



Basic Boat Building

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Boat building

Material used

- Fishing boat design defines the detailed engineering aspects of boat building like security, storage, dimensions, materials and efficiency.
- It secures hydrodynamics, strength, convenience and durability.
- Several construction materials are available for fishing vessels up to 100ft.
- For vessels over 100 ft steel is the dominant material. Each material has its own construction method.
- In general, a fishing vessel of any material is built up of some kind of frame and a skin.



Boat building

Material used

➤ Following are the materials available for construction of fishing vessels.

A. Wood

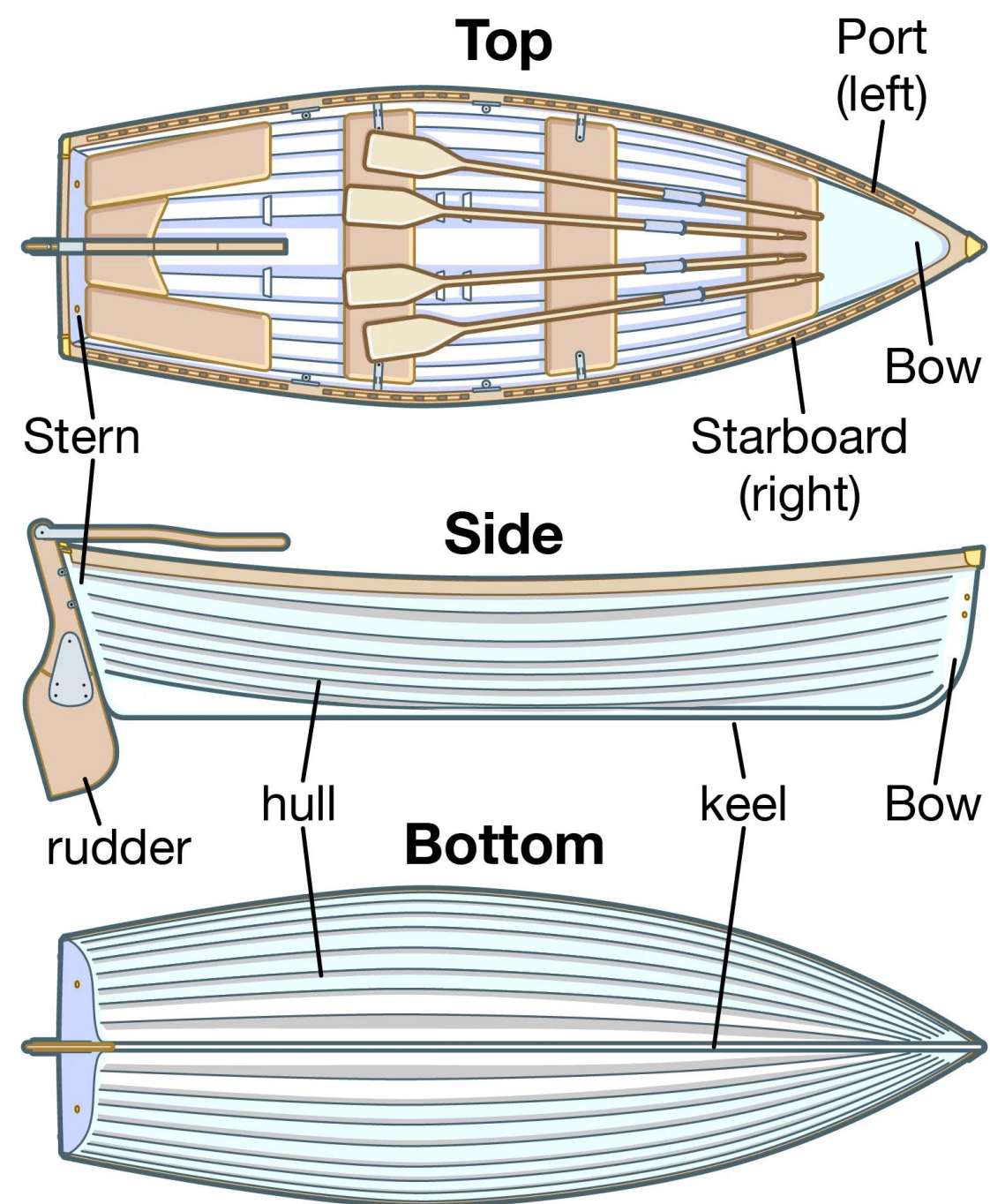
B. Plywood

C. Steel

D. Aluminum

E. Fiber Reinforced plastic (FRP)

F. Ferrocement



Boat building

Material used

- **A. Wood:** The timber is being used as a boat building material since ancient time .
- India has 70.7 million hectares of forest land and around 5000 species of Indian tropical trees are known to yield timber though only about 400 species are actually suitable as boat-building material.
- About 200 of them can be put to commercial use of which a few have been found ideally suited for the construction of modern mechanized boats.



