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**MSU working to make cars lighter and stronger**

If automakers want to reach the federal mandate of 54.5 miles per gallon by 2025, they are going to have to come up with ways of making cars lighter.

One possibility is the increased use of fiber-reinforced composite materials, which are lighter yet stronger and stiffer than most traditional materials. Composite materials are composed of fibers such as carbon, glass and Kevlar that are held together using a polymer such as an epoxy.

While manufacturing vehicles completely out of composites remains an expensive alternative, it is possible to replace many existing car parts with parts made of composites.

The problem: Joining composite and noncomposite materials together.

The solution: Mahmood Haq and his team at Michigan State University’s [Composite Vehicle Research Center](https://www.egr.msu.edu) are developing new ways in which composites and traditional materials, such as steel or aluminum, can be joined without compromising the desirable structural properties of the composites.

When joining a composite and a metal, Haq said manufacturers want to avoid drilling holes in the composite.

“If you drill a hole with mechanical means, damage is introduced at the edges of the hole, and the layers that make up the composite separate,” said Haq, an assistant professor of civil and environmental engineering. “You lose up to 60 percent of the capacity of the composite to carry load.”

Using an adhesive to bond the two together also has limitations. “That, unfortunately, is a one-time cure. Once the adhesive cures, the joint can’t easily be undone.”

So Haq and his team are working on advanced adhesives with special properties that allow them to be taken apart, repaired or healed. These special properties are obtained by adding electrically conductive nanoparticles to the adhesives.

“Millions of these nanoparticles are embedded in the adhesive,” he said. “By using what we call targeted heating we can bond them and reverse the bond and take them apart,” he said.

When activated with the right kind of electromagnetic radiation, the nanoparticles begin to vibrate and heat the adhesive. “Just the adhesive heats up without having to heat up the entire structure,” Haq said.

He said one key to making this joining technique practical is to be sure it can be integrated into today’s auto assembly line practices.

“We want joints that are easily and quickly produced,” he said. “We don’t want to have to totally re-tool the assembly lines. We don’t want to have to invent a new technology which disrupts current manufacturing practices.”
Much of the funding for Haq’s work is provided by the U.S. Department of Energy and the American Chemistry Council.

MSU is a national leader in composite-material research. In fact, MSU leads the light-and-heavy-duty vehicle technology component of the Institute for Advanced Composites Manufacturing Innovation, or IACMI, a 122-member consortium funded by a more than $70 million commitment over five years from the U.S. Department of Energy.

Related Website: Story courtesy of MSUToday
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