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## **Miracle fabrics - but cost and complexity keep most off the market**

What if someone invented an "invisible fabric" - material that would be camouflaged by projecting an image of whatever scene shifts behind it? Imagine how a designer might use this optical illusion if, say, a dress's outer edges could be made "invisible," producing extreme silhouettes that were not previously possible.

No longer would the designer be limited to a body's measurements for garment proportions. If such "invisible panels" could make a woman appear far slimmer than her real figure, imagine how much they would be worth to the brand that trademarks the method.

Susumu Tachi, a professor at the University of Tokyo, unveiled exactly such a camouflage technique, called the Transparent Cloak, five years ago, but the fashion designer needed to apply this retroreflective technology has yet to materialize.

A host of high-tech developments has recently come out of scientific laboratories, start-ups or academic researchers in need of the kind of experimentation, refinement and craftsmanship that only fashion's most talented designers can give. The fact that many of these innovations often emerge from chemistry, engineering or other fields - far from the sound of stilettos pounding on a runway - means that, aside from very notable exceptions, few of these prototypes and trial technologies have been made into products.

"Contrary to popular belief, the fashion world is, in fact, quite conservative," says Suzanne Lee, author of "Fashioning the Future: Tomorrow's Wardrobe," which features Tachi's invention and other pioneering discoveries. "In such a highly competitive and high-stakes industry, it doesn't pay to be too far ahead. Just far enough to be seen to push boundaries, but not so far as to alienate consumers."

And while the fashion establishment can be slow to catch on, the greater public can be even more plodding. "Both investors and consumers prefer small leaps to great bounds," says Lee. "Fashion by its very nature is transient. There is no incentive to invest in ideas that have any longevity."

But at least one famous name does check all the boxes. Over the last year, Hussein Chalayan has been exploring the use of embedded microcomputers, engineered pulley systems and electroluminescent textiles to create dresses that can change shape or display abstract light-emitting diode (LED) films through their fabric.

"Ironically, the hard thing is working with companies or organizations that actually can help you develop these related technologies," Chalayan says. "You can only do them as prototypes and when you try to produce them on a bigger scale, you're limited because then the manufacturers don't want to take risks."

So Chalayan's creations, which mutate from 21st-century interpretations of iconic Edwardian restraint into liberated flapper-era party dresses with the flick of switch, are relegated to catwalk gimmicks. Even though he has collaborated with one of the world's

most eclectic prototyping studios to produce the samples, he has yet to find a manufacturer capable or willing to adapt them to ready-to-wear.

The technology, which is embedded into corsets and pads under fabric, is still cumbersome, but without further experimentation by fashion designers and manufacturers, a more streamlined version for repeat production will remain elusive, according to the studio that turned Chalayan's sketches into catwalk outfits, 2D3D.

"I don't think anybody could take it on as it stands. It would be too expensive and too labor intensive," says Rob Edkins, director of 2D3D, a London studio that built Chalayan's prototypes and that normally works with automobile and furniture companies. "Until it's more cost effective, they will have to stay one-offs. Eighty percent of our costs to build the show samples went into the research and development."

Costs vary widely, but, for example, Tachi has said that the research and development cost of his cloak material was about \$3 million.

The Catch-22 facing designers is that the only way to bring down the cost of such experimental garments would be increasing investment in research and development, something most do not have the budgets to do. But cost is not the only prohibitive factor.

"Fashion aesthetics are quite complicated and usually retrospective rather than prospective, more backward looking than forward thinking. So it's unlikely that everyone would get on the technological bandwagon," says Chloe Colchester, author of "Textiles Today: A Global Survey of Trends and Traditions."

Lee agrees: "Designers tend to be more akin to artists than engineers and this means research tends to focus on the aesthetic end of the scale not the technical."

The designer Paul Smith, says: "The fabrics that we use are for everyday use, mostly in cities, so generally speaking we don't tend to be using high-tech fabrics. The only area that I would specifically look to use these fabrics would be maybe in my jeans line and elements of casual clothing in some of my other lines.

"The exciting thing for us has been the fact that we have managed to replicate traditional-looking British fabrics, for example to look like tweeds and checks but in technical fibers, creating a performance material."

According to a 2004 report by the Brussels-based European Apparel and Textile Organization, investment by European clothing companies tends to focus on non-technological innovation and "most textile and clothing companies have no permanent R&D personnel or departments and no regular R&D budgets."

Some businesses beyond fashion's epicenters are venturing into the field, however. Most begin with a focus on functional advantages in clothing, like health benefits or improvements in fabric care.

Grado Zero Espace is a spinoff of the independent Italian fashion label, Corpo Nove. Like 2D3D, it works as a research and development intermediary for fashion brands and other design fields. For example, Hugo Boss and Dolce & Gabbana have commissioned Grado Zero Espace for special projects in the areas of technical support for clients like Dolce & Gabbana and athletic sportswear.