Boat building

Material used

- **A. Wood:**
- Timber species which are in good demand for boat building includes Aini, Punna, Iron wood, Venthekku, Mango, Malabar neem, Paduak, Venga, Sal, Irul, etc. (Santhakumaran and Jain, 1986).
- Hence selection of the timber is very essential.



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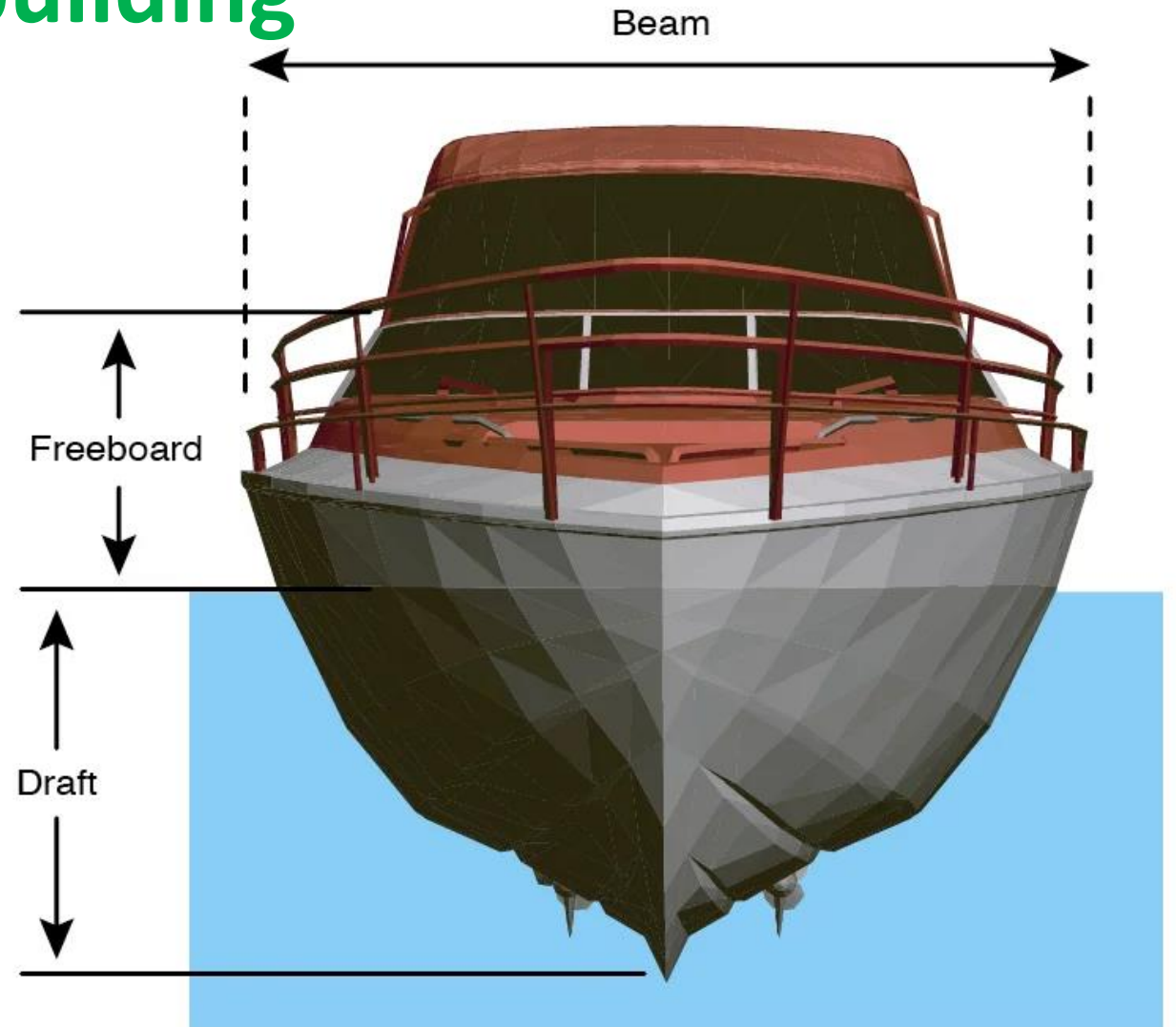
Material used

- **A. Wood:** Wood has been used for various marine constructional purposes due to its excellent properties like buoyancy, workability, strength, elasticity, durability, heaviness, load-bearing capacity, treatability, nail holding power, strength to weight ratio and poor transmission of heat.
- Reusable and recyclable natures are some of the added properties of wood which might have attracted the boat builders for its application in the boat building sector..



