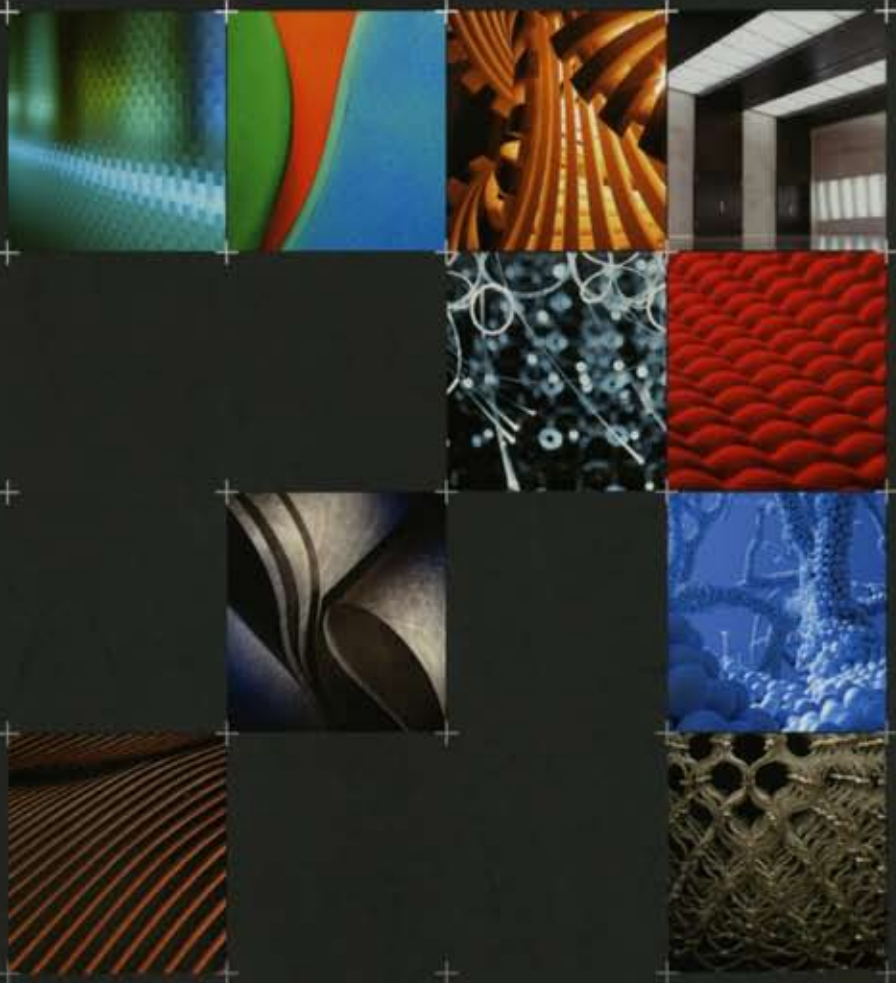

ULTRAmATERIALS

How materials innovation is changing the world

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edited by Bradley Quinn

Thames & Hudson

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MATERIAL INTELLIGENCE

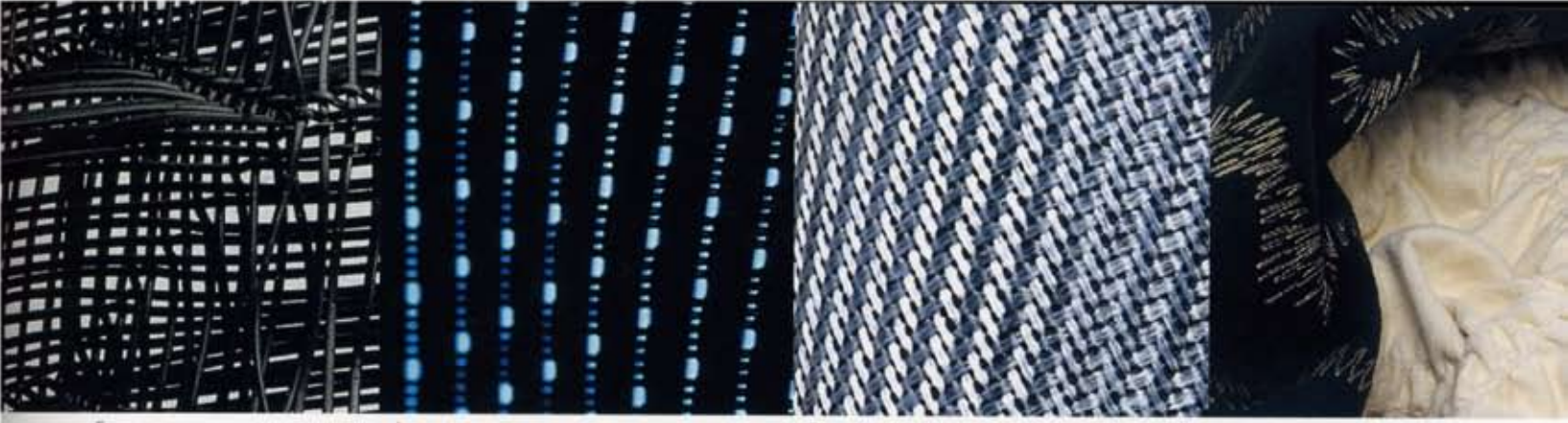
BRADLEY QUINN

PREVIOUS PAGE The extruded aluminum modular sections of Mathias Bengtsson's award-winning Modular Aluminium Bench were originally coated in chrome. This new version, produced in 2006, is coated to create a white finish. The coating is formed by giving the powder a negative charge and spraying it onto the positive-charged surface. The entire chair is then heated, causing the powder to sinter into a strong, protective surface.
1-8 Architecture and design utilize virtually all known materials. As high-tech metals meet today's technology, new hybrid materials emerge that work as well in cutting-edge fashion as they do in body-conscious buildings. Light has been redefined as an aesthetic technique to give materials expressive subtleties, yet also creates lasers and new cutting processes.
OPPOSITE Just like yarns and filaments, separate strands of carbon fibres can be woven, bundled or braided into ropes and cords. This detail from Mathias Bengtsson's Spun chair reveals that when woven in a continuous pattern, carbon fibres can also create a seamless mesh.

The worlds of materials and design are merging. At the dawn of the 21st century, materials advanced to become more adaptable, tactile and empathic, and the demand for objects with sculptural, aesthetic and multi-functional qualities rocketed. As high-performance materials were reconceived as immersive webs, structural networks and technological interfaces, their ability to engage with the built environment resulted in a whole new paradigm of design. Today, the carbon-fibre matrices, woven wooden panels and metallic meshes of contemporary architecture have more in common with the high-tech filaments of techno fashion than they do with modernist monoliths. Membrane skins and pneumatic structures are as common in furniture design as they are in interior design and textiles, while tactile fibres and triaxial weaves are aligning vehicle design with public artworks. From the traditional to the intangible, from the technical to the tectonic, the exchanges taking place between materials and design are forging a uniquely multi-disciplinary arena.

