

# Lightweight Materials

## Our Expertise

Analysis-Informed Materials Design | Advanced Recycling Strategies | Biomass- and Waste-Derived Epoxy Development | Synthesis, Characterization, and Recycling Across Scales

## The Need

### Improving Electric Vehicle Efficiency, Driving Down Ownership Costs

Ever-increasing adoption of electric vehicles (EVs) represents a massive step toward decarbonizing one of the biggest culprits contributing to climate change—the transportation sector. NREL researchers are working to make EVs an even more environmentally friendly option through a variety of creative ways,

like improving battery technologies, accelerating integration with the grid, and most recently developing novel sustainable and lightweight materials to construct EVs that are both readily recyclable and Earth-friendly.

## The Solution

### Developing Cheaper and Greener Carbon Fiber Composites

Steel is commonly used in vehicles, but it is heavy, emissions-intensive to manufacture, and difficult to recycle. The more a vehicle weighs, the more energy—from the pump or from a battery—it takes to get around. To combat this problem, NREL researchers are developing alternative materials with the environment in mind. The result is NREL's lightweight,

strong, and recyclable carbon fiber composites made of up of bio-derivable epoxies, anhydride hardener, and carbon fibers. Researchers employ chemical depolymerization and thermoforming techniques to recycle the material without causing degradation.

## The Impact

### Improving Economics for Mass-Market EV Adoption

When used in place of steel in vehicle parts like hoods and roofs, NREL's recyclable carbon fiber composites can reduce the weight of a typical passenger car in half to boost fuel efficiency by up to 35%. This swap can free up weight and space for bigger batteries in EVs, resulting in longer ranges and better energy

efficiency. Plus, vehicle parts made with NREL's recyclable carbon fiber composites can be recycled up to three times, making their reuse even more cost- and energy-efficient. In fact, recycling the material just once reduces the costs and emissions of the material's second life by 90% to 95%.

## Partners

U.S. Department of Energy | Vehicle Technologies Office