Boat building

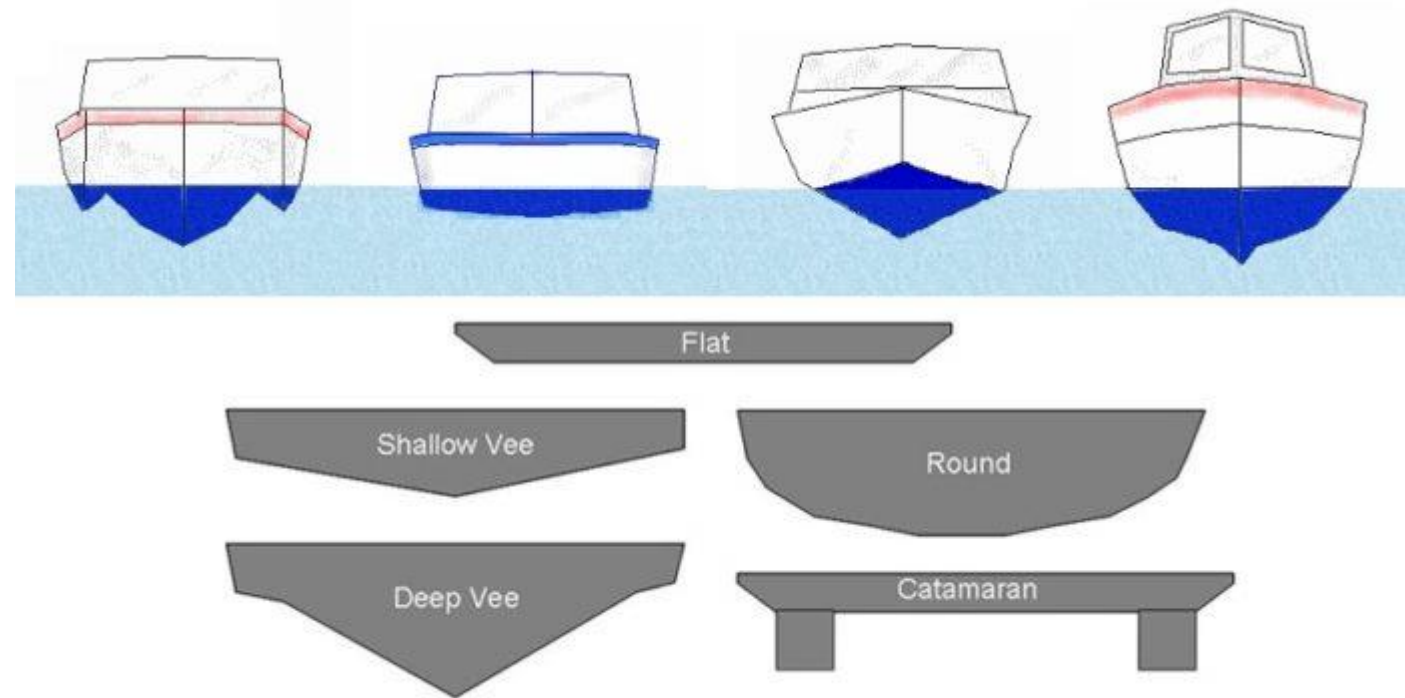
- **Hull:** Specific requirements of wood for hull planking.
- Hull may be of wood or steel.
- Hulls are built for speed.
- They're most commonly found on smaller boats that don't have tricky weight demands.
- Hulls are designed to rise out of the water as they reach higher speeds.
- Power boats and smaller watercraft are often equipped with hulls for these reasons.