Many advanced materials have fluid properties that engineers can synchronize in order to suit a product or environment. Interactive materials, such as photochromatic pigments that change colour when subjected to daylight, light-emitting electroluminescent films, shape-changing polymeric gels and shape-memory alloys eliminate the need for technological triggers. The discovery of polymers, the invention of nanotechnology and recent developments in biomimicry have created the most technologically advanced materials imaginable. Yet, few new materials have proved their worth, because relatively few practitioners have been able to put them to the test.

By investigating the works of key practitioners in architecture, interior design, fashion, textiles, furniture design, vehicle design and the arts, this chapter reveals many of the breakthroughs, obstacles, victories and challenges these practitioners experience. As today's generation of materials change how the human body is experienced and how the urban environment is built, they reveal their capacity to transform our world today more dramatically than any other time in history.



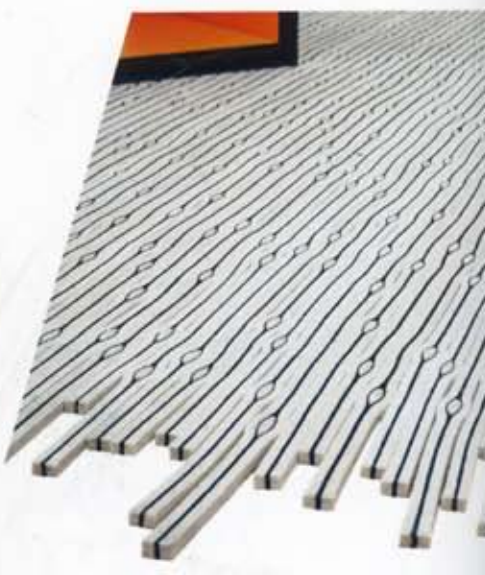
5 6 7 8

This natural fibre rug has a deep pile height. These 100 per cent New Zealand rugs are woven using felted wool loops in ten patterns. They are backed with a woven jute and cotton mat and are class 1 (class 2 in some cases) fire rated. They are woven 3.66 m (12 ft) wide with a pile height of up to 70 mm (2¾ in). The rugs can be used for residential interior flooring, although they are not recommended for stairs. 4791-03

Felt-based fabrics like the above example offer sound absorption, tactile effect and unique visual appeal. The fabrics are handmade from 100 per cent wool felt and woven wool, and incorporate patterns created by twisting and/or stitching different pieces of fabric together. The textiles are sold by the square metre and are available in a standard range of colours and textures. Special orders or commissions are also available with four to six weeks of lead time. The textiles are naturally fire-retardant. Current applications are for wall panels, window blinds, cushions, blankets, ottomans and upholstery. 5453-01

