

# Smart and Modern Materials

**Smart Materials-** Smart materials change their properties in response to stimuli, e.g. temperature, light, stress, moisture or PH. They are called smart because they sense conditions in their environment and respond to those conditions. For example they may change shape or colour. They often return to their original state when the stimulus is taken away.

**Modern Materials-** Modern materials are developed through the invention of new or improved processes. They are designed to purely be functional, rather than look good.

Modern Material	Description	Uses
Kevlar	Is as strong as steel. It is stab and bullet proof.	Bullet proof vest, used in bridges, gloves.
Fast Skin	Mimics sharks skin and makes athletic swimmers swim faster. This is known as biomimicry (using nature to design)	Swimwear for athletic sports.
Nomex	Fire resistant clothing. This is built into the fibres so can't be washed or worn away.	Fire fighters clothing or racing drivers overalls.
Laminated	This is when 2 or more fabrics are glued together in layers. This is normally to improve function or appearance.	Winter coats, ski wear.
Microencapsulation	Tiny little capsules have chemicals added, and these are then embedded into fabrics. These chemicals could be insect repellent, perfume, antibacterial medicine etc.	Socks, scented lingerie, medical bandages, plasters, ladies sanitary wear.
Gore Tex	Gore Tex is a laminated material. It is wind proof, water proof and breathable material.	Ski wear, hiking wear.
Carbon Fibre	Carbon Fibres have several advantages including high stiffness, high tensile strength, low weight, high chemical resistance, high temperature tolerance and low thermal expansion.	Used in aerospace, civil engineering, military, and motorsports, along with other competition sports.
Sun Protective Clothing	Sun protection clothing carries a UPF (ultraviolet protection factor) rating that indicates exactly how much UV can be blocked by the special fabric.	Clothing.

Name: \_\_\_\_\_

**Quantum-tunnelling composite (QTC)** is an insulating rubber containing tiny particles of metal. When squashed, the metal particles meet and allow the flow of electrical current. As a result, QTC is an insulator when resting and a conductor when pressure is applied. It has been used in clothing to control smartphones and portable music players, in power tools to give variable speed controls and in touch-sensitive pads.

**Polymorph** is a polymer that becomes malleable when heated to about 62°C. When it cools down it becomes hard enough to drill and cut. This makes it perfect for modelling as it can be reheated and formed again. It is also excellent for creating ergonomic handles.

**Conductive fabrics** allow a small electrical current to safely pass through them. This technology is used to dissipate static charge or for touch-screen gloves, which allow a small amount of charge to flow through the glove to connect to the screen.

**Interactive textiles** allow small electronic components such as batteries or lights to be embedded inside them and can then function as an electronic device or sensor. These include circuits that can be integrated into fabrics, such as heart rate monitors. When used in biometrics, the new technology can help collect body measurements and calculations. You can also get interactive textiles to respond to mobiles or music players.

**Electroluminescent film or wire, ie LCD**, is a thin copper wire that is coated in phosphor, which glows brightly when a current is applied to it. It is commonly used in fancy dress and decorative luminescent clothing, nightlights, waterproof displays, medical tool display screens and billboards.

Example of Smart Material	Description	Uses
Thermo chromic	Reacts and changes colour due to heat.	Mugs, T-shirt, Sports wear, babies feeding spoons.
Photo chromic	Reacts and changes colour due to light.	Glasses, Biker's visors.
Hydro chromic	Reacts and changes colour due to water.	Umbrella, Coats.
Phosphorescent	Glow in the dark. Stores light throughout the day and releases it during the night.	Fancy dress costumes, stars on ceiling, trainers.
Phase Changing		
Shape Memory Alloys	Alloys that remember their original shape. They can be easily shaped when cool, but return to their original shape when heated above a certain temperature.	Glasses made of Nitinol can bend out of shape. By putting them in a bowl of hot water they will form back into their original shape.

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Photochromic		
Hydrochromic		
Phosphorescent		
Phase Changing		
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Fast Skin		
Nomex		
Laminated		
Microencapsulation		
Gore Tex		
Carbon Fibre		
Sun Protective Clothing		

Name: \_\_\_\_\_

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<b>Polymorph</b>
<b>Conductive fabrics</b>
<b>Interactive textiles</b>
<b>Electroluminescent film or wire, ie LCD, I</b>