Boat building

➤ Types Hull:

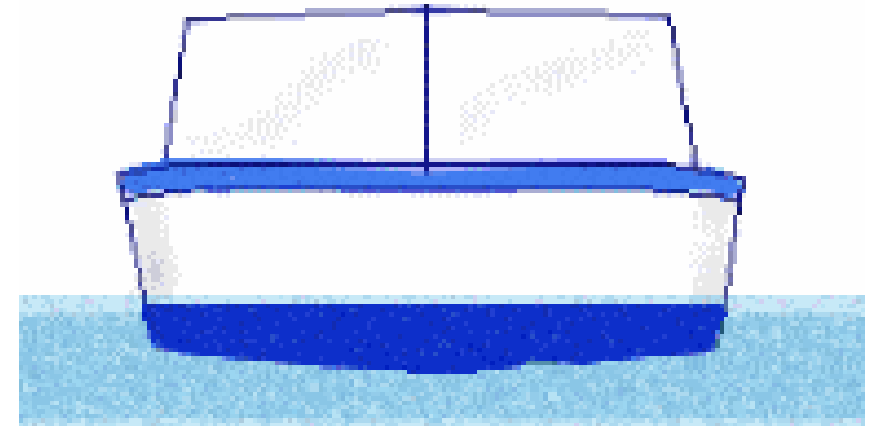
1. Flat bottom boat
2. Vee bottom boat
3. Round bottom boat
4. Multi-hull boat
 - i. Catamarans
 - ii. Trimarans



Boat building

Types Hull

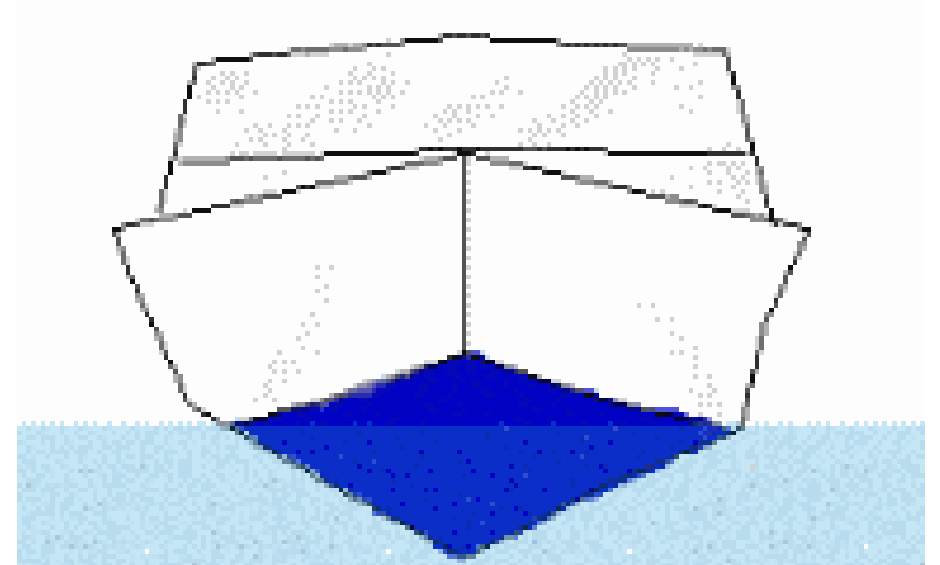
- **1. Flat bottom boat:** These boats are generally less expensive to build and have a shallow draft (the part of the boat that's under the water).
- They can get up on plane easily but unless the water is very calm they tend to give a rough ride because of the flat bottom pounding on each wave.
- They also tend to be less stable and require careful balancing of goods.
- Examples of flat bottom boats might be Jon boats, small utility boats, and some high-speed runabouts.



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Types Hull

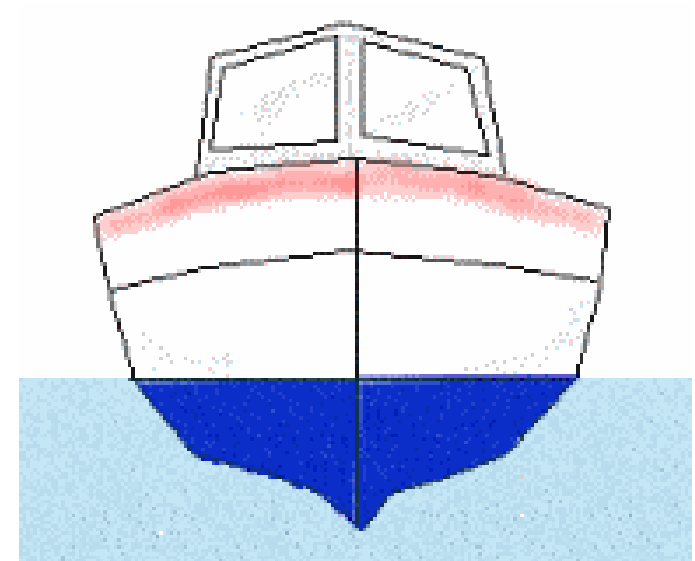
- **2. Vee bottom boat:** The vee bottom tends to have a sharper entry into the water which provides for a smoother ride in rough water.
- They do, however, require more power to achieve the same speed.
- Many runabouts use the vee-bottom design.
- Some have a deep v for better performance..



