Global Fiberglass Solutions, in Collaboration with Washington State University, Creates Chemical Recycling Solution for Carbon Fiber Composites

A WSU research team, in collaboration with industry partner Global Fiberglass Solutions, has developed a way to recycle carbon fiber composites. Taken to commercial market by GFS, this development represents a viable recycling solution and landfill alternative for industries like aerospace and wind energy.

PULLMAN, Wash. (PRWEB) March 18, 2019 -- 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 works, reported in Polymer Degradation and Stability and Green Chemistry, exemplify two efficient ways to re-use the expensive carbon fiber and other materials that make up the composites.

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 thermostets. These types of plastics are cured and can’t easily be undone and returned to their original materials.

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.

In their project, Jinwen Zhang, a professor in the School of Mechanical and Materials Engineering & Composite Materials and Engineering Center, and his team developed new chemical recycling methods that used mild acids as catalysts in ethanol, mixed ethanol/water or water alone at a relatively low temperature to break down the thermostets. In particular, it was the combination of catalyst and solvent 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. The solvent (e.g., ethanol and/or water) was used to first make the resins expand and then to break down carbon-nitrogen bonds or ester bonds by the effect of catalyst.

“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 in aqueous medium or benign solvents like ethanol,” he said.

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 two patents and are working to commercialize their methods.

In terms of the efforts for commercialization, WSU industry partner Global Fiberglass Solutions is poised to take this technology to a booming composites market in dire need of recycling solutions. The CFRP market is set to reach $20.3 billion by 2020, the industry growth accelerated primarily by aerospace giants Boeing and...
Airbus. GFS and the state-funded Joint Center for Aerospace Technology Innovation (JCATI) together provided funding for Dr. Zhang’s research team’s operations.

Global Fiberglass Solutions, an industrial fiberglass recycling and manufacturing firm headquartered in Bothell, WA, is embracing WSU’s “Smart Systems” Grand Challenge as an industry partner. GFS is already operating a mechanical process to recycle thermoset fiberglass at its plant in Sweetwater, Texas, where the company recycles wind turbine blades to manufacture new products from the material. In the spirit of Smart Systems, GFS aims to create a truly holistic approach to composites recycling and recycled product manufacturing. GFS can recycle clients’ composite waste and use the material to manufacture customized products for that client’s needs. With the addition of the chemical process of carbon fiber recycling to GFS’ industrial operations, the company is well on its way to becoming a centerpiece in the CFRP and fiberglass industries’ intended future in environmentally sustainable operations.
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