

Materials Used in Building Technical Objects

There are many types of materials. The choice of materials is important in the producing a good quality object.

1. Type of FORCES/CONSTRAINTS that affect materials:

Mechanical constraint	Description	Example
Compression	<i>Force that crushes materials.</i>	Opening a nut with a nutcracker.
<i>Tension</i>	<i>Force that stretches materials.</i>	<i>Pulling on a dog's leash.</i>
<i>Torsion</i>	<i>Force that twists materials.</i>	<i>Screwing a screw into wood with a screwdriver.</i>
<i>Bending</i>	<i>Force that bends materials.</i>	<i>Standing on a diving board.</i>
<i>Shearing</i>	<i>Force that tears materials.</i>	<i>Cutting fabric with scissors.</i>

2. Mechanical Property of Objects:

How an object will react when an it object undergoes certain types of force.

Mechanical property	Description	Example of an object that illustrates this property
Hardness	<i>Resists penetration.</i>	Marble stair.
<i>Elasticity</i>	<i>Regains its initial shape after being subjected to a force.</i>	<i>Coil.</i>
<i>Resilience</i>	<i>Resists physical impacts.</i>	<i>Steel frame.</i>
<i>Ductility</i>	<i>Stretches without breaking.</i>	<i>Copper wire.</i>
<i>Malleability</i>	<i>Flattens or bends without breaking.</i>	<i>Metal sheet.</i>
<i>Tensile strength</i>	<i>Resists tension without becoming permanently deformed.</i>	<i>Crane cable.</i>

3. Materials Commonly Used in Making Technical Objects

1. Wood

Why wood?

1. Easy to work with
2. Easy to assemble
3. Good thermal insulator (keep in heat)
4. Does not conduct electricity (to avoid shock)

Hardwood comes from deciduous trees (trees with leaves) and softwood comes from coniferous trees (trees with needles and cones)

Modified wood is treated wood or material made with wood mixed with other substances.

Characteristics

1. **Hardness:** High level
2. **Elasticity:** Good elasticity
3. **Resilience:** Good when it has enough moisture
4. **Ductility:** Very Low; doesn't stretch
5. **Malleability:** Heat increases its malleability
6. **Tensile Strength:** Excellent; hardwood has a higher level of strength than softwood

2. Metal

• Commonly use metals:

- | | |
|------------------|-------------------|
| 1. Iron (Fe) | 2. Magnesium (Mg) |
| 3. Copper (Cu) | 4. Zinc (Zn) |
| 5. Aluminum (Al) | 6. Nickel (Ni) |
| 7. Chrome (Cr) | 8. Tin (Sn) |

• Why metal?

1. It's ductile and malleable.
2. It's a good conductor of heat and electricity.

- **Alloys:** material obtained from mixing a metal with one or more metallic or non-metallic substances.

- **Ferrous Alloy:** an alloy whose main material is iron. *Example: steel (iron, carbon, maybe nickel, chrome and zinc)*

- **Non Ferrous Alloy:** an alloy whose main material is NOT iron. *Example: Brass (copper & zinc), Bronze (copper & tin)*

3. Plastics:

- A manufactured material made of molecules called *polymers*.
- Most of the polymers come from petroleum or natural gas; others comes from cellulose, which come from plant cell walls.

• Why Plastics:

1. Can be made in various colours
2. Are durable
3. Do not rust
4. Are lightweight
5. Are inexpensive