Boat building

Types Hull

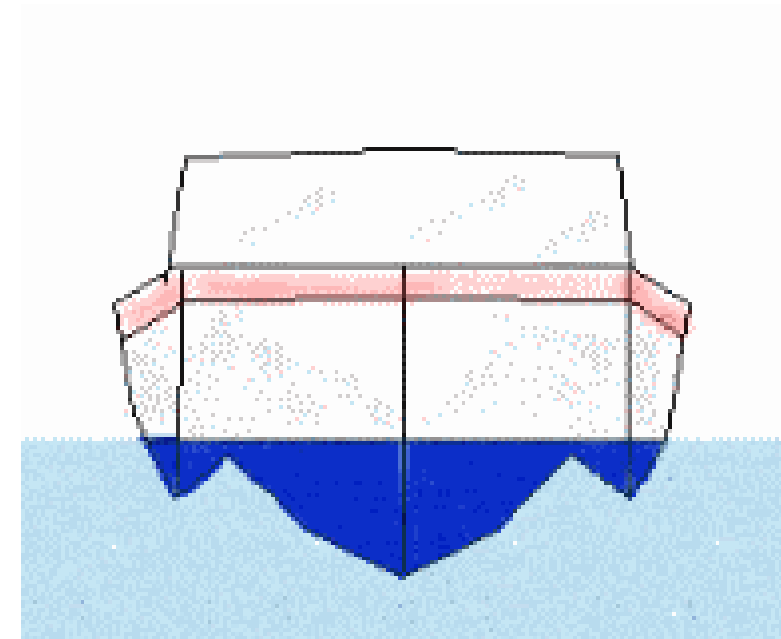
- **3. Round bottom boat:** These move easily through the water, especially at slow speeds.
- They do, however, tend to roll unless they are outfitted with a deep keel or stabilizers.
- Many trawlers, canoes and sailboats have round bottoms.



Boat building

Types Hull

- **4. Multi-hull boat :** Catamarans, trimarans, pontoon boats, and some houseboats use a multi-hull design.
- The wide stance provides greater stability.
- Each of the hulls may carry any of the above bottom designs.
- **Catamarans:** These boats feature two separate hulls with a deck or a stretched material suspended between them. Having two hulls gives them great stability, and a lot more living and storage space compared with other vessels.
- **Trimarans:** A trimaran is like a catamaran but it has three hulls instead of two! A typical trimaran has a main hull in the middle that's flanked by two side hulls that keep the whole thing stable.
- These boats can be quite wide.



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B. Plywood

- Marine plywood is extensively used for marine vessels construction due to its commercial feasibility, high economical viability and relatively low damage in aquatic conditions.
- Marine plywood is prepared by gluing together a number of thin veneers of wood using a waterproof adhesive such as epoxy or phenol resorcinol.
- The wooden plywood's are bonded under high temperature and pressure with phenolic resin glue.
- Best quality marine grade plywood should have at least 5 layers of veneers.
- The marine plywood is having strength-to-weight ratio. The adjacent veneers are kept in such a way that the grain direction is in right angles to each other.

Boat building

B. Plywood

- The most common preservative for plywood used in boat construction is chromated copper arsenic (CCA).
- After the preservative treatment, the panels are re-dried to a moisture content of 18%.
- The kiln drying method is preferred so as to minimize the development of bends and cracks.
- Many uses of plywood in boats involve laminating fiberglass over a plywood boat component.
- The fiber glass coating protects the underlying plywood from scratch and wear during landing and launching of boats.
- Marine plywood boats can ensure protection in severe conditions if it is made of durable or treated veneers.



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C. Steel

- Steel is one of the most popular materials used for boats and has consistently been the material of choice for the past century.
- Its high strength, durability, resistance to abrasion, and relatively low cost are some of the main reasons why steel is widely used in the industry.
- Steel is mainly used to construct hulls of large vessels mainly beyond 50 m in length.
- A steel hull has a relatively thin outside shell and the minimum thickness is 2 - 3 mm.



