

Smart, Interactive and Technical Textiles

The future of fibres & fabrics

Learning Objectives

- To explain the terms:
 - Smart Textiles
 - Technical Textiles
 - Interactive Textiles.
- To be able to give examples of the above.
- To create a model of a textile product that uses this technology

Technical Textiles

- Technical textiles are fibres & fabrics which have been developed for their performance, and functional properties.
- They are often made of microfibres (synthetic fibres up to 60 times finer than human hair)
- Technical Textiles are all around us.

Uses

Building Industry
Agricultural Industry
Medical Industry
Transport Industry
Armed Forces
Police
Performance Sportswear

Smart Textiles

Smart textiles can sense, react & adapt to the conditions around them.

For example, they can react to:

- Hot or cold temperature
- Light
- Pressure
- Moisture
- Time

Some smart materials meet a real need & have been developed for specific functions. Others are more of a novelty design feature.

Uses

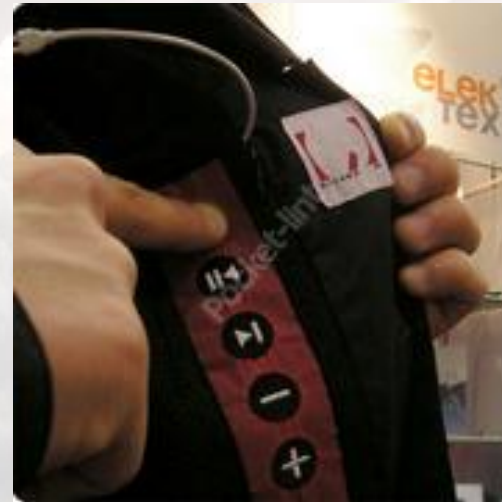
Novelty clothing
Protective clothing
Safety equipment
Medical textiles
Military uses
Anti-allergen products
Baby products

Interactive or Electronic Textiles

Interactive textiles, fabrics and materials contain electrical circuits or conductive fibres that enable them to conduct electronics and power so that we are able to communicate and work through the use of smart textiles. Interactive textiles have advanced from miniaturization of computers to the development of computers integrated into garments and textiles. The power needed to operate the devices can be in the form of solar power, battery and human power. They are referred to as: **Intelligent clothing and wearable electronics,**

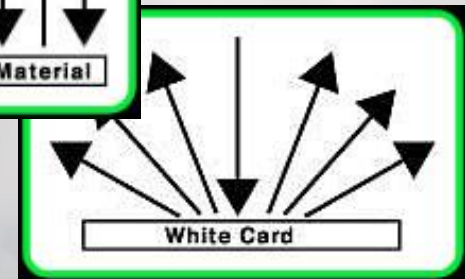
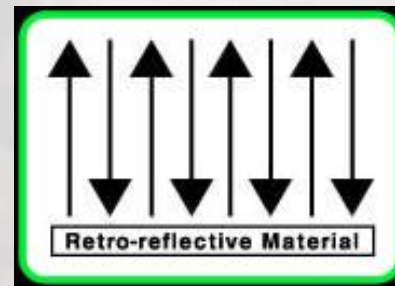
Most wearable electronic garments/items available on the market feature either permanent or removable electronic functions. This concept has its use; however the ultimate breakthrough in wearable electronic is the full integration of electronics into fabrics from which clothing can be made.

PURPOSE: to aid communication or detecting locations.

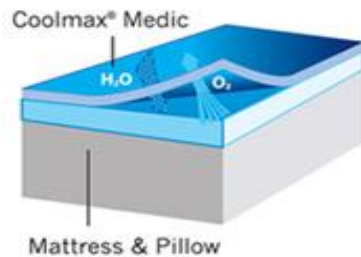
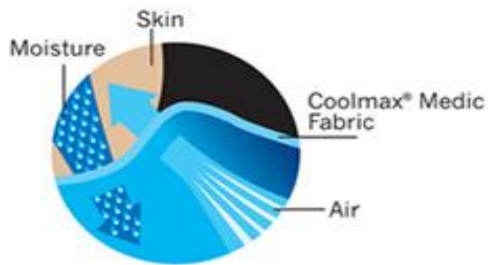


Technical Fabrics used by the Armed Services and Police

- Kevlar - used in body armour / bullet proof vests.
- High Visibility jackets use strips of 3M retro-reflective tape. This works by concentrating the light source & reflecting it back.

