as carbon fiber for civilian infrastructure and defense applications. UD-CCM research has shown that recycling processes significantly reduce the energy required compared to original material production. Current efforts focus on the development of recyclable-by-design polymers, advancing an aligned short fiber microstructure technology called Tailored University Feedstock for Forming (TuFF), and improving composite recycling methods.

**High Performance Bio-Derived Polymers**

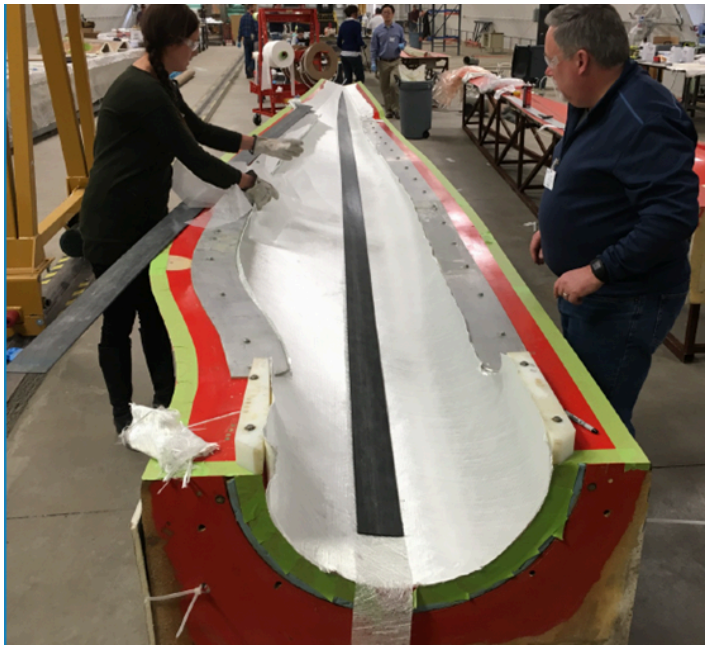
Researchers are exploring new polymer systems that enable effective material reuse while maintaining the high-performance standards required for advanced applications. The center is currently collaborating with a new NSF initiative to investigate TuFF-aligned wood fibers, further advancing research into sustainable, high-performance polymer composites.

**AI-Guided Composite Design**

Utilizing AI simulations to model novel composite material design and manufacturing processes significantly reduces the need for resource-intensive trial-and-error testing. UD-CCM researchers, supported by the DOE, are working on inverse AI composite design research to enhance the efficiency and effectiveness of composite development and remanufacturing strategies.

**Future Focuses**

Beyond current research efforts, UD-CCM leadership is exploring new opportunities in recycling and remanufacturing to strengthen supply chain resilience. Key focus areas include improving methods for separating resin and fibers, as well as advancing AI-guided, sensor-based classification technologies to optimize material recovery and reuse.



UD-CCM is developing a sustainable, low-cost material and process solution for recycled spar caps for offshore wind blades, reducing embodied energy by 80% and fiber material cost by 70%

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