DESIGN FUTURES

BRADLEY QUINN

MERRELL

LIGHTER

Robust materials are often equated with density and mass, while lightweight materials, by comparison, can appear flimsy, fragile and weak. Technological developments are reversing this norm, and it is now possible to create superstrong materials that weigh far less than traditional materials with equivalent strengths. Smaller in mass and much lighter in weight, materials derived from polyurethane elastomers, fibre-reinforced polymers, metal alloys and biomimetic substances are heralding a new generation of lightweight designs.

Materials developed for the automotive and aerospace industries include a wide range of metal alloys and high-performance fibres, many of which have found applications in other areas of design. Titanium, typically alloyed with other metals, is often used for applications where high strength and low weight are required, such as the production of lightweight parts for jet engines, spacecraft, medical implants, sports equipment and communications technology. High-modulus fibres have demonstrated unprecedented strength and surprisingly low weight ratios, and although they are flexible, they are also rigid enough to give everyday products structure and shape. Such materials are revolutionizing the way in which products are manufactured, while their low mass will dramatically reduce the energy needed to ship them to the consumer.

Carbon Fibre

Carbon atoms bond together in microscopic crystals that are more or less aligned on a long axis. The alignment makes it easy to extract long filaments from raw carbon, and the microscopic crystals present in the carbon make them incredibly strong for their size. Although a single carbon fibre consists of several thousand carbon filaments, it is extremely lightweight for its strength. Carbon fibres have the strength and resilience of metal fibres of a similar length, but weigh far less than most other strong filaments. Carbon fibres underpin many aspects of architecture and design today, often in surprising guises. Vehicles are partially constructed from carbon-fibre components, aeroplanes are made with carbon-fibre composites and sailing boats are being fitted with carbon-fibre sails. As materials scientists develop new methods of processing carbon, and engineer it to conform to fire and safety regulations, it is revealing its potential to be an essential material for the future.

Concrete Cloth

The use of architectural textiles is rising annually, with applications ranging from commercial and residential buildings to military camps and open-air concert venues. It is likely to be a growth area with the construction industry, in which the use of the groundbreaking cement-impregnated fabric known as Concrete Cloth is becoming more widespread. The creation of Welsh firm Concrete Canvas, Concrete Cloth is pliable and easy to work with, and can be moulded by hand and readily set into shapes. It makes the construction of strong and stable structures simple, efficient and quick

TOP
Concrete Canvas broke new ground when it developed the material known as Concrete Cloth. Made from fibres impregnated with dry concrete, the cloth hardens to form a solid concrete surface when it is sprayed with water. Its many applications range from the building of retaining walls to ditch lining, as shown here.

BOTTOM LEFT
Lightweight and extremely strong, carbon fibre is an ideal material for sports equipment. Carbon fibres are as flexible as they are durable, acting as shock absorbers in the event of an impact.

BOTTOM RIGHT
The Vienna-based practice Veech Media Architecture has designed a number of inflatable textile structures in response to commissions for lightweight portable architecture. The roof of this dome-like portable textile pavilion was designed with ventricles in the roof to promote the circulation of cool air inside and to enable hot air to escape.

Although Concrete Cloth, the innovative construction material produced by Concrete Canvas, has many uses, it was originally developed for the shelters shown here. Lightweight and flexible, the cloth is bonded together to form dome-shaped, tent-like structures. Once erected, each structure is sprayed with water and left to harden, resulting in a shelter strong enough to be used as a military bunker.