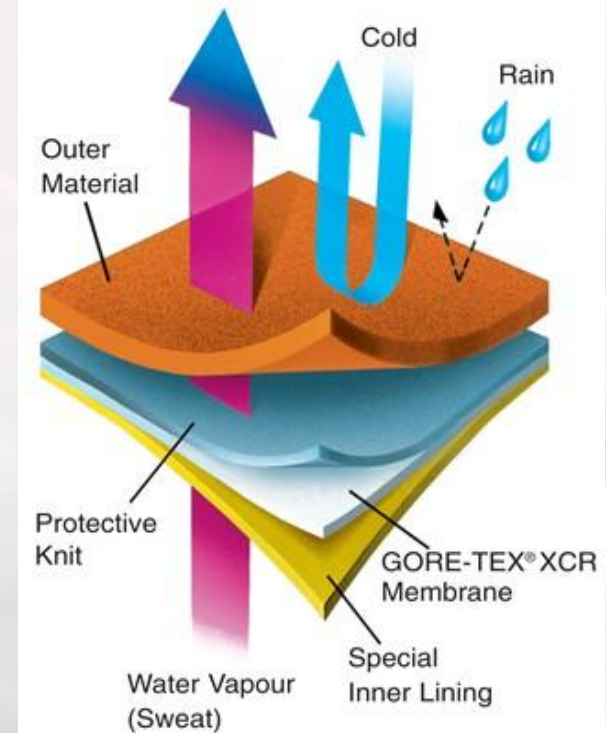


Lots of Technical Fabrics in Sportswear



Coolmax® wicks moisture to the surface of the fabric, to keep you dry & comfortable.

Nomex - fire retardant used in Formula 1 (& also oven gloves)

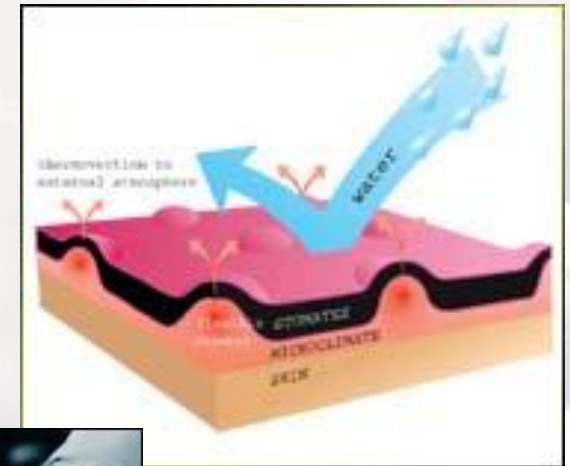


Gore-Tex – water repellent and windproof: used in cycle jackets, outdoor wear

Biomimetics

These fabrics have been designed to mimic nature

Speedo's Fastskin® swimsuit was developed using V-shaped fibres which mimic the ridges found on the skin of a shark



Stomatex® is a lightweight, strong & flexible material that mimics transpiration in plants.

Pressure response Fabric

D3o is a new innovation
It is a soft malleable material
most of the time, but when it
comes into contact with force, it
hardens on impact

http://www.youtube.com/watch?v=tKQxDoXqc_I



d3o
intelligent
shock absorption



d3o

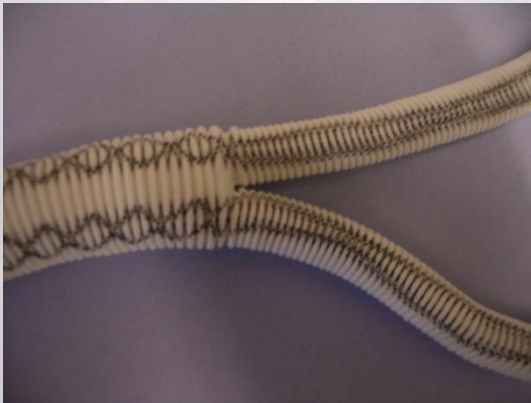


Memory Foam is temperature & pressure sensitive foam that moulds to the shape of the body & returns to normal when pressure is removed.



