C-Lith

AREA EXPLORES THE POTENTIAL OF THE LIGHTWEIGHT, HIGH-STRENGTH MATERIAL.

Carbon fiber has unparalleled strength and lightness, but it is one of those sexy modern materials whose cost stymies its usefulness in architecture. That cost barrier could begin to disappear if architects become strategic in its use.

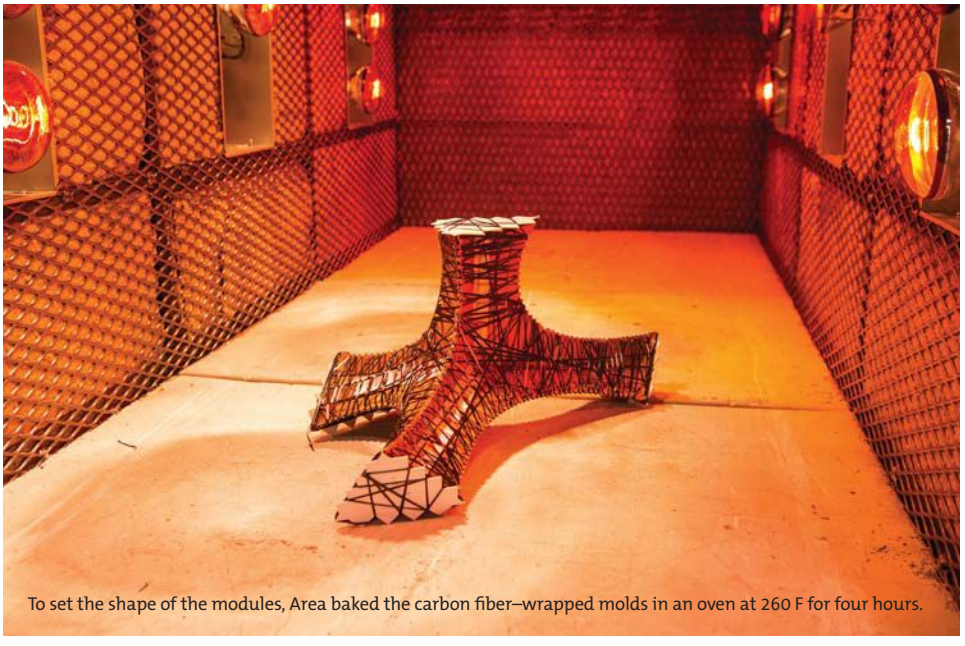
Anca Trandafirescu and her husband Glenn Wilcox—both assistant professors of architecture at University of Michigan and principals of Area in Ann Arbor, Mich.—took this approach by developing carbon fiber architectural units that can be joined to form structural framing, scaffolding, and lightweight construction. They observe that, by weight, carbon fiber is 18 percent stronger than aluminum and 14 percent stronger than steel.

Standing 14 feet tall and 8 feet wide at the base, their C-Lith prototype is a semi-cylindrical, hollow structure composed of 143 interlocking carbon fiber modules that vary in shape and size. Each unit measures about 2 feet in its longest dimension and weighs about 3.5 ounces. "Lightness has been more of a technical question for Glenn," Trandafirescu says, "but for me it is also a question of cheapness."

To make C-Lith, the designers worked with spools of prepreg, or carbon fiber filament pre-impregnated with epoxy resin to stay malleable and sticky until baked. However, prepreg must be wrapped around something to give it form prior to curing. In lieu of the metal molds that other carbon fiber researchers have used, Wilcox and Trandafirescu opted for inexpensive cardboard molds. They derived the molds' form, along with that of the C-Lith structure, from a packed tetrahedral base geometry. A computer script translated each four-sided tetrahedron into a four-pronged unit, which they cut and joined out of cardboard to make the molds.

Of course, the cardboard molds would ignite in a regular kiln, so Area built an elementary oven powered by 18 infrared heat lamps that max out at a relatively cool 260 F. After baking for four hours, the hardened carbon fiber pieces are soaked in water to remove the molds. Meanwhile, a parallel set of cardboard pieces are formed into a mock-up tower, or dummy jig. These are then swapped, one by one, for the carbon fiber components. Glued-on node plates and cotter pins connect the components, which can be quickly disassembled and reassembled.

The jurors were pleased by Area's material exploration but wanted a greater sense of purpose and refinement. "This opens the possibility of what you can do with carbon fiber, but I don't think it does anything more than be a sculpture right now," juror Gerardo Salinas said. Juror Bill Kreysler said, "This technique, which is fundamentally sound and reliable and potentially economical, could evolve into things that become more complete. And less [visually] scary."



To set the shape of the modules, Area baked the carbon fiber–wrapped molds in an oven at 260 F for four hours.

CITATION

Area sculpted the 14-foot-tall, 8-foot-wide, and 31-pound C-Lith installation from carbon fiber pre-impregnated with epoxy resin. The structure's form was derived from a packed tetrahedral base geometry.

BRIAN KELLY