

# TECHNICAL MATERIALS I. WOOD

## WOOD PROPERTIES

Wood is a natural resource that has been used by man since early times, first as fuel to produce heat, and later for tool-making. Even today, timber, by its own properties, is a material used for purposes as diverse as construction of buildings, furniture, craft items, paper, etc.

Wood is a very common material used because of its characteristic properties, which we are going to study:

### ***Easy to work***

It's simple to shape it if the appropriate tools are used.

### ***Low density***

It floats on water and has been used for the manufacture of boats.

### **Hardness**

It is scratch resistant. Although it varies widely from one type of wood to the other types of wood, compared with other materials, it is low.

### ***Flexibility***

Many types of wood can be bent easily in the direction of the grain.

### ***Aesthetically pleasing***

It has a wide variety of colours, textures and veining.

### ***Poor conductor of heat and electricity***

It can be used as insulating material.

### ***Easy availability***

Wood is a natural resource that we have available worldwide, but we must take care of our farms and repopulate our forests so that we continue to provide future wood.

### ***Anisotropy***

It means that their properties are different depending on the direction in which they work. You can see it in the direction of the grain, wood is weaker and breaks more easily than going through all the grains.

## WOOD HARDNESS

According to its hardness, the wood is classified into:

- **Hardwood:** those that come from trees grow slowly, so are denser and withstand bad weather better than softwood. These woods come from deciduous trees, which take decades, even centuries, to reach sufficient maturity to be cut and can be used in making furniture or beams of detached houses. They are much more expensive than softwoods, its slow growth causes scarcity, but they are much more attractive to build furniture. They are also commonly used for wood carvings or any product in which quality wood is necessary.
- **Softwood:** it encompasses wood of trees belonging to the order of conifers. The great advantage with respect to hardwoods, is its lightness and its much lower price. They don't have such a long life as hardwoods. Manipulating softwoods is much simpler, but has the disadvantage of producing more splinters.

### OBTAINING PROCESS

As we all know, wood is a material of plant origin obtained from trees, mainly of their trunks.

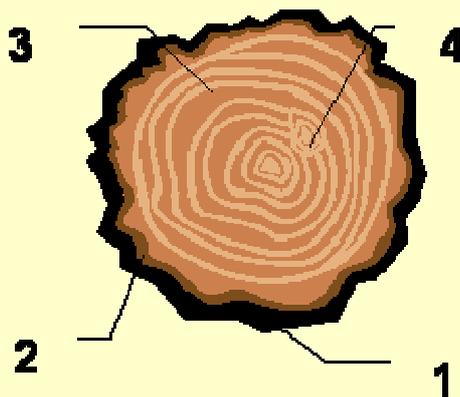
If we make a cross section of a tree trunk we can distinguish the following parts, from the outside inwards:

**1. Bark.** It is the outermost layer, which protects the tree from the elements.

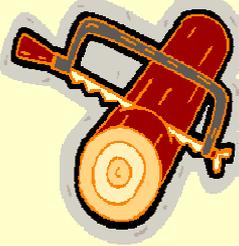
**2. Lieber.** It is the layer responsible for conducting the tree sap.

**3. Sapwood.** It is the young wood and it will harden with time.

**4. Heartwood.** It is the wood we can use.



Wood, from when it is extracted from trees until it is used to manufacture objects, goes through the following transformation.

<b>Transformation process of wood</b>	
	<p><b>Cutting down</b></p> <p>It consists of cutting the tree trunk and taking it down. First the tallest trees should be selected and then the area should be replanted.</p>
	<p><b>Debarking and removing branches</b></p> <p>Normally only the tree trunks are utilized, making it necessary to remove the bark and branches</p>
	<p><b>Sawing</b></p> <p>It consists of making a reduction of the trunk in boards, so as to make the most of the wood.</p>
	<p><b>Drying</b></p> <p>It involves the removal of the humidity of wood.</p>

## **DETERIORATION OF NATURAL WOOD**

### **1. Physical agents**

Although the deterioration of wood is traditionally seen as a biological process, the wood can also be degraded by physical agents. Agents are generally slow to act, but can become quite serious in specific locations. Physical agents include mechanical abrasion or impact, ultraviolet light, metal corrosion products, and strong acids or bases. Physical agents can also damage the preservation treatment and expose untreated wood to attacks by biotic agents.