Here are just a few examples:

Super absorbent medical textiles used in wipes, wound dressings & nappies.



Super stretchy polyester yarns knitted in tubes & used in artery replacement

X-Static® is the name of new yarn which uses silver in its production. It can kill bacteria & fungi & can be used in wound dressings & underwear.



Micro-encapsulation

MICRO-ENCAPSULATION

Tiny bubbles that contain scent or chemicals are incorporated into materials. The scent or chemicals are released or activated with heat or friction.

FACT!

Recent developments have enabled microscopic capsules that contain substances beneficial to the healing process such as vitamins, antiseptics, oils, moisturisers, antibacterial or aromatic chemicals to be applied to fabric surfaces or yarns. These are used for medical reasons as well as novelty items such as "scratch and sniff" t-shirts.

SCENTED TEXTILES

PURPOSE - They contain aromatic scents that aid sleep and relaxation.

ANTIBACTERIAL TEXTILES

PURPOSE - they contain antibacterial properties that assist healing.

ANTI-ALLERGENIC TEXTILES

PURPOSE - Anti-allergic products are added to fabrics to prevent reaction to animal hair, dust mites or pollen.

END USE:

- Aromatherapy pillows that release the scent of lavender when they are heated.
- Clothing that help mask bad odours such as scented socks, sportswear.



END USE:

- Materials that contain antibacterial properties such as clothing for babies and cleaning cloths.
- Bandages that release drugs to aid healing.



END USE:

- Anti-allergy bedding such as pillows, duvets and mattresses.
- Outdoor wear fabrics contain anti mosquito repellent.



Thermochromic Colour

THERMOCHROMIC INKS

Clothing or textile items printed with thermochromic inks change colour according to wearer and environment. They react to changes in temperature such as body heat or boiling water.

The inks are effectively colourless without the application of heat and turn into vibrant colour once activated.

When the body or general temperature of the product reduces, the inks become clear again.



PURPOSE:

Fabrics that contain thermochromic inks aid the wearer of the dangers of changes in temperature. They act as a temperature warning such as:

- a drinking cup, kettle or hot surfaces
- They are also used as novelty fashion garments.

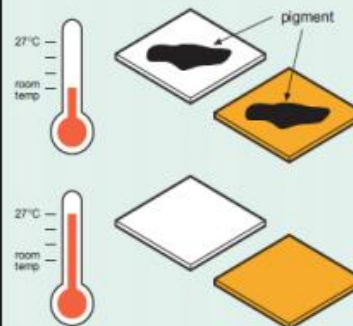
END USE:

Thermochromic inks have a number of end uses such as:

- Kettle and mugs that change colour when in contact with high temperatures.
- Novelty t-shirts or nail varnish that change colour when the body's temperature \uparrow increases. Spoons change colour if the food is too hot, helping you keep baby safe and your own fingers.
- Bandages that respond to infections or change in temperature.

The Principle...

At normal room temperature the pigment appears coloured, but at 27°C the colour disappears. For example, if black thermochromic pigment is applied to a white surface, the surface turns from black to white at the change-over temperature. Similarly, if the pigment is applied to something orange the surface colour changes from black to orange at 27°C. When the temperature falls, the pigment colouring re-appears.



DISADVANTAGES:

- The colour fades during washing.
- The finish that is applied to the garment/item will only last between 5-10 washes.

Photo chromic dyes

PHOTOCHROMIC DYES

Photochromic dyes or inks change colour when exposed to Ultra violet sunlight. They are able to alter from colourless to intense colour after only 15 seconds in direct sunshine and return to clear after about 5 minutes indoors. They are used as an indication to how much UV rays the wearer/user is exposed to.

PURPOSE:

Fabrics that contain photochromic dyes are useful to alert the wearer/user of the dangers of over exposure to harmful ultra violet sunlight. They act as a temperature warning in the form of garments or accessories.

