Newark firm whips up aluminum foam

Lightweight metal could be used in cars, military vehicles, aircraft

By RICHARD SINE / The News Journal
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The metallic bars in Alulight of America's Newark labs look like steel, but they have less than one-tenth the density. Pick one up, and you'll find you can toss it around like Superman.

The bars are made of a material known as "metal foam." The technology isn't new, but its makers hope their technique will lead to its widespread commercialization. Someday soon, they believe, it will make all kinds of vehicles safer, lighter and more comfortable.

And while Alulight's presence now is confined to a small office at the Delaware Technology Park, Delaware will be the "site of choice" for any future metal foam-producing factory, said Thomas Trendelenburg, president of Alulight of America.

Alulight's German parent company, Ecka Granules, makes the powdered aluminum that is a key ingredient in the metal foam. The powder is also used in rocket fuel, explosives, silver paint and antiperspirant, Trendelenburg said.

To make the foam, a chemical known as a metal hydride is added to the aluminum powder and compacted into a bar known as a precursor. The bar is placed into a mold and heated to near its melting point. The hydride then decomposes and releases a gas that forms bubbles in the metal. The precursor bar expands and takes the shape of the mold.

The technique was devised by Germany's Fraunhofer Institute for Applied Materials Research in the early 1990s, said William Hartman of Fraunhofer USA, the institute's American wing. Fraunhofer and Alulight later formed a partnership. Together, they have registered about 40 patents on the technique and spent over $25 million developing it, Hartman estimated.

Development continued at Fraunhofer's office at the Delaware Technology Park, and in January Fraunhofer said it had transferred the technology to Alulight of America.

Trendelenburg is charged with attracting industrial clients for the foam by drawing up business plans and producing prototypes. It can be a tough sell, Trendelenburg admits.

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William Hartman (left) and Thomas Trendelenburg demonstrate Alulight of America's aluminum foam in Newark.

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One drawback to Alulight's aluminum foam, in the eyes of many engineers, at least, is its pores. Engineers class them as defects.

"Engineers don't like pores," he said. "They call them 'defects.' A lot of endurance testing and fatigue testing has to be done before they will approve such a piece."

Compared to steel, aluminum foam boasts improved shock absorption and vibration dampening, Trendelenburg said. It's also highly fire-resistant.

The Alulight foam found its first commercial application two years ago when a European automaker started putting it in the side frames of its sports cars to help in absorbing the energy from a side collision, Trendelenburg said.

Alulight of America hopes one of its first major customers will be the American military, which is on the hunt for lighter, more fuel-efficient vehicles.

"The whole concept in the military is to rapidly mobilize anywhere in the world," said Dennis Claar, former director of Fraunhofer's Center for Manufacturing and Advanced Materials in Newark. "You can't do that with 70-ton tanks."

Claar said the foam could be built into seats, where it can absorb shock and provide fire resistance during a crash.

The foam could also be built into the outer shells of armored vehicles, when combined with harder materials that can stop projectiles, Claar said.

"This foam can't stop a bullet. It's 80 percent air. But it will help absorb a shock wave and prevent injury to soldiers and electronic components in the vehicle."

Claar now heads a spinoff company, Lightweight Solutions Inc., that plans to market the foam in partnership with Alulight.

Someday, Claar wants to sell the foam to commercial auto and aircraft makers in the United States. The foam could be used in the floors or cargo compartments of aircraft, reducing weight while providing protection against fires or explosives.

Trendelenburg estimated it would be at least two years before any manufacturing facility for the foam would be built. While Delaware is a preferred location, investors in the technology would have the final say on the facility's location.

Metal foams of various kinds have been used for "obscure military applications" for decades, said Bryan Leyda, chief engineer of Calif.-based ERG Materials and Aerospace Corp., which has put its aluminum foam in spacecraft panels.

After the end of the Cold War, the U.S. government funded studies for commercial uses of the foam and several manufacturers sprang up, Leyda said. A Canadian firm, Cymat Corp., makes metal foams using a different technique than Alulight. It's aiming at the auto market, said its chief executive, Paul Tichauer.

Hartman said the Fraunhofer-Alulight process reduces the cost of manufacturing. "There have been a bunch of companies out there trying to make metal foam successful, but no none has been been able to do it cheaper. Alulight is getting very close to doing it. ... Cost reduction is the most important attribute for getting it accepted as a commonly used material."

Claar said the Alulight foam is easier to shape and to join with other materials than the kind made by Cymat or ERG.

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