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C. Steel

- Mild steel is commonly used to construct fishing vessels where the carbon content is 0.15 to 0.30%.
- Steel can be easily bent and twisted so that larger designs/sections can be fabricated easily with less wastage.
- Steel is susceptible to corrosion and anticorrosive paints are essential for the hull protection.
- Seawater corrosion of steel can only be controlled by external factors rather than by the composition of steel.
- For small boat construction steel is not an efficient material.



Boat building

D. Aluminum

- Aluminum is preferred by a lot of boat manufacturers on account of its being lightweight, especially when compared to steel.
- Aluminum boats are more stable and seaworthy and can travel faster due to reduced weight.
- This means that you get better mileage for the same quantity of fuel from an aluminum boat.



Boat building

D. Aluminum

- Aluminum is a corrosion-resistant material due to the production of a surface film of aluminum oxide.
- On the downside, aluminum is expensive.
- Also it is soft metal and hence more susceptible to abrasion.
- Aluminum is recyclable, so that is a point in its favor.
- Application of eco-friendly paint instead of lead-based paint can be a helpful addition to making an aluminum



Boat building

D. Aluminum

- **Aluminum boats cost more for the fabrication but painting is not essential for these boats except antifouling paints.**
- **Antifouling** (Anti-fouling paint is a specialized category of coatings applied as the outer layer to the hull of a ship or boat) **paints should be carefully selected and it should not contain mercury because it destroys aluminum by forming an amalgam.**



Boat building

D. Aluminum

- Aluminum pieces are joined by the welding process where heating during the process partially reduces the strength and hence care should be taken.
- Attention must be given during the installation of electric circuits to avoid currents.
- The scrap value of aluminum is more.



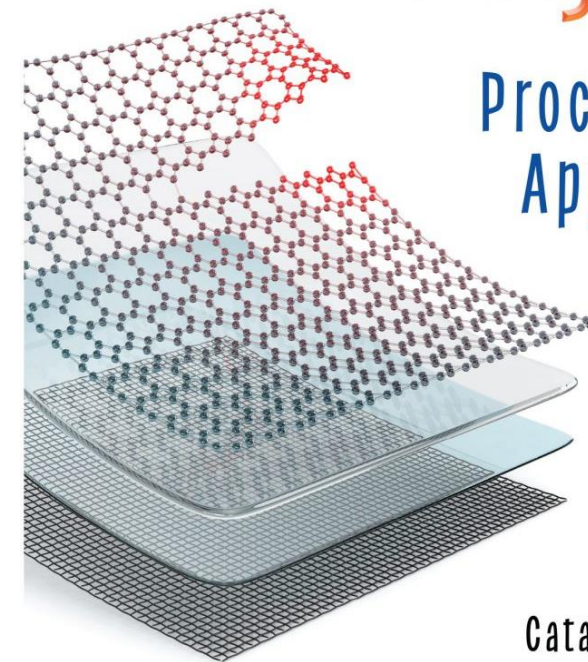
Boat building

E. Fiber Reinforced plastic (FRP)

- Fiber reinforced plastics or FRP is also known as Glass reinforced plastic/GRP.
- The usage of FRP as a boat building material is flourished because of its low production cost and anticorrosive property.
- It is also easy and simple to fabricate.
- The main material components of FRP are the reinforcing agents like glass fiber in the form of thin fiber and a plastic resin capable of impregnating fibers.
- For the construction of FRP boat, the primary requirement is a mould.

