

COMPOSITE MATERIALS

This mobile revision pdf is based on detailed work found in the MATERIALS section.

Tap on the green link button below to go to the complete website section



Tap the blue button to view COMPOSITES covered by this Revision PDF



PROPERTIES OF MATERIALS

1. DEFINITION OF COMPOSITES

2. NATURAL WOODS

3. CONCRETE

4. FIBREGLASS / GLASS REINFORCED PLASTIC (GRP)

5. CARBON FIBRE REINFORCED POLYMER (CFRP)

6. PLYWOOD

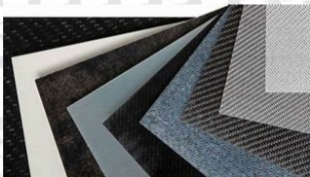
7. KEVLAR®

DEFINITION OF COMPOSITES

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Composite materials, sometimes referred to as composites, are materials composed of two or more component parts. These component parts may have different physical or chemical properties and when carefully inspected, they appear as separate parts, bonded together, forming a composite material.

Tap the image for more information



Tap the red button to return to the
Contents page



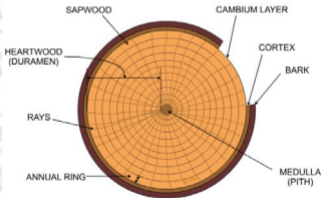
NATURAL WOODS

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Composite materials are often regarded as being modern materials, this is not the case.

Perhaps the best example of a composite material is natural wood. Natural woods are composed of varying shapes of cellulose fibres. A simplified cross-section of a tree trunk is drawn below and shows the different parts. The structure of natural woods makes them extremely versatile and they have a vast range of uses / practical applications.

Tap the image for more information



Tap the red button to return to the Contents page

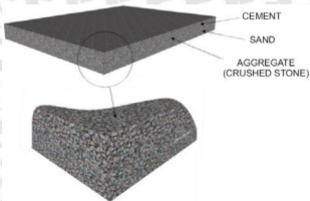


CONCRETE

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Concrete is regarded as a composite material, because it is composed of a number of materials, that combine to form this versatile building material. Most concrete is made up of Portland Cement, aggregates (gravel, crushed stones) and sand. Water is added to the mix.

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Tap the blue button for the next
COMPOSITES page.



Tap the red button to return to the
Contents page



CONCRETE – PRACTICAL APPLICATIONS

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Concrete can be purchased ready mixed and poured into an area prepared for a foundation. Alternatively, the component parts that make up a concrete mixture, can be mixed to produce 'liquid' concrete, on site. This can be poured to produce an area such as a driveway or foundations to a building.

GARDEN PONDS - PATHS - PAVING - WALLS - PILLARS/SUPPORTS - DRIVEWAYS - PATIOS - CONCRETE - CASTINGS - FOUNDATIONS - LAMP POSTS - BEAMS - ARTIFICIAL STONE

Tap the image for more information



Tap the blue button for the next
COMPOSITES page.



Tap the red button to return to the
Contents page



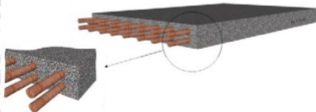
REINFORCED CONCRETE

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Concrete is made from small stones and gravel called aggregate, sharp sand, cement and water. The small stone and gravel (aggregate) is the reinforcement and the cement is the matrix that binds it together.

Concrete has good 'strength' under compression but it is weak in tension. It can be made stronger under tension by adding metal rods, wires, mesh or cables to the composite. The concrete is cast around the rods. This is called reinforced concrete.

Tap the image for more information



Tap the blue button for the next
COMPOSITES page.



Tap the red button to return to the
Contents page



REINFORCED CONCRETE PRACTICAL APPLICATION

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Tap the red button to return to the
Contents page



FIBREGLASS / GLASS REINFORCED PLASTIC (GRP)

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Fibreglass is an excellent example of a relatively modern composite material (Invented in 1938 by Russel Games). In industry it is often referred to as Glass Reinforced Plastic (GRP).

