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Touchstone Research Laboratory co-owner Brian Joseph takes a test drive on a custom-built bicycle featuring strips of the company's new aluminum and fiber composite called MetPreg. This allowed the researchers to use less pure aluminum, making the cycle half as heavy as any commercial model.

Not Heavy Metal

Touchstone Wins Again With New Composite

By ADAM TOWNSEND

TRIADELPHIA - Imagine a composite so light that it could cut the weight of a bicycle frame by half, yet still be strong and durable enough to serve as a fuel tank for a rocket.

Researchers and engineers at Touchstone Research Laboratory in Triadelphia envisioned just such a product with their new aluminum and fiber composite called MetPreg. In the process the company captured the prestigious "R&D 100" award for 2005, the second year in a row Touchstone has earned the coveted prize.

"This is probably the most sought-after award in research and development in the world," said Touchstone co-owner Brian Joseph. "The idea of winning it two years in a row - that's very unusual, especially for a small company."

(Continued on page 2)

(Continued from page 1)

Touchstone won the award in 2004 for its Cfoam carbon composite, a fireproof product made from West Virginia coal that can be used in a variety of aerospace, marine and other applications. This year, Touchstone won the award for its new aluminum and fiber composite called MetPreg.

"We do to aluminum what fiberglass does to plastic," Joseph said of the new composite.

He said that thin fibers of aluminum oxide - each thinner than a human hair - are impregnated into the aluminum, making up 50 percent of the composite's mix. These fibers make MetPreg three times stronger than pure aluminum.

Touchstone manufactures the aluminum composite most often in thin, stiff strips or tapes. The tape itself is brittle, but when bonded to pure aluminum or even styrofoam, it becomes extremely strong.

To demonstrate this, Touchstone built an aluminum bicycle and bonded MetPreg strips to the outside of the frame. This allowed the researchers to use less pure aluminum, making the cycle half as heavy as any commercial model. The frame is only a little more than four pounds.

To illustrate the strength of this new composite, Joseph put the concept in concrete terms: "Imagine a rod (of MetPreg) one inch square in cross section: you could hang 100 tons on that," he said.



Gregg Wolfe, technical director for Touchstone, lifts the bicycle with a frame that weighs about 4 pounds, demonstrating that MetPreg can help make a variety of products light but strong.

According to Brian Gordon, Touchstone's senior program manager, the lab also has devised an alternate way to process its new product. In the lab's conference room, he arranged several shiny, hollow structures on the table in front of him.

"These cylinders can be used for pressure vessels," he said, gripping one that looked like a silver-plated ball of twine, "These can be scaled up to make really large containers."

(Continued on page 3)

(Continued from page 2)

Gordon said that Touchstone makes the containers through a "filament winding" technique in which thin lines of MetPreg wind around a mold or "mandrel" to form a hollow shape.

"The finished product can take whatever the shape of the mandrel is," Gordon said.

He said that Touchstone currently has several government contracts to produce MetPreg products, like mortar tubes, rocket motor casings and rocket fuel tanks.

Joseph believes that MetPreg could even be the answer to creating a viable consumer vehicle that runs on hydrogen. He said that hydrogen-fueled travel faces three major obstacles to mainstream adoption: First, scientists have yet to reach the desired level of fuel efficiency for such cars; second, there exists no hydrogen infrastructure, meaning you can't pull in to a gas station to fill up your tank with hydrogen; and third, scientists have not developed a satisfactory way of carrying the fuel.

MetPreg, however, can withstand a lot of pressure, more than conventional fuel tank materials, he said. "To that third one, we think we have the answer with this project," Joseph said.

But what's with the odd name? Joseph said the name would make sense to those who deal in composites.

"In the composite world, if you order a material of fibers already in a matrix, it's called a 'pre preg,'" he said, explaining that the term was short for "pre-impregnated."

"Because MetPreg is a fiber-reinforced metal, people in the industry recognize what that means."

Joseph and company co-founder Elizabeth Kraftician will travel to Chicago in October to accept Touchstone's award at a ceremony there.