Fiber-Reinforced Polymers

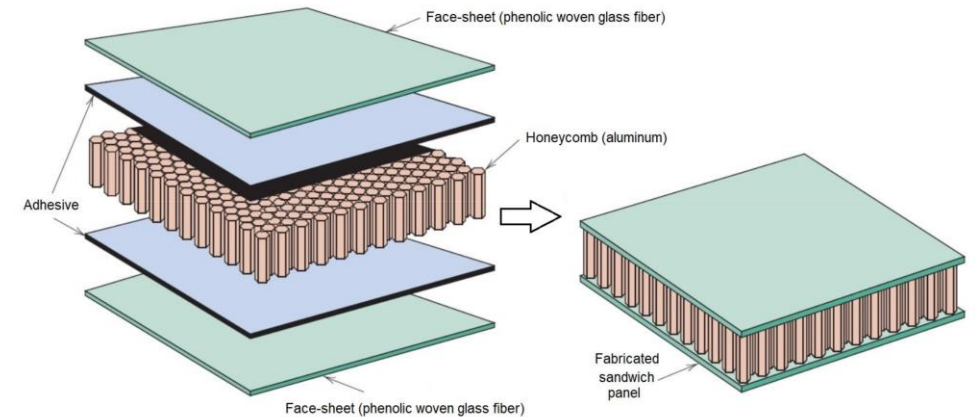
Processes and
Applications

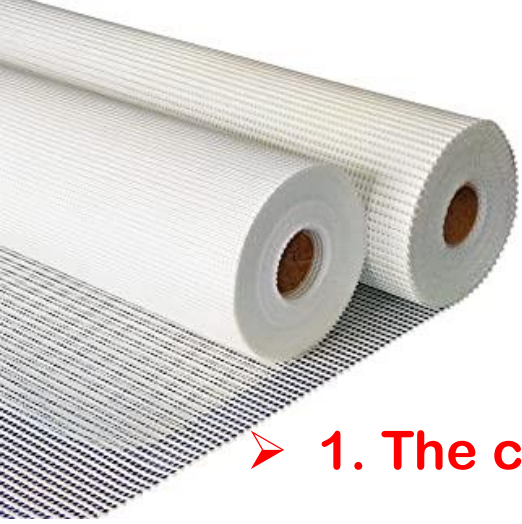


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E. Fiber Reinforced plastic (FRP)

- The most popular reinforcement used is a form of glass processed into filaments which are then chopped and supplied in rolls.
- The thickness depends on the weight of the glass in grams per square meter.
- The two main types of glass fibers available in the market are
 1. Chopped strand mat
 2. Woven roving

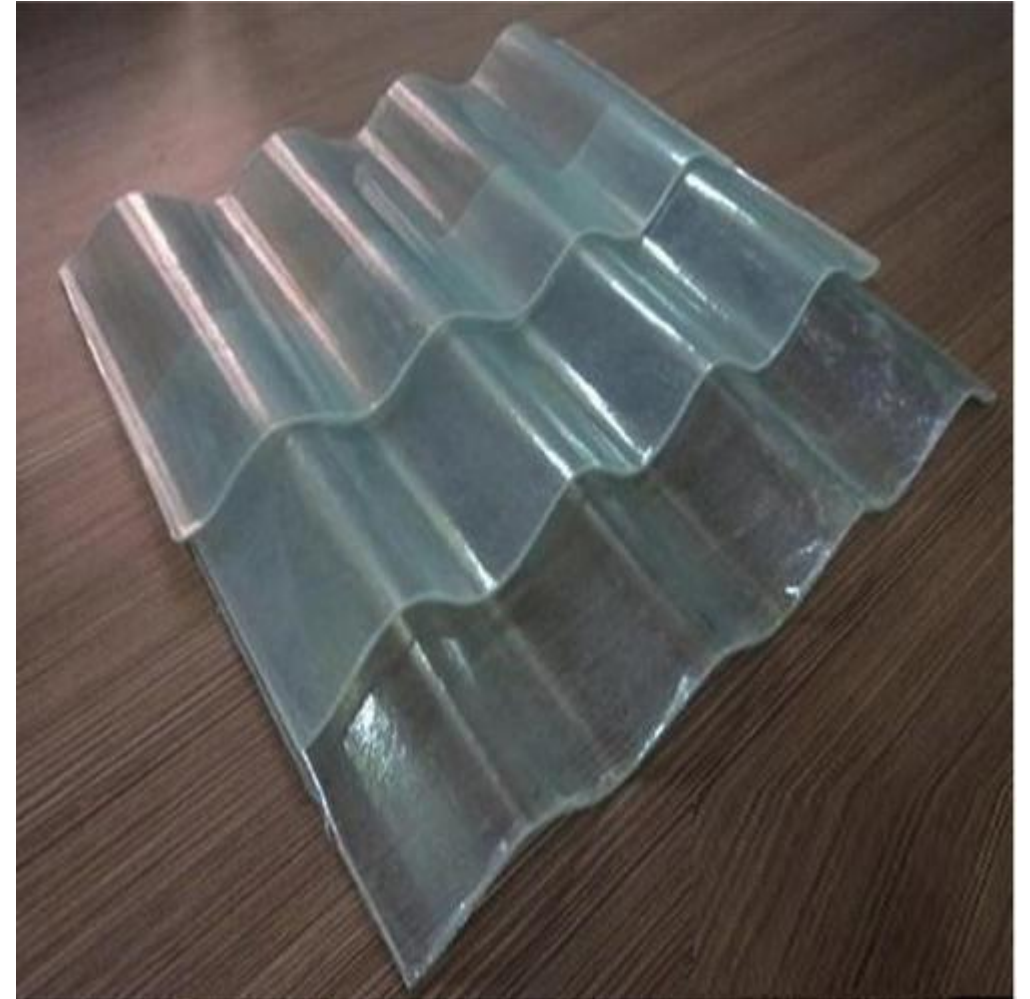




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E. Fiber Reinforced plastic (FRP)

