Smart Materials

It is important to be aware of the technological developments in the textile industry with the production of new materials that are referred to as:

SMART, INTERACTIVE OR INTELLIGENT TEXTILES.

They are used for a range of textiles products, and can be divided into two categories;

- Smart textiles
- Technical textiles

SMART TEXTILES

Smart fibres and materials interact and adapt to you and the environment around them to create “Micro-environments”. They are often referred to as “sense and react” materials. Smart textiles can be divided into three groups:

- MICRO-ENCAPSULATION
- PHOTOCHROMIC INKS
- THERMOCHROMIC INKS

TECHNICAL TEXTILES

Technical textiles are fabrics and fibres that are developed for their unique properties. They function as electronic devices and sensors. Technical textiles can take the form of:

- INTEGRATED CIRCUITS
- WEARABLE ELECTRONICS
- INTEGRATED WEARABLE ELECTRONICS

MICROENCAPSULATION...MICROENCAPSULATION... MICROENCAPSULATION...

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.

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.

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.

ANTIBACTERIAL TEXTILES

PURPOSE- they contain antibacterial properties that assist healing.

END USE:

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

ANTI- ALLERGENIC TEXTILES

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

END USE:

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

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….THERMOCROMIC INKS...THERMOCHROMIC INKS...THERMOCHROMIC INKS…..

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 are 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 t 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.

HOW IT WORKS:

At normal temperatures the pigment appears coloured but once the temperature reaches 27^{o}C the colour disappears. Pigment applied to a coloured surface will disappear over 27^{o}C leaving only the background colour. Once the temperature drops below 27^{o}C the pigment re appears.

DISADVANTAGES:

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

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….PHOTOCROMIC INKS...PHOTOCHROMIC INKS...PHOTOCHROMIC INKS…..

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 are 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 adapts 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.

…PHASE CHANGING MATERIALS (PCM)…PHASE CHANGING MATERIALS (PCM)…

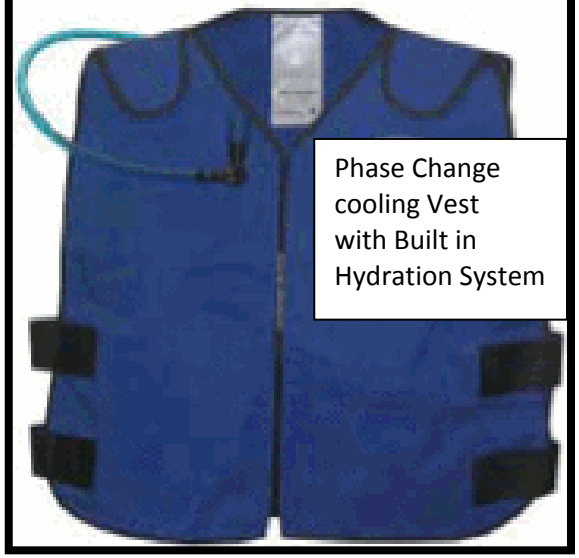
PHASE CHANGING MATERIALS (PCM)

Phase changing materials (PCM) when incorporated into clothing have to ability to interact with changes in the wearer's body temperature. Phase changing materials are able to transform from solid to liquid and back whilst storing and releasing heat, large amounts of heat are absorbed and released. This is commonly known as phase change.

Phase changing jacket that adapts to the wearers body temperature.

PURPOSE:

Phase changing materials are used in products where warmth and energy are essential such as underwear, socks, gloves, and sleeping bags; they also have medical and special industrial applications. They aid researchers in the Antarctic and astronauts.



Phase Change cooling Vest with Built in Hydration System

END USE:

Phase changing materials are used for:

- Gloves for skiers and snowboarders
- Helmets to keep you cool
- Walking gear such as gloves and jackets
- Lining for hiking boots.

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……INTERACTIVE TEXTILES… INTERACTIVE TEXTILES… INTERACTIVE TEXTILES……

INTERACTIVE 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 devises can be in the form of solar power, battery and human power. They are referred to as: **Intelligent clothing and wearable electronics,**

HOW DO THEY WORK?

