Cl + UV x H_20 = a pool of technology

It could be argued that swimwear has done a full lap in terms of its development and fashion. Swimwear fashion over the centuries is a story of extremes. In ancient times people generally bathed naked, whilst in the 18th century women wore long bathing gowns with weighted hems to ensure that they maintained their modesty. The idea of covering up in the pool or sea was literally 'blown out of the water' with the large scale appearance of the bikini in the 1960s and nowadays it seems that 'anything goes' as swimwear ranges from the tiniest string bikini to all-in-one competition suits. One thing that is not open to debate, however, is the advances in technology that have transformed the swimwear industry into one of the most technically advanced areas of sporting apparel.

Keeping in shape

As a large majority of swimming takes place in pools rather than the sea, chlorine resistance came to the fore in terms of desired functionality for swimwear.

Creora brand spandex—developed by the second largest spandex producer in the world, Hyosung Corporation, based in Korea—offers chlorine resistant spandex (H250) that is well-suited to the swimwear market. This environmentally friendly chlorine resistant product has been developed to protect against fabric damage resulting from swimming in and washing with chlorine and works to maintain the elasticity of spandex and deliver lasting fit to the consumer. French mill Sofileta combines Creora H-350 elastane with polyester in its swimwear and sportswear. H-350 offers high heat resistance, improved wash fastness and chlorine resistance.

The invention of Lycra by DuPont (now Invista) is often viewed as a breakthrough in swimwear. Prior to this, swimwear had been manufactured from wool, silk or rubber, and even linen, none

Australian swimmer Ian Thorpe models adidas' JetConcept suit.

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of which were in any way ideal. As Lycra could be combined with nylon, polyester and many other fibres, it enabled swimwear designers to create suits that could be fitted and which retained their shape in and out of the water.

Since its commercialisation in 1962, Lycra has become a household name, and there are now many variations of the branded spandex fabric to suit the wide ranging uses for it. The latest development for swimwear is Lycra Xtra Life which is said to resist chlorine and pool chemicals and helps suits avoid bagging and sagging due to standard chlorine degradation, offering between five and ten times the durability of conventional elastane—even after 80 hours in chlorinated water.

A number of European mills and garment manufacturers are now using Lycra Xtra Life in their fabrics including Italy's Eurojersey. It supplies well-known names such as Sloggi and Speedo with its Sensitive fabric which incorporates an innovative blend of Meryl polyamide microfibre and Lycra stretch fibre. This fabric is said to be 25% more resistant to chlorine compared with other fabrics and twice as fast to dry compared with normal "charmeuse" fabrics. It also provides high UV protection, and has been tested according to Australian solar protection standards.

Stretching the boundaries of resistance

Most of the major brands now incorporate chlorine resistance into their swimwear but one company, Dow Fiber Solutions — a business unit of the Dow Chemical Company — has gone one step further and has developed what it claims to be the first inherently chlorine-proof stretch fibre, Dow XLA CP. This olefin-based fibre is naturally resistant to harsh chemicals and resists degradation due to exposure to UV light, sunscreen, heat, and chlorine, whilst offering the level of fit that is demanded by today's consumer.

According to Brad Miller, commercial director for Dow Fiber Solutions, "Nearly 70% of women rank 'fit' as the most important attribute when choosing a bathing suit, but historically swimwear fabrics break down as a result of either chlorine or the combination of UV light and suntan lotion. As these fabrics break down over time, the consumer sees a change in the shape of the swimsuit, such as bagging and sagging."

As the properties are inherent in Dow XLA CP fibre, it is also durable and can resist harsh chemicals longer than many host fibres. In fact, it is said to maintain its functionality for over 1,000 hours of testing at 3.5 ppm of chlorine at room temperature.

Staying dry in the pool

Although it may appear to be somewhat of an oxymoron, dryness is extremely important in the swimming pool. Modern swimwear not only has to withstand the rigours of a wet, chemical environment, it also needs to be manufactured from quick-drying materials so as to improve comfort on emerging from the water. Let's face it, sitting around in a damp, soggy swimsuit is not a pleasant experience. This has led to a number of new developments in fibre and fabric technology in the swimwear market.

Spanish fabric manufacturer Kanui has developed a special fabric blending Creora's H-450 spandex with polypropylene that can be used in swimwear, intimate apparel and sportswear. It combines the stretch and fit of spandex with the hydrophobic, water-resistant properties of polypropylene to produce quick drying, fitted swimwear.

To sum it up, "The fabric is quick drying, comfortable, soft to touch, with no chemical absorption and water resistant for swimwear," says Vicente Mico, general manager at Kanui.

Bathing safely in the sun

With the continued rise in the number of incidents of skin cancer, UV protection has become a focal point in all outdoor and sports apparel. As swimwear is often worn on the beach or by the pool in hot climates, putting UV protection into swimwear has become a 'hot' topic.

