Superplastic: structural engineering's big thing

By Becky Pallack
ARIZONA DAILY STAR

Stronger than steel, able to withstand bomb blasts and earthquakes, and extremely flexible.

It's not the latest superhero. It's the newest innovation in structural engineering: high-strength, plastic composites that could be the solution to deteriorating infrastructure.

A University of Arizona scientist and a new local company are teaming up to develop new ways to use plastic composites in construction. Some of the first projects using the latest materials are in Tucson.

"This material is similar to fabric but 10 times as strong as steel," said Hamid Saadatmanesh, a structural-engineering professor at the UA.

Originally used in the aerospace industry, plastics composite technology grew to include multiple products, from space shuttles and advanced aircraft to bikes and surfboards. The materials are extremely strong, lightweight and flexible, and they don't corrode like metals.

Saadatmanesh was among the first to see the plastics' potential for upgrading and strengthening structures.

It came to him when, 17 years ago, he was looking over a balcony at the UA. He saw some exposed steel rebar corroding in concrete. He started to look for a material that doesn't corrode and found plastic.

But plastics alone weren't strong enough for construction projects, so he started researching.

After years of research, encompassing more than 100 research papers and 23 grant-funded research projects, Saadatmanesh is recognized as one of the world's leading experts in the field of fiber-reinforced polymer, or FRP, composites. He chairs the International Conference on Composites in Infrastructure, sponsored by the National Science Foundation.

He patented the use of plastic composites in masonry and concrete construction.

Saadatmanesh's latest technology uses fabric made of carbon, Kevlar and other strong fibers that bond to walls with epoxy, creating a plastic sheet. The application process is a lot like hanging wallpaper, Saadatmanesh said.

The ways to use high-strength plastic composites are numerous.

"The applications are bounded by one's imagination," Saadatmanesh said.

Applying the plastic to a concrete column increases the structure's resistance to earthquakes by four or five times, while applying it to a beam on a bridge increases its weight capacity about four times, he said.

"Whatever you can do with steel you can do with this, better and more economically," Saadatmanesh said.

That's where HJ3 Composite Technologies, a local company co-founded by Saadatmanesh and several colleagues with UA links, comes in.

"As a company, we're trying to help him fulfill his vision," said Jim Butler, HJ3 co-founder and sales and marketing director and a 2002 MBA graduate of the UA's Eller College of Business and Public Administration. "We just thought this was the next great thing."

He joined with a former associate director of the college's entrepreneurship program, John Nighswander, to start the business with Saadatmanesh.

The company is taking the basic product and developing innovations for new uses. New products are designed in the firm's Tucson offices and manufactured elsewhere. Four patents are pending.

Engineers like the idea of using the new plastics because they are stronger than steel and less expensive.

The materials have been used to reinforce steel beams in a UA dorm room when it was converted into offices and needed to bear more weight. It is being used at the Ice House Lofts to strengthen an old warehouse to be used for condos.

Building products that address safety concerns have become increasingly important amid concerns over terrorism.

HJ3 is developing a way to use plastics on Army vehicles. Steel plates don't resist blasts very well when troops drive over homemade explosives. But plastic combined with Kevlar could take the blow, saving the passengers, Butler said.

Saadatmanesh said the federal building in Oklahoma City could have stood up to the car bombs used in that 1995 attack if plastic products had been used on the outside of the building.

The products also have been used on bridges, power plants, water pipelines and transmission structures.

● *Contact reporter Becky Pallack at 573-4237 or bpallack@azstarnet.com.*