

# Integrated Laser Curing & Electrospinning for 3D Nano-Architected CFRP Composites with Enhanced Properties

**Laser-cured electrospun CNT skeletons in CFRP create lighter, stronger, multifunctional composites at scale.**

Researchers at Purdue University have developed an Integrated Laser Curing and Electrospinning (LC-ES) manufacturing method for producing advanced 3D nano-architected carbon fiber-reinforced polymer (CFRP) composites. This novel process enables the precise embedding of carbon nanotubes (CNTs) into epoxy matrices through electrospinning, followed by in-situ laser curing, to fabricate materials with superior mechanical, thermal, electrical, and electromagnetic properties. Unlike traditional methods, LC-ES allows for tailored nanostructures, efficient resin flow, and scalable manufacturing. This leads to lighter, stronger, and more multifunctional composites. This new approach also minimizes waste, reduces manufacturing time, and supports sustainability goals.

## Technology Validation:

This technology was validated through experimental fabrication and testing of CNT/epoxy nanofibers using a custom electrospinning setup. Mechanical properties such as flexural modulus, flexural strength, and interlaminar shear strength were measured across different nanofiber skeleton thicknesses, demonstrating enhanced structural performance. Electrical conductivity, EMI shielding, and thermal conductivity were also tested, confirming improved multifunctional properties. Laser curing was optimized using simulations of Gaussian beam profiles to ensure uniform thermal distribution.

## Advantages:

- Enhanced mechanical, thermal, and electrical performance
- Scalable and cost-effective manufacturing
- Reduced material waste and production time

**Technology ID**  
2025-DALI-70960

## Category

Aerospace & National  
Security/Hypersonics &  
Propulsion Systems  
Computing/Networking &  
Connectivity  
Automotive & Mobility  
Tech/Micromobility & Smart  
Urban Infrastructure

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## View online



**Applications:**

- Aerospace and automotive components
- Electronics and telecommunications shielding
- Renewable energy and sporting goods equipment

**TRL:** 4

**Intellectual Property:**

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