#### **a. Mechanical damage**

Mechanical damages are probably the most significant deterioration of wood by physical agent. The most common are mechanical abrasion damage, which produces worn or damaged surfaces and reduces the thickness of wood. A more severe mechanical damage can be caused by long term exposure to extreme forces (overloads).

#### **b. Ultraviolet light**

It is the most visible on the wood deterioration; it results from ultraviolet sunlight because it degrades the lignin near the surface of the wood. The good thing is that these damages only penetrate a short distance below the surface

### **c. Corrosion**

It consists of wood degradation by corrosion of the metal surrounding it.

### **d. Chemical degradation**

In many cases, the presence of acids, bases or solvents can cause significant damage to the wood. This damage causes a colour change, from bleaching to a burnt appearance. This occurs because the wood cell is damaged or because the natural glue that forms the veins disappears. Products that damage wood can be acids like vinegar, bases like bleach or solvents like alcohol, acetone or nail polish remover.

## **2. Biological agents**

Wood is remarkably resistant to biological damage, but a number of organisms are able to use the timber in a way that alters its characteristics. The organisms that attack wood include bacteria, fungi and insects. Some of these organisms use wood as a source of food, while others use it for shelter. To develop themselves they need certain requirements, moisture, available oxygen, suitable temperature, and a suitable source of food, which is usually wood.

### **a. Bacteria**

Bacteria are tiny single-celled organisms that are among the most common of the land. It has recently been shown to prefer non-treated wood exposed to high humidity, causing increased permeability and a weakened surface of the wood.

### **b. Fungi**

Fungi are organisms that use wood as a source of food. They grow on wood as a network through microscopic holes or directly penetrating the wood cell wall. A very common type of fungus is mildew.

### **c. Insects**

The insects are among the most common organisms on earth, and many species have the ability to use wood for shelter or food. Of the 26 kinds of insects, 6 cause damage to the wood. Termites (Isoptera), beetles (Coleoptera), bees, wasps, moths (Lepidoptera) and ants (Hymenoptera) are the primary causes of most of the destruction in the wood. Insect attack is usually evident from tunnels or cavities in wood, often containing dust or sawdust (insect faeces). The presence of dust at the foot of wood or sawdust on the surface of wood, are samples of an attack.

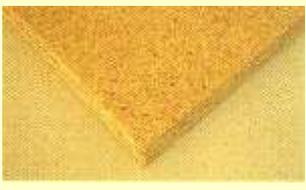
## NATURAL WOOD

They are derived from wood obtained directly by cutting the trunks of trees. The most common types are:

	<p><b>Solid boards.</b> Usually obtained by joining several boards together and glued. If they are made from a single piece of wood, they are called <b>thick planks</b>.</p>
	<p><b>Small boards.</b> They are small parts used for parquet floors or to manufacture large boards.</p>
	<p><b>Natural wood block.</b> They are used for carving pieces.</p>
	<p><b>Battens.</b> They are long pieces, which are named according to their profile. They can be square, rectangular, round or patterned. If they are patterned, they are called mouldings.</p>
	<p><b>Wooden panels</b> (Okoumé). They are thin veneers that are used to make thin pieces or to make plywood.</p>

## ARTIFICIAL WOOD

They are derived from wood, made from sheets or wood chips treated appropriately. The most common types are:

	<p><b>Chip board.</b> It is obtained by mixing wood chips and debris crushed with special glues and compressed. They can be coated by a thin sheet of wood or plastic to provide a better finish.</p>
	<p><b>Plywood.</b> It is manufactured by the gluing and pressing of several thin sheets of wood in different directions</p>
	<p><b>Fibreboards.</b> They are obtained boiling timber and thus eliminating natural "glue" between different cells, and then the product is pressed with artificial resin. One of the most used is the MD (Medium Density).</p>
	<p><b>Laminate boards.</b> They consist of a base of an artificial board (usually chipboard) plus a very thin sheet of wood or plastic (melamine). They have more attractive finishes than chipboards.</p>