Interactive textiles contain either *Conductive fibres* that enable communication between the user and wearer. They take the form of either *conductive thread* or *conductive printing inks*.

- Small amounts of conductive thread produced from materials such as steel, silver and carbon as little as 10% as needed to activate a mobile phone
- Conductive printing inks are used to print a pattern onto fabric which can be used to trigger electronics, such as a control panel on ski jacket.

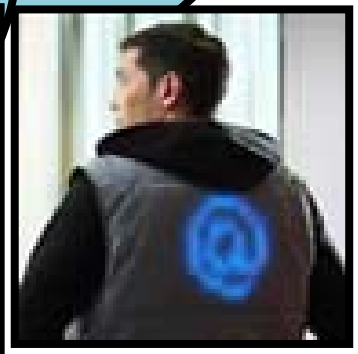
INTERGRATED WEARABLE ELECTONICS

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.

NEW DEVELOPMENTS

Further developments in interactive and wearable electronics include garments and clothing that contain **Lumalive** textiles that are able to transmit messages/advertisements. They have the ability to change colour, and contain LED's incorporated within the clothing.
Phillips the electronics company behind these latest innovations is planning to develop fabrics with Lumalive technology that will allow soft furnishings such as cushions, curtains to transform/ alter colour and illuminate consecutively enhancing mood and atmosphere of their surroundings.



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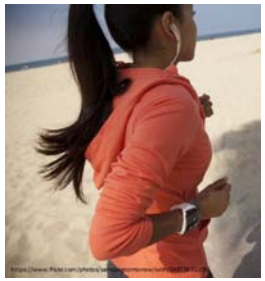
...WEARABLE ELECTRONICS...WEARABLE ELECTRONICS...WEARABLE ELECTRONICS...

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.

…WEARABLE ELECTRONICS…WEARABLE ELECTRONICS…WEARABLE ELECTRONICS…

PURPOSE:

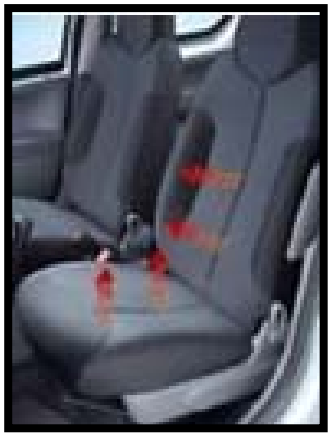
MEDICAL:

- The" **life jacket"** is a medical devise 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:

TRANSPORT AND AUTOMOTIVE USE:

- Modern contemporary cars contain control panels that activate heated seats, air-bags.
- Transport and automotive industries is one of the largest that benefits from interactive electronic and technical textiles. They have uses in space shuttles, aircraft and racing cars.



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.

END USE:

Interactive textiles are used for:

- Industrial
- Medical
- Entertainment
- Sportswear
- Automotive and transport

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SIGNALLING TEXTILES

PURPOSE:
Signalling textiles are used to make reflective garments that help the wearer to be seen in darkness. Glass beads are integrated within the fabrics. They are unrecognisable in daylight, and are reflective only when light is directed on them.

END USE:

- Highway engineers that work on roads and motorways so that they can be seen in darkness or poor lighting conditions.
- Cyclists and pedestrians at night.

GEO TEXTILES

PURPOSE:
Geo textiles can be natural and synthetic, bonded or woven. In the past geo textiles have been mainly used for civil engineering such as road maintenance and construction. However recent usage has been broadened to include to protection of agriculture crops.

END USE:

- Finishing nets- "Aurora luminous" nets that glow in the dark enabling night fishing.
- Textile roofs- such as Space centre, Leicester and The Eden Project Cornwall.
- Geo membranes- such as Canal liners, road and pavements.
- Drainage and erosion- fabric act as a filter, allowing water to pass through.

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.