END USE:

Photochromic dyes are mainly used for:

- Children's sun suits that contain a label which changes colour as an indication of excessive contact to harmful sun rays. The sun suits also protect the wearer/users skin by forming a barrier similar to sun cream that aids protection from sunburn.
- Wristbands that can be worn which adapt in colour as an indication when it comes into direct contact with sunlight.
- Sun glasses that adapt to the UV sun light, becoming darker the stronger the rays and therefore offer advanced protection.



DISADVANTAGES:

- The colour fades during washing.
- Are less effective when in contact with chlorine.

Phosphorescent Pigments



Phosphorescence is a process where the energy from the sun is absorbed by a 'material' and it is released slowly over a long time, in the form of light. The energy / light emitted is a low intensity but can last for many hours. Unlike fluorescence, a phosphorescent material does not immediately re-emit the radiation it absorbs. One advantage of this product is that the person wearing it at night, perhaps when training / running / working, will have a band that glows in the dark. (like a glowing worm)



These dyes are used in glow-in-the dark products.

Interactive or Electronic Textiles

WEARABLE ELECTRONICS

PURPOSE: Devices integrated into the garments that allow the wearer/user to listen to music or use mobile phones. Wearing computers as an extension of your body was first seen in 1980's films like Robocop and terminator. Fabrics have recently been developed to make this a reality.

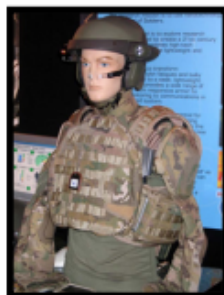
PURPOSE: SPORTSWEAR:

- Sports enthusiasts are able to benefit from integrated fabric sensors and display panels. They monitor heart rate and blood pressure during a gym workout or morning run and are able to analyse the information giving feedback on performance along with playing mood/performance enhancing music.
- Some sports clothing such as car and motorbike racing also astronauts suits contain integrated electronic components.



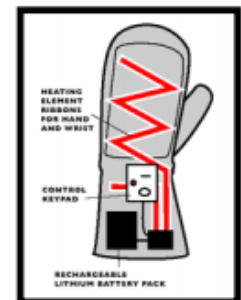
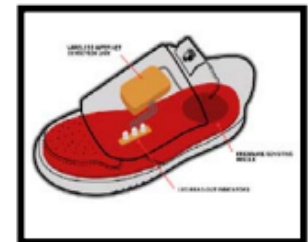
PURPOSE: INDUSTRIAL:

- Voice active wearable computers that enable the user to work hands free whilst operating machinery etc...



PURPOSE: CLOTHING/ LEISURE

- Gadgets such as **mobile phone connectors** in the form of **Bluetooth technology** and **MP3 players** with wireless control panels in a jacket sleeve.
- Global Positioning Systems (GPS)** incorporated into walking shoes which allow the user to be tracked by mountain rescues services. Or in Ski jackets to help locate the wearer in the event of an avalanche. They can also used to monitor the whereabouts of young children.

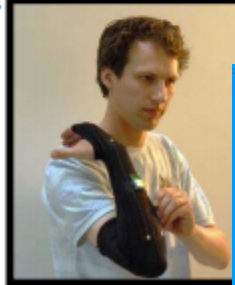


- Gloves** that contain heaters, or built in LED's emitting light so that a cyclist can be seen in the dark.

Interactive or Electronic Textiles

PURPOSE: MEDICAL:

- The "life jacket" is a medical device worn by the patient that consequently reads their blood pressure or monitors the heart rate; the information is transferred to a computer and read by medical staff.
- A specialised camera in the form of headwear has been developed to be worn by paramedics. Visual information captured by the camera can be transferred directly to medical staff at the hospital enabling them to advise instantly on appropriate treatment.



PURPOSE: ENTERTAINMENT:

- Club wear that reacts to movement, heat and light. They include garments with panels that illuminate when the dancer moves, or clothing that contain fibre optics woven and integrated into the fabric.



