

Researchers develop improved recycling process for carbon fibers

March 8 2021, by Luisa Low



Credit: Unsplash/CC0 Public Domain

Recycling of composite materials could be up to 70 percent cheaper and lead to a 90-95 percent reduction in CO₂ emissions compared to standard manufacturing.

In recent years there has been an increased focus on the circular economy and a heightened demand for products made of [recyclable materials](#), however many materials can only be recycled so many times before they begin to wear out.

This is the case with [carbon](#) fiber reinforced polymer (CFRP) composites, non-biodegradable materials which, until now, have lacked a viable recycling method.

CRFP composites are present in products such as [wind turbines](#), airplane parts, vehicles such as cars and ships, and everyday technology such as laptops and mobile phones.

They are typically disposed of in landfills or by incineration, which pose significant threats to both the environment and public health.

The vast majority of existing recycling methods also cause a major reduction in the mechanical and physical properties of the recovered material, weakening its core functionality.

Researchers from the University of Sydney's School of Civil Engineering have developed an optimized method for recycling CFRP composites while maintaining 90 percent of their original strength.

"Globally and in Australia there has been a march towards better recycling processes, however there is often the belief that a material can be recycled an infinite amount of times—this simply isn't the case. Most recycling processes diminish mechanical or physical properties of materials," said the study's lead researcher Dr. Ali Hadigheh.

"Until now, it has been impossible to continuously recycle products made of carbon fibers. Given that most recycling involves shredding, cutting or grinding, fibers are worn out, decreasing a future product's

viability," said Dr. Hadigheh.

"This presents a huge challenge and threat to our environment, as it has led to the production of virgin carbon fiber which contributes significantly to greenhouse gas emissions.

"To combat this issue and to support a true [circular economy](#), we developed an efficient and cost-effective method for recycling carbon fiber, which is present in tablets through to BMWs."

"To do this we used a two phased, optimized process. The first step is called "pyrolysis," which breaks down a material using heat, but significantly chars the materials which prevents it from developing a good bond with a resin matrix. The second process, oxidation, uses high temperatures to remove this char.

"Pyrolysis and oxidation alone are not enough to preserve carbon fibers and these processes have existed for some time already. To ensure a high quality recovery and economic efficiency, thermal decomposition of CFRPs need to be guided by analyzing the energy required to initiate a chemical reaction in the composit, and separate carbon fibers from the surrounding resin matrix.

"What makes our method so successful is that we have added specific parameters—such as temperature, heating rate, atmosphere or time spent being oxidized and heated—that preserve the functionality of carbon fiber."

"We embarked on the project with the aim of producing high grade, low cost structural materials made from recycled carbon fiber composites, for use in industries from aerospace and automotive through to sporting goods and renewable energy and construction."

In 2010, the global production of fiber reinforced polymers (FRP) was approximately 6 million tons with a projected growth of 300 percent in the next decade. With this projection, the consumption of FRPs will exceed 18 million tons by 2025, with an end-product value of AUD \$80 billion.

"The [2016 Australian National Waste Report](#) concludes that the use of [composite materials](#) is creating future challenges to [recycling](#). Plainly put, if we do not develop efficient and cost-effective methods to recycle carbon fiber composites, we risk damaging the environment significantly," said Dr. Hadigheh.

More information: S.A. Hadigheh et al. Evaluation of composite action in cross laminated timber-concrete composite beams with CFRP reinforcing bar and plate connectors using Digital Image Correlation (DIC), *Engineering Structures* (2021). [DOI: 10.1016/j.engstruct.2020.111791](#)

Provided by University of Sydney

Citation: Researchers develop improved recycling process for carbon fibers (2021, March 8) retrieved 20 June 2024 from <https://phys.org/news/2021-03-recycling-carbon-fibers.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
--