As skin cancer is a particular worry in Australia, many developments have emerged from Antipodean producers in this sphere. One such company is Stretchtex, which supplies fabrics to Speedo and also provided fabrics for adidas' range for the 2006 Commonwealth Games. Its chlorine resistant fabrics ChlorobanT and Aquamax T are both certified to UPF 50+ in accordance with Australian and New Zealand standards AS/NZS 4399 1996 demands. Not only have the company's fabrics been approved by the Australian cancer council and approved by the Authority of Australian Radiation Protection and Nuclear Safety (ARPANSA), the company has gone one step further and has been accredited by ARPANSA to test fabrics produced by other manufacturers.

The developments in UV protection in swimwear have also led to other developments. The Speedo brand, which is synonymous with swimwear, has used the know-how it has gained in integrating UV protection into its swimwear to expand its product offering into children's beachwear and adult apparel ranges with UV protection.

With the global swimwear industry bringing in upwards of $12.65 billion annually and the demand for a stretch product that resists chlorine degradation higher than ever, Dow Fiber Solutions developed Dow XLA CP – which is said to be the first-ever inherently chlorine proof stretch fibre.

Dow Fiber Solutions

Like a fish in water

The level of technology achieved in swimwear is clearly visible in the competition pool. The big brands launched groundbreaking technologies in time for the 2004 Olympics, and these have since been improved and tweaked to enhance performance further still.

The Speedo brand has been one of the leading forces in technical advances in the segment. Its Fastskin technology was launched in 2004 and the company has since evolved the suit further to produce its latest offering of the Fastskin FSII.

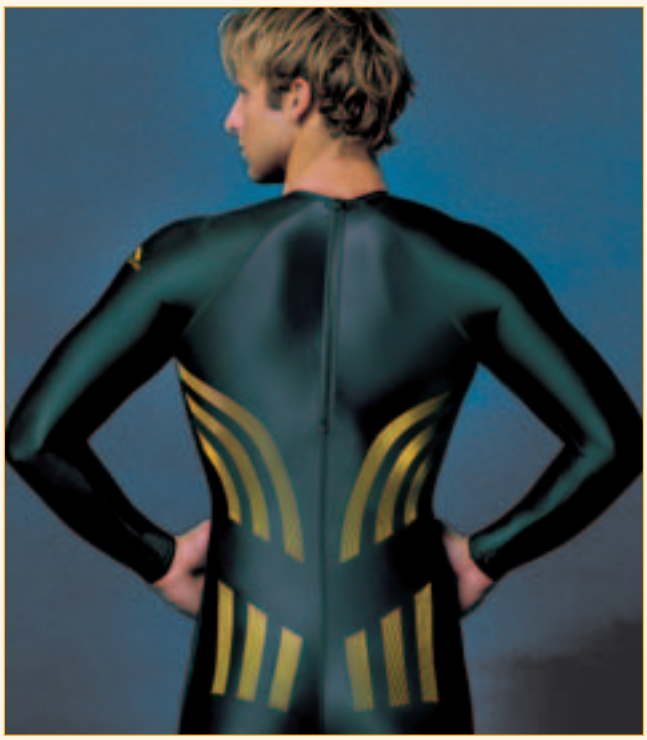
The result of four year's work at Speedo's research and development headquarters, known as Aqualab, in conjunction with the Natural History Museum in London, the design emulates the skin texture and feel of a shark's denticles to increase speed by reducing passive drag.

This resulted in the development of a full 'Bodyskin' with different fabrics on different parts of the body, to optimise the flow of water around an athlete's body and allowed Speedo to create male and female specific and stroke specific swimsuits for the first time, which is said to reduce drag by up to 4% compared with other leading brands.

Flying high

Adidas' JetConcept suit, as worn by Ian Thorpe, was inspired by the dynamics and V-shaped grooves used on jet aircraft to reduce drag and friction. Using a combination of Lycra stretch fabric, adidas' Second Skin Fit, flatlock seams and strategically placed ribbed panels, it is designed to control the flow of water over the body.

Ribbed panels positioned from the underarm to the lower back and across the bottom channel the water over the swimmer's back to reduce the amount of 'dead water' carried over the back; Lycra Power materials increase speed and endurance by using compression by holding the body better in the water, stimulating skin receptors and improving blood circulation; the brand's 'Second Skin Fit' provides flexibility and freedom of movement by preventing water from penetrating at the neck, wrists and ankles thus reducing water retention; and finally strategically placed flatlock seams



In the adidas JetConcept suit riblets channel water over the swimmer's back to reduce drag.

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reduce water drag and add comfort. This mixture of fabric technologies and design features channel water more efficiently over the swimmer's back, reducing drag, streamlining movement and cutting turbulence and is said to be able to improve the swimmer's performance by up to 3%.