GRP is composed of strands of glass woven to form a flexible fabric. The fabric is normally placed in a mould, for instance a mould for a canoe and polyester resin is added, followed by a catalyst (to speed up the reaction). The resulting material is strong and light. Glass Reinforced Plastic can be sanded for a smooth finish and painted.

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Tap the blue button for the next
COMPOSITES page.



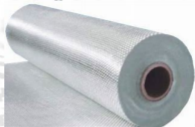
Tap the red button to return to the
Contents page



(GRP) PRACTICAL APPLICATION

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Tap the red button to return to the
Contents page

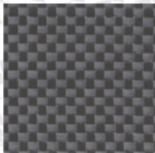


CARBON FIBRE REINFORCED POLYMER (CFRP)

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CFRP is sometimes referred to as Carbon Fibre Reinforced Plastic is similar to fibre glass. Carbon fibre is woven into a textile material and resin such as epoxy resin is applied and allowed to cure. The resulting material that is very strong as it has the best strength to weight ration of all construction materials. It is an improvement on glass fibre reinforced plastic, although much more expensive.

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Tap the blue button for the next
COMPOSITES page.



Tap the red button to return to the
Contents page



CFRP PRACTICAL APPLICATION

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Boat building
Automotive parts
Aerospace supplies
Hobbies
Bikes and motorcycles

Eurofighter has a large proportion of its airframe manufactured from Carbon Fibre Reinforced Plastic.

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Tap the red button to return to the Contents page

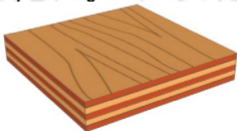


PLYWOOD

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Plywood is a composite material, although we often consider it as a traditional working material. It is composed of individual plies / veneers of wood. It is very strong due to the way the plies are put together. The grain of each ply is positioned at ninety degrees to the pieces of ply above and below it. The plies are glued together with synthetic resin, making a very strong composite material. Furthermore, plywood is usually constructed so that an odd number of plies are used. Plywood is less likely to warp or split, due to this construction.

Tap the image for more information



Tap the blue button for the next
COMPOSITES page.



Tap the red button to return to the
Contents page



PLYWOOD - APPLICATIONS

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Plywood a popular material in the construction industry.

Softwood ply tends to be used in the construction industry for walls, roofs and floors.

Hardwood ply tends to be used quality laminate flooring, kitchen units and some furniture.

Marine plywood is used in boat hull construction. It is specially treated so that it is water resistant .

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Tap the red button to return to the Contents page



KEVLAR®

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Kevlar® is a liquid that is converted into a fibre (called aramid fibres) and then woven into a textile material. The resulting textile material is extremely strong, lightweight, corrosion and heat resistant. It is often used in combination with other materials, forming composites. It has a wide range of uses. Kevlar® was developed at DuPont in the 1960s.

Tap the image for more information



Tap the blue button for the next
COMPOSITES page.



Tap the red button to return to the
Contents page



KEVLAR®

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Kevlar® is formed by combining para-phenylenediamine and terephthaloyl chloride. Aromatic polyamide (aramid) threads are result and they are spun into regular fibres. When woven, Kevlar® forms a strong and flexible material. If layers of the woven Kevlar® are combined with layers of resin, the resulting 'rigid' material is light and has twenty times the strength of steel. It is also superior to specialist metal alloys

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Tap the blue button for the next
COMPOSITES page.



Tap the red button to return to the
Contents page



KEVLAR® AND MODERN CARS

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Modern luxury cars, rely on the use of materials such as carbon fibre and kevlar®, to ensure that they are lightweight and fast.

These materials can be formed into more interesting and 'sporty' body shapes, than traditional materials, such as sheet steel and aluminium. Furthermore, kevlar® has many other uses including; brake pads, alternator belts, gaskets, clutch plates, hoses and even tires.

Tap the image for more information



Tap the red button to return to the Contents page

