

### 1. Materials; Metals

Ferrous Metals		These Metals Contain IRON (Fe).
1	Iron	Machine Bases, Metalworking Vices
2	Tool Steel (Carbon Steels)	Screwdrivers, Hammers, Saws
3	Stainless Steel	Sinks, Rules, Cutlery
4	High Speed Steel	Drill Bits, Lathe Tools
Non-ferrous Metals		Metals which do not contain IRON.
5	Copper	Plumbing & Electrical Components
6	Aluminium	Cooking Foil, Sauce Pans, Ladders
7	Zinc	Coatings On Steel Products
8	Tin	Coating On Food Cans
9	Lead	Weather Proofing For Roofs
10	Titanium	Jewellery, Surgical Implants.
Alloys		A mixture. of two or more metals.
11	Brass	Plumbing Accessories
12	Bronze	Boat Propellers

**Smart Materials**- materials which have properties that can be significantly changed in a **controlled fashion** by external stimuli, such as heat, moisture, electric or magnetic fields, light.

### 3. Materials; Ceramics

1	Tungsten Carbide	Cutting Tool Tips
2	Glass	Windows, GRP, Fibre Optics - Broadband.
3	Ceramic Bearing Material	Electric motors, applications under water, aerospace

### 4. Materials; Composites

A material made from **two or more** different materials that, when combined, are stronger than those individual materials by themselves.

1	Glass Reinforced Plastic (GRP)	Car / Boat Bodies, Bike frames
2	Carbon Fibre	Bicycle Frames, Sports equipment
3	Concrete	Constructional applications

### 5. Materials; Smart & New Materials

1	Shape-memory Alloys	Dental Braces, surgical implants, fire prevention.
2	Thermochromic Materials	Thermometers for rooms, refrigerators, aquariums, and medical use.
3	Shape-memory Plastics	Smart fabrics, intelligent medical devices and self-disassembling mobile phones
4	Quantum Tunnelling Composite (QTC)	Switches on mobile phones, pressure sensors and speed controllers
5	Nanotechnology	Sunscreen, cosmetics, food packaging, and clothing

### 2 Materials; Polymers

Thermoplastics		Can be remoulded numerous times with the application of heat.
1	Acrylonitrile - butadiene-styrene (ABS)	Appliance casings
2	Polyethylene	Pipes, Buckets, Toys
3	High Impact Polystyrene (HIPS)	Vacuum Forming, electronics casings
4	Polyvinyl Chloride (PVC)	Water Pipes, Chemical Tanks
5	Nylon	Curtain Rails, Hinges, Clothes
6	Polycarbonate	Safety Goggles, Bullet Proof Windows.
7	Polypropylene	Medical Equipment, Food Containers.
Thermoset Plastics		Polymers which cannot be remoulded once set in shape.
8	Polyester Resin	Used in GRP - Car/ Boat bodies
9	Urea-formaldehyde	Electrical fittings, Door Handles.
10	Epoxy Resin	Glue, Casings, Coatings.
11	Phenol-formaldehyde	Heat resistant saucepan handles

## 6. Properties Of Engineering Materials

1	Malleability	Is capable of being extended or shaped by beating with a hammer or by the pressure of rollers.
2	Ductility	The ability of a material to be drawn out into wire or thread without losing strength or breaking.
3	Conductivity	Measure of a material's ability to conduct an electric current.
4	Resistivity	A measure of the resisting power of a specified material to the flow of an electric current.
5	Hardness	The measure of the resistance of a material to surface indentation, abrasion, or scratching.
6	Machinability	A characteristic of a metal that makes it easy to drill, shape, cut, grind, etc. Materials with good machinability can be cut with relatively little power and low cost.
7	Corrosion Resistance	How well a metal can withstand damage caused by oxidization or other chemical reactions.
8	Elasticity	The ability of a metal to resume its normal shape after being stretched or compressed.
9	Plasticity	Is the ability of a metal to undergo permanent deformation, a non-reversible change of shape.

## 7. Materials Testing: Destructive Testing

Carried out to find properties and behaviour of materials under different loads and conditions. The material is damaged during the test.

1	Tensile Testing	Controlled tension (pulling force) is applied to a sample material either as a load for proof testing (make sure it is strong enough) or until it fully fails.
2	Hardness Testing	This involves applying a constant load via a rounded or pointed object, under controlled conditions, to create an indentation in a metal surface. The width of the indentation is then measured to determine the hardness of the material.
3	Compression Testing	Used to establish the compressive force or crush resistance of a material and the ability of the material to recover after a specified compressive force is applied.
4	Impact Testing	Performed to determine the impact resistance or toughness of materials by calculating the amount of energy absorbed during fracture when a free falling weight is dropped into the sample material.

<https://www.bindt.org/videos/>

## 8. Materials Testing: Non-Destructive Testing (NDT)

A testing technique used by engineers to evaluate the properties of a material or product **without** causing damage to the original product.

1	Conductivity Testing	The measurement of a materials ability to conduct an electric current. When carried out over a weld or a joint it will inform you as to the quality of the weld / joint. Good conductivity indicates a good joint, poor conductivity / high resistivity could be caused by gaps or cracks within the joint or damage to the material by heat.
2	X-ray Crack Testing	The tyre industry use x-rays to show up air bubbles between rubber layers.
3	Visual Inspection	One NDT method used extensively to evaluate the condition or the quality of a weld or component. It is easily carried out, inexpensive and usually doesn't require special equipment. Visual testing is the primary NDT method of many quality control programmes.
4	Ultrasonic Testing	Used on sheet material to precisely locate faults. Aircraft industry employ this method.
5	Dye Penetrant	Sprayed onto a surface, and the dye/penetrant will settle in any cracks to highlight them.