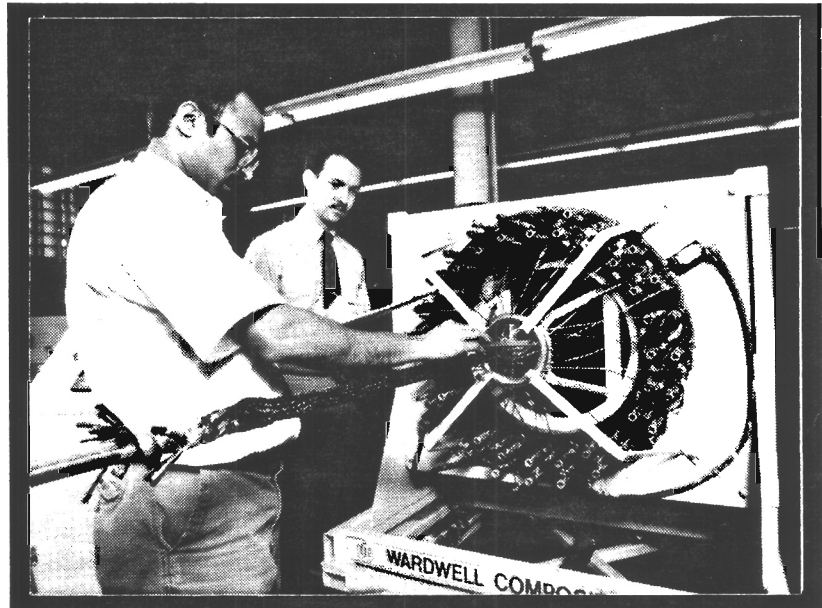


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NEW TECHNIQUE FOR PRODUCING FLEXIBLE PREPREG EXPANDS APPLICATIONS FOR ADVANCED COMPOSITES AND ENHANCES THEIR PERFORMANCE

A Georgia company has begun producing a new type of composite prepreg material which will lower the cost of manufacturing complex composite components, improve the performance of finished parts, expand the range of the material's applications -- and reduce environmental concerns.

Produced through a process developed and patented at the Georgia Institute of Technology and licensed to Custom Composite Materials, Inc., the TOWFLEX (TM) prepreg is flexible enough to be woven, braided or wound into three-dimensional shapes using automated textile



Georgia Tech doctoral candidate Al Ramasamy and CCMI's Applications Engineering Manager Tim Greene inspect a braided sample of the company's towprepreg. (Color/B&W Available)

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manufacturing techniques instead of costly hand lay-up methods.

"A major advantage of our product is that it can be processed using conventional textile production techniques, which are much more cost-effective than traditional labor-intensive processes," said Tim L. Greene, manager of applications engineering for the company. "You can weave or

braid the material to make complex three-dimensional preforms, then put them into a mold under temperature and pressure to form a consolidated part."

Part of an expanding \$700 million a year market, advanced composites are

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materials based on a reinforcing structural fiber encased in a resin matrix. Composite materials offer strength, weight and other advantages over metallic materials, but high production costs now limit their use. Two factors contribute to that cost: labor-intensive production techniques required to make complex shapes, and exacting processes for mixing resin with the fiber prior to final consolidation of the part.

The TOWFLEX material can be used to produce parts for the aerospace, sporting goods, medical device and other industries which need lightweight, noncorroding and high-strength components. The processing technique can be used with a wide range of fibers, and both thermosetting and thermoplastic resins.

In the TOWFLEX process, a spread bundle of continuous fiber called a "tow" is passed through an electrostatically-charged cloud of powdered resin. The resin adheres to the tow, which then passes through an oven to fuse the resin onto the fiber. The resulting material retains enough flexibility to be processed with standard textile equipment -- or even tied into a knot.

Once woven, braided or otherwise formed, composite structures made with the prepreg are finished through a consolidation process which melts the resin around the fibers to produce the desired solid part.

Alternative prepregging processes used for thermoplastic composites produce a stiff material which is difficult to work with, or require that fibers made from the resin material be produced and commingled with the structural fibers. Other fiber coating processes use solvents which pose environmental and storage problems.

The flexibility of the new process extends to the production line, where quick changes can be made in the fiber and resin types being combined. Many resins are available in the form of dry powders, allowing a wide range of resins and fibers to be combined to optimize composite properties for specific applications, explained Dr. David Holty, vice-president of marketing for the company.

Because the powdered resin thoroughly infiltrates the fiber bundle, the new process can improve the quality of composite components by minimizing voids left in composite structures and by ensuring uniform mixing of the resin

with the fiber, said Dr. John Muzzy, Georgia Tech professor of chemical engineering and one of the developers of the process. Cycle times are reduced and processing temperatures and pressures can be cut back, leading to significant energy savings.

Muzzy believes the new process will be especially beneficial for thermoplastic resins, which are more difficult to combine with fibers by conventional techniques than thermosetting resins. But the technique can be used with any thermosetting resin which can be ground into a powder, and even allows use of materials that now cannot be processed with conventional composite methods.

"It gives us broad material utilization capabilities with this one basic technology," he added.

By lowering manufacturing costs, the new process may expand the applications for composite components into areas where the material is now not cost-effective, said Dr. Jon Colton, Georgia Tech professor of mechanical engineering and another of the process' developers.

"Materials that cost \$100 a pound are not going to be widely used," he said. "By reducing the cost, we should be able to increase the use of composites."

The advantages of the TOWFLEX material could change the way composite components are produced by increasing the use of pultrusion, filament winding, braiding, and weaving. Engineers from Custom Composite Materials have obtained help from Georgia Tech graduate students in adapting the technology to the specific needs of customers. And two engineers recently hired by the company obtained their degrees from Georgia Tech.

Colton said the continued Georgia Tech involvement helps the researchers maintain current knowledge of the industry, and gives students experience that will help them find jobs after they graduate. The technology transfer process thus helps both the start-up company and its Georgia Tech partners.

EDITOR'S NOTE: Information about the process will be presented at the 38th annual International SAMPE Symposium in May.