2.3.3i Modern and smart materials

- Smart materials or intelligent textiles react to a change in their surroundings or external stimuli such as temperature, light, moisture or friction.
- Modern materials are continually being updated and developed. Some are engineered for specific purposes.

Smart textiles

• *Photochromic*

Photochromic dyes change colour as a result of changes in light intensity i.e. sunlight. Photochromic inks can be printed onto fabric, as well as dyeing it. Sewing thread and beads can also be photochromic.

• *Thermochromic*

Thermochromic dyes in fabric change colour in response to a change in heat levels. Thermochromic liquid crystals can be encapsulated onto fibres and fabrics. Thermochromic materials could act as a warning. For example, if impregnated onto dressings, a rise in temperature and colour change could indicate infection.

• *Solvation chromism*

This refers to colour change that occur as a reaction to a change in moisture levels.

• *Microencapsulation*

Microscopic particles containing various substances such as essential oils, moisturisers, antiseptics and anti-bacterial chemicals can be applied to fibres and fabrics. These substances are released through friction alongside contact with the skin.

Interactive or intelligent textiles

• *Wearable electronics*

Electronic devices can be integrated into fashion and textile products or into the fabric itself. These devices communicate wirelessly with the user/ wearer. Integrated devices already in use include: mobile phones, heart rate monitors, GPS trackers, LEDs, heated panels, solar panels and performance trackers.

Circuits embedded into clothing or fabric rely on conductive fibres to carry the electricity to the device.

• *Conductive fibres and yarns*

Fine flexible conductive fibres and threads made from carbon, steel and silver can be seamlessly woven into fabrics without interfering with the texture and aesthetics of the fabric. In some cases, conductive fibres can be washed without impeding future functionality.

• *Optical fibres*

Optical fibres are transparent flexible fibres made from glass or plastic that are slightly thicker than a human hair. Optical fibres can be used as sensors in smart clothing and technical textiles. They can carry an enormous amount of data as pulses of light.

• *Heat storage materials*

PCMs or phase changing materials change from one state to another by absorbing, storing and releasing heat over a small temperature range. PCMs are encapsulated into textiles or applied as a coating. When used in clothing, they help regulate body heat – store energy when it is hot (liquid) but release it on cooling (return to solid).

Modern materials

• *Sun protective clothing*

A very closely woven or knitted fabric will effectively block out harmful UV rays. Synthetic fibres have a natural lustre which reflect UV rays away.

• *Rhovyl®*

Rhovyl® is a synthetic fibre known as chlorofibre derived from polyvinylchloride (PVC). It is anti-bacterial, waterproof, crease resistant and quick drying. It does not retain odours and wicks away moisture. Ideal for sportswear.

• *Carbon fibres*

Carbon fibres are extremely lightweight and strong with excellent covering power. Constructed through an electrospinning process and made into sheets like non-woven felt. These sheets that can folded down into very compact sizes. Carbon fibre sheets can be used as breathable membranes.

• *Aramid fibres - Kevlar and Nomex*

Engineered fibres said to be 5 times stronger than nylon. They are heat and flame resistant with no melting point, resistant to abrasion, cutting, solvents and chemicals. Easy to care for and comfortable to wear.

Kevlar has high tensile strength to weight ratio and can be manufactured to withstand extreme conditions. Nomex is used where resistance to heat and flames is critical.

• *Biosteel*

Biosteel is comparable to steel and has a high tensile strength, and can stretch up to 20 times its normal length. It is the strongest natural fibre and is biodegradable. It is currently not commercially viable but could potentially replace Kevlar.