UK-based Mera swimwear also uses Lycra Power in its EXS range of compression swimwear, which is said to improve performance by as much as 30%. Designed to work in harmony with the body, EXS reduces muscle vibration which reduces muscle fatigue and, following rigorous testing, has been proved to improve total force and power production by 12% on average.

Floating in a sea of fakes

It is not only the swimwear itself that has to stand up to the rigours of chlorine.

Tagging is a vital part of the industry today as in today's competitive environment it is each individual brand's technology which sells its swimwear to consumers—especially since the advent of cheaper imports from the Far East, and other producers, and the significant increase in the number of counterfeit products appearing on the market. However, despite the necessity of tags to identify brands, labelling swimwear poses possibly the biggest problem for performance apparel manufacturers, as consumers refuse to wear products which have large, bulky tags or labels.

In response to this Avery Dennison has developed ComfortTag heat transfers to allow manufacturers, retailers and brand owners of

Avery Dennison Comfort transfer tag.

Avery Dennison

swimwear and water activewear to identify their goods on the market.

What is interesting about these tags is that they meet the same standards for chlorine and salt resistance as the swimwear itself, having been proven by third party testing to meet salt

Plain sailing

Arena has also incorporated 'riblet' technology into its Powerskin Xtreme suit, inspired by the technology used in the aeronautical industry as well as in the construction of racing yacht hulls for the America's Cup.

Arena began its quest to design a new suit by again focusing on data relating to water drag and fluid dynamics. Further studies were run concerning the bio-mechanical movements of bodies in water, even the microscopic characteristics of the skin structure, covering humans through seals and dolphins to even octopuses, as well as specific attributes of some of the most advanced artificial surfaces, specifically designed for delivering superior gliding performances.

Arena Engineers and scientists from the M.O.X Institute of the Polytechnic Engineering University, based in Milan, came to the conclusion that the best way to increase the effectiveness of a competition swimsuit was to apply a specific structure on the surface of the 'Powerskin' fabric using 'riblets'.

The riblets on the surface of the fabric trap microscopic water molecules. This creates the effect of water moving over water, therefore reducing the vortices typically created on smooth bodies moving in water. This allowed Arena to reduce the three main types of drag – frictional, pressure and induced.

The result is a lower drag and increased speed

The suit also provides improved muscle compression through the use of a second fabric, placed along the side of the torso and twisting around the swimmer's legs to fit the ergonomic characteristics and the bio-mechanics of the swimmer's body in movement. This Body Alignment System by Arena delivers intelligent muscle compression to the torso and leg zones while still allowing optimal blood circulation, slowing the build up of lactic acids in the swimmer's body, and at the same time reducing the muscle vibration during the swimming performance.

However, whilst requiring muscle compression, swimmers also need freedom of movement, especially in the knee zone which is particularly important during the turn, and whilst swimming breaststroke as limited flex around the knee zone speeds up the onset of fatigue and reduces the effectiveness of each kicking stroke. Arena responded to this by introducing an ergonomic panel, made of a third fabric, to create superb flex and compression around the knee zone.

The result was Powerskin Xtreme which delivers higher speed through the use of a new fabric that creates an improved gliding effect through water, jointly developed with one of the world-wide leaders in the creation of technologically advanced fabrics.

Alena Popchanka sporting Arena's Powerskin Xtreme suit.
Arena

and chlorine durability requirements established by the American Association of Textile Chemists & Colorists.

"What this means is that marketers can now convey brand on swimwear and water activewear with heat transfers that have passed every major test for durability and retention of image quality," says Mark Hansinger, Avery Dennison Retail Information Services marketing director – Apparel Labelling. "This opens new vistas for marketers because the product combines the comfort of soft heat transfers with the durability of more conventional labelling, such as woven and fabric labels. Accordingly, they are highly versatile. ComfortTag heat transfers can be produced in every Pantone and process colour, and they present images with faithfulness to original artwork even on rough fabric such as denim."

Avery Denisson has now taken this technology one step further with the addition of ink-based, covert (non-visible) security technologies that defend against counterfeiting and diversion. The technologies include an option whereby security ink is loaded with a DNA component.

It has been designed to complement overt security techniques, such as microline coding, which entails the application of codes in microscopic print.

"Brand owners can now choose to identify their merchandise with the high definition and brilliant imaging of ComfortTag heat transfers without sacrificing the covert security they enjoyed with more conventional labels," says Sharon Dalton, product marketing manager. "Or they may opt to employ a combination of overt and covert securities or periodically switch from one security technology to another. Loss prevention experts advise switching security technologies or changing the location of security devices at least once every year to help thwart counterfeiting. The use of additional security devices, such as security-enabled hang tags, is yet another way to enrich the security mix."