NANOTECHNOLOGY

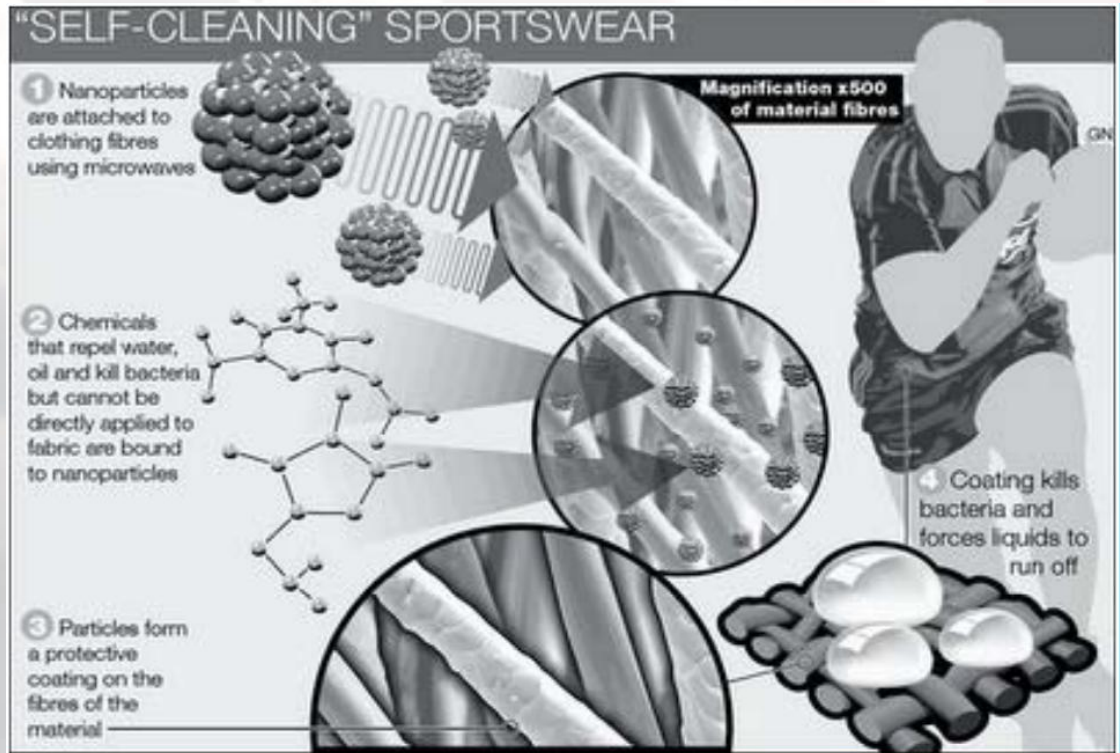
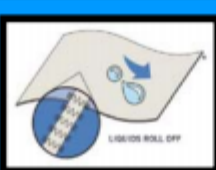
PURPOSE:

Nanotechnology enhances fabrics molecularly without compromising their comfort qualities. This is a comparatively new area of textiles, individual atoms are manipulated and located in the desired structures resulting in the development of new textiles: fabrics that are spill or static resistant, stain or moisture resistant.



END USE:

- Outdoor walking socks- that contain silver particles inside the fibres that provide protection to prevent fungus and odour.
- Gore-tex®- produced to contain an anti-static membrane that is able to protect the wearer against the release of electrostatic.
- Moisture absorbing textiles- recent developments include football shirts that absorb moisture, to keep the wearer dry and comfortable pulling moisture away from the body.
- Medical dressings that help prevention of bacteria.



Some more Electronic Fabrics

Graphic Equilizer T-shirt playing to Lady GaGa

<http://www.youtube.com/watch?v=uGv6Bw34PtU>

Electronic fashion on the catwalk – by Diana Eng

<http://www.youtube.com/watch?v=BkdJv5OCXio&feature=related>

The climate dress

<http://www.youtube.com/watch?v=bgVaUqSK3IQ>

Shape changing couture

<http://www.youtube.com/watch?v=nnCkJCyjixU&feature=related>