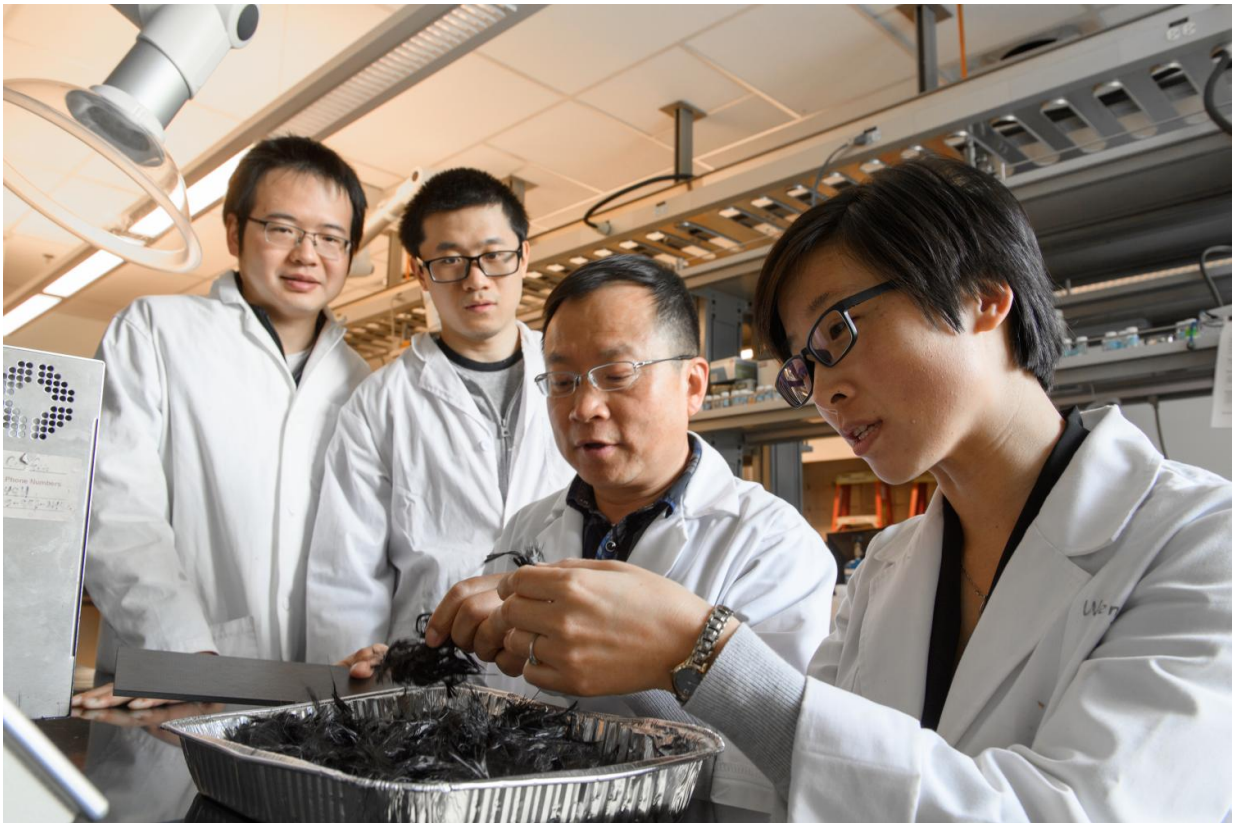


# Researchers develop recycling for carbon fiber composites

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Washington State University Professor Jinwen Zhang with his carbon fiber recycling research team. Credit: Washington State University

A WSU research team for the first time has developed a promising way to recycle the popular carbon fiber plastics that are used in everything

from modern airplanes and sporting goods to the wind energy industry.

The work, reported in *Polymer Degradation and Stability*, provides an efficient way to re-use the expensive [carbon fiber](#) and other materials that make up the composites.

## **Planes, windmills, many products**

Carbon fiber reinforced plastics are increasingly popular in many industries, particularly aviation, because they are light and strong. They are, however, very difficult to break down or recycle, and disposing of them has become of increasing concern. While thermoplastics, the type of [plastic](#) used in milk bottles, can be melted and easily re-used, most composites used in planes are thermosets. These types of plastics are cured and can't easily be undone and returned to their original materials.

## **Caustic chemicals eliminated**

To recycle them, researchers mostly have tried grinding them down mechanically or breaking them down with very high temperatures or harsh chemicals to recover the expensive [carbon](#) fiber. Oftentimes, however, the carbon fiber is damaged in the process. The caustic chemicals used are hazardous and difficult to dispose of. They also destroy the matrix resin materials in the composites, creating a messy mixture of chemicals and an additional waste problem.

## **Mild chemicals, low temperatures**

In their project, Jinwen Zhang, a professor in the School of Mechanical and Materials Engineering, and his team developed a new [chemical](#) recycling method that used mild acids as catalysts in liquid ethanol at a relatively low temperature to break down the thermosets. In particular, it

was the combination of chemicals that proved effective, said Zhang, who has a chemistry background. To break down cured [materials](#) effectively, the researchers raised the [temperature](#) of the material so that the catalyst-containing liquid can penetrate into the composite and break down the complex structure. Zhang used ethanol to make the resins expand and zinc chloride to break down critical carbon-nitrogen bonds.

"It is critical to develop efficient catalytic systems that are capable of permeating into the cured resins and breaking down the chemical bonds of cured resins," he said.

## Preserving fibers for re-use

The researchers were able to preserve the carbon fibers as well as the [resin](#) material in a useful form that could be easily re-used. They have filed for a patent and are working to commercialize their methods.

**More information:** Tuan Liu et al, Mild chemical recycling of aerospace fiber/epoxy composite wastes and utilization of the decomposed resin, *Polymer Degradation and Stability* (2017). [DOI: 10.1016/j.polymdegradstab.2017.03.017](#)

Provided by Washington State University

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