And the company, using its expertise in military and aerospace technologies, has created an "Oricalco" shirt with a "shape memory" alloy in the fabric. The alloy helps its draping quality and exposure to a little bit of heat will cause a wrinkled Oricalco product to pop back into shape. What's more, its sleeves can extend or contract automatically when one's environment reaches a certain temperature.

The company also has created prototypes of coats with super-lightweight Aerogel insulation, considered to be the best insulator in the world.'

And two years ago Textronics, a U.S. company based in Delaware, introduced the

NuMetrex Bra, which can monitor heart beat and respiration through a second-skin layer of fabric. The bras retail for around \$50 and are sold in sportswear and fitness shops around North America.

Nanotechnology, which involves enhancing or modifying materials at the atomic level, is one field that has begun to generate some striking textile developments. It has led to biomimetic, or mimicking, textiles with a nanotechnology finish that can replicate the properties of different materials found in nature - like spider's silk (five times stronger than steel) or a lotus leaf (which can repel water, oil or honey).

D3O, a British company, has produced impact-resistant fabrics worn by the 2006 American and Canadian Olympic ski teams. The so-called "intelligent molecules" allow the fabric to move with the wearer but then "lock up" on impact for protection.

While practicality usually is a low priority for couturiers, avoiding a nasty caviar stain or bruises from a dance-floor fall could be attractive to the woman who paid six-figures for a ball gown.

The Swiss textile company Schoeller recently introduced 3XDRY fabrics, said to reduce perspiration marks, cool heat-prone areas and repel certain stains through so-called NanoSphere finishes. Similar products from an American rival, NanoTex, already have been exploited by major brands like Perry Ellis, Brooks Brothers, Hugo Boss and Adidas for suits and separates.

Entirely new subdisciplines have cropped up in recent years from the crossdisciplinary approach of these technologies, like "fabriceuticals," the mix of textiles with health products or medicines. International Flavors & Fragrances, in its collaborative range with Lycra, called Lycra Body Care, has invented a microencapsulation delivery system for textiles, called SensoryPerception, that allows fragrance or active ingredients like aloe vera or vitamin E to be released over time.

Designers in the cutthroat game of finding new ways to make their products more luxurious could, with such new methods, add aromatherapy, skin moisturizing and anti-cellulite claims to their ad slogans.

Another unlikely source of ideas is from the stark labs of bioengineering. Bioactive textiles and fibers containing living bacteria are being developed to be self-cleaning, odor-eating or even healing. As far back as 1997, the Belgian designer Martin Margiela collaborated with a microbiologist to create a decorative decay effect by introducing bacteria to cotton in his collection, and Hussein Chalayan's renowned graduate collection of decomposed silk also touched on this concept.

E-textiles conduct electricity so that fabrics can act as conductors, switches, sensors, transistors, antennae or displays. Interactive "wearables" that house iPod controls already are part of the public's lexicon thanks to British companies like Eleksen, whose ElekTex fabric has been used by Zegna Sport and Marks & Spencer in jackets and coats.

According to experts like Lee, probably the most appealing kind of gadgetry out there for designers right now is electroluminescent fiber optics, which have an obvious ornamental benefit. Light-emitting textiles, like those created by the Italian firm Luminex, are beginning to appear in the collections of up-and-coming designers like the Antwerp-educated, Chicago-based Anke Loh, whose line includes dresses and separates.

Here, the light source is from the textile fibers themselves rather than an LED (light emitting diode) screen emitting through fabric (as seen in Chalayan's recent autumn/winter collection).

The latest generation of LEDs don't compromise a fabric's supple texture with overly intrusive hardware and harness light in a more sophisticated way than their precursors. Loh's surreal dresses, using the Lumalive fabrics of the lighting giant Philips, have the potential to display as many as 16 million colors in a removable, flexible panel sandwiched between layers of fabric.

Like Chalayan, Loh's spirited effort to incorporate the most cutting-edge dimensions of fashion into her Chicago brand actually underlines the reluctance of bigger names to take on similar challenges. Are the luxury titans in Paris, New York and Milan impediments to progress because of prohibitive costs and the rapid-fire pace of the business, or do they simply have technophobia?

"Yes and no," says Lee. "In some ways fashion is still terribly antiquated - manufacturing clothing in much the same way as we did centuries ago. On the other hand, fabric innovation and manufacturing techniques borrowed from sportswear design constantly filter into fashion, reinventing what fashion can be."

Although the precedent may be there in designer sportswear, what is needed to stimulate grander fashion breakthroughs are more partnerships between high-tech pioneers and the creative personalities behind fashion brands.

"I think that when it is 'off the shelf' and easy to implement, designers are happy to embrace new things," says Lee.

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