There has been a great push towards more sustainable packaging materials. This corn starch-based, biodegradable packaging foam is one attempt. The foam is extruded into sheets for protective packaging applications and completely dissolves in water. It is available in one colour (off-white) in sheets up to 610 x 1524 mm (24 x 60 in), with thicknesses ranging from 12.7 to 50.8 mm (½ to 3 in). This foam is available at a similar or lower cost than comparable petroleum-based polymer foams. It is water soluble, readily biodegradable and assimilated by soil micro-organisms as food. 5558-01

ABOVE + BELOW
Strips of felted wool are adhered together in this material using a polyester woven backing to create a flexible sheet, and are typically used for carpeting. There are over thirty colours of strip, and the resulting flexible mats are non-flammable, water repellent and breathable; and the mat may be dry-cleaned or wiped clean with a damp cloth. Individual damaged strips can be easily replaced. 5304-01



1 5 2 6 3 7 4 8

POLYMERS

1 These thermo-plastic elastomers can be overmoulded onto nylon and have been developed to bond onto a broad range of nylon grades. Applications are for kitchen utensils, gardening equipment and tools.
2 This hand-loomed 100 per cent recycled rubber rug is made from recycled bicycle tubes woven onto a wool backing.
3 This laminated resin incorporates a decorative inner layer. Applications include partitions, windows, lighting and furniture.
4 This broadband sound- and heat-absorbing insulation is made from recycled polyester fleece and can be used for vehicle and construction insulation.
5 Based on the colour illumination of the Morpho butterfly wings, this decorative, self-illuminating filament is composed of nylon and polyester and has applications for pigments in coatings for cars, sports goods, cosmetics and printing.
6 Natural (wool) and synthetic (nylon) fibres from post-consumer carpet scraps are bonded using a synthetic resin to create rigid panelling for construction.
7 This high-pile, laser-cut faux fur is used to create 3-D patterns. Applications include interior decoration and apparel.
8 This decorative nylon fabric is semi-transparent and tear-resistant and is used for residential drapery.

The latter part of the 20th century could justifiably be described as an age of plastics. Although usage of all other materials continued to grow throughout that period (and still does), it has been nothing compared to the explosion of the use of plastics and the proliferic creation of various types of this versatile material. The number of different plastics now runs to tens of thousands, and there are very few areas of our lives that are not awash with the stuff. In many ways this has been a boon, with so much of our daily lives made better through the use of plastics that are lighter, smaller, softer, less expensive, safer and more colourful than alternatives. And although it is unlikely that our use of polymeric materials will lessen in the years ahead (indeed they will probably continue to replace other materials in many applications), the source for polymers most likely will.

Yet as we start to see the beginning of the end for the oil-based economy, so the same is feted for these plastics, thanks to the fact that ninety-five per cent of plastics are derived from oil. As oil becomes more expensive, so do the plastic raw materials, and low cost has always been one of the major advantages for polymers in the past, as well as one of the main reasons for their massive increase in use over the last thirty years. This price increase has forced manufacturers to look elsewhere for low-cost alternatives, with one area that appears to offer a promising future being biopolymers.

Though still very much in its infancy, this category of materials has the great advantage of having a raw material that can be grown rather than extracted, thereby offering an annually renewable resource; so long as there is soil, rain and sun, these biopolymers can be easily produced. Possibly one of the most amazing images to illustrate this process shows tiny polymer pellets growing inside a plant structure designed by Metabolix, a company developing PHA polymers from sugar.

The changeover from oil-based to plant-based plastics will be a gradual one though, and innovations within existing plastics technology continue to enable the next generation of products to be a step ahead of the last. Noticeable advances have

ABOVE + BELOW
This laser-cut faux fur is used in decorative applications. High-pile, faux-fur fabrics are laser-cut to create 3-D patterns. The faux fur is 100 per cent acrylic with a cotton and wool backing. The fabrics are available in five standard colours as well as custom colours. Applications include interior decoration and apparel. 5304-02

Combining monofilament and proprietary fibres to create a translucent fabric, this fabric includes a decorative Nylon monofilament and a patent-pending transparent polymer fibre woven together to incorporate additives to give increased UV-resistance. Possible applications for this textile include window treatments, as panel fabrics and for lighting. 5032-01

Produced with minimal impact on the environment, this velvet fabric is manufactured from 100 per cent wool from New Zealand and a cotton backing, both of which have been tested for pesticides and other harmful substances. The fabric is then coloured (five colours available) with dyes that contain no heavy metals and are purported to be the lowest impact dyes on the market. 5255-05

This self-supporting woven textile is used for office chair upholstery. The open weave, mesh fabric is elastomeric in one direction with the other direction providing colour and pattern. Able to withstand over 181.5 kg (400 lbs) in weight with complete recovery, the textile is comprised of 76 per cent flame-retardant polyester and 24 per cent nylon, the textile withstands 90,000 double rubs on the Wyzenbeek test, passes the California Technical bulletin 117 for flammability, and is colourfast. 5423-01