Creating Composites for Lightweight Outdoor Sports Applications. By Kathlyn Swantko

A New Building Block

Coffee table made from O-ACS tubes supporting Brigand Arms AR-15 handguard strength

For more information on Open Architecture Composite Structures (O-ACS), contact Professor Royall Broughton at Auburn University, (334) 332-7136, Brougrm@auburn.edu, or David Branscomb at Highland Industries (256) 810-0570, David.Branscomb@Takata.com.

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In applications requiring strength for hard goods, composites have answered the call, with one of the earliest versions being fiberglass. While fiberglass is still in use, it is brittle and lacks flexibility. More recently, carbon fiber and carbon nanotube composites are being used. These materials are stronger and lighter weight than fiberglass, but are more expensive to produce.

Recently, Auburn University has developed a new composite material that has a variety of advantages and is also less expensive to produce. Highland Industries now holds the exclusive manufacturing rights for the new Open Architecture Composite Structures (O-ACS) under license from Auburn, and has commercialized the braided O-ACS for use in a variety of hard goods applications. These structures are lightweight, strong, can be made stiff or flexible, and are cost-effective.

The O-ACS patented technology was developed at Auburn as part of a 2008 NASA Space Fellowship, awarded to fund PhD research on minimal weight composite structures for space and aerospace vehicles. O-ACS is a composite design of optimal braided tubular structures that utilizes a maypole braiding process. The composite lattice/truss structures use yarns containing bundled carbon fiber filaments, as the primary reinforcement, to create multiple pre-impregnated, untwisted carbon fiber tows. (Neither resin infusion nor autoclave processing is required in this production.) The tows are then consolidated into a thin braided jacket or tube that maintains round cross sections. O-ACS can also be formed into more complex cross-section shapes using an over-braiding process.

Auburn's research team leaders are Dr. Royall Broughton, professor emeritus in polymer and fiber engineering, and Dr. David Beale, faculty member in mechanical engineering. Broughton explains, "Over the last two decades, we developed a new braided structure with a weave pattern identical to that produced on a triaxial loom, as well as a braiding machine for this process. Then we turned our attention to composites braiding and used a maypole braider to produce a structure which we call O-ACS."

Dr. David Branscomb was Auburn's first student on the O-ACS research in 2008, and is now the Product Development Manager of Braids & Engineered Fabrics for Composites at Highland Industries. He notes, "The O-ACS technology, in its simplest form, is a building block material suitable for a wide range of structural applications comprising shafts, beams, and columns."

Advantages & End Uses O-ACS Technology Research

The primary advantages of O-ACS are rapid parts manufacturing, along with its ability to achieve high specific material properties such as strength and stiffness, as well as lightweight, and the ability to control cost. A flexible version of the technology can also be created for a multitude of uses, and the cost can be varied to meet specific design objectives.

The architectural elements typically formed from the O-ACS lattice material can be used for such applications as light poles, flag poles, bicycle frames and wheels, hiking sticks, sporting goods, hunting and fishing products, patio furniture, and concrete reinforcing bars. Branscomb says, "Our O-ACS components can also be made using weather resistant materials, so they are ideal for outdoor products. The potential product applications are only limited by the designer's imagination."

Because the open nature of O-ACS can blend into the environment or contrast from it, long term goals include the expansion of the commercial offerings through Highland Industries to provide a broad foundation for versatile and turnkey customer solutions.