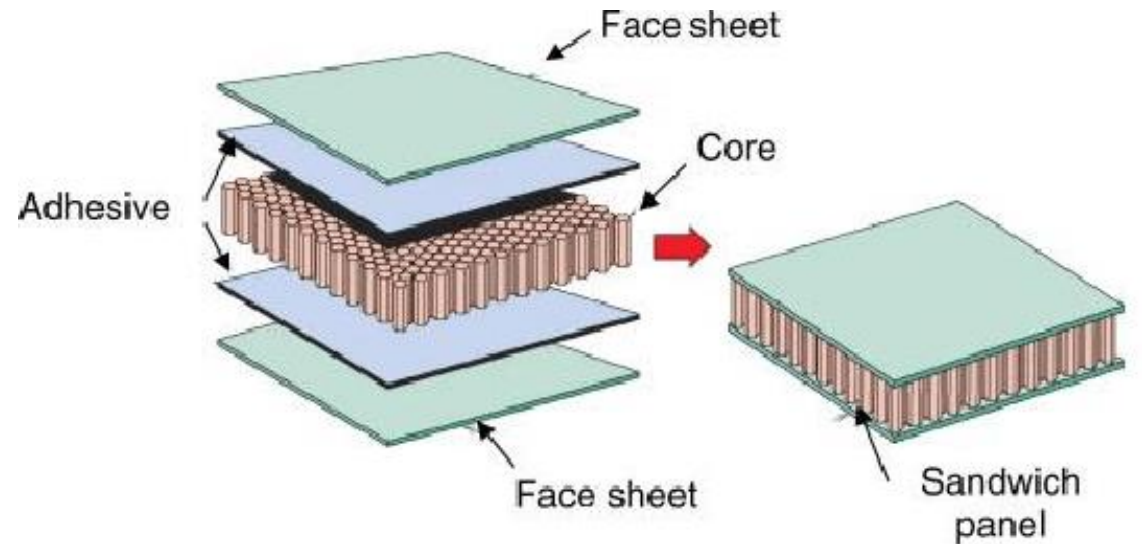
- **1. The chopped strand mat (CSM):** is made up of long fiber glass strands that are randomly oriented and held together with a binder glue.
- These are available in fabric form as rolls or in small folded packages with varying thickness.
- The boat builder purchases it in rolls of 30–35 kg which are about 1 m in width.



Boat building

E. Fiber Reinforced plastic (FRP)

- **2. Woven roving (WR):** is made from continuous glass fiber roving to increase strength and stiffness of the laminate which is sandwiched between layers of fiber glass mat.
- The greater strength of laminate can be achieved by using such woven glass mats.



Boat building

F. Ferrocement

- Ferro cement was first introduced as a boat-building material in 1847 in France by Joseph Louis Lambot.
- However it took professor Pier Luigi Nervi of Italy in 1940 to successfully develop a Ferro cement boat.
- Since then it is finding application as a boat building material in many countries.
- Ferro cement is a highly versatile form of reinforced concrete made of wire mesh, sand, water and cement which possess unique qualities of strength and serviceability.



Boat building

F. Ferrocement

- It consists of a reinforcement of a number of layers of galvanized iron wire mesh over an arrangement of mild steel rods and fully plastered with a mortar mix of sand and cement combination.
- The Ferrocement as “A thin, highly reinforced shell of concrete in which the steel reinforcement is distributed widely throughout the concrete so that the material under stress acts approximately as a homogeneous material.



Boat building

F. Ferrocement

- Ferrocement is a combination of wire mesh saturated within mortar of fine sand and cement.
- The main difference between ferrocement and other forms of reinforced concrete is in the use of a fine-grained aggregate and fine meshed reinforcement in a thin shell structure.



Boat building

F. Ferrocement

- The fine ingredients give increased flexural and shear strength, increased specific surface, improved tensile bonding capacity, crack inhibition due to high proportion of small diameter wires in mesh and resistance to corrosion due to restriction of crack widths below critical values above which moisture could enter the shell structure.



Boat building

F. Ferrocement

- The strength of ferrocement is related to the weight and distribution of the steel reinforcement.
- Cement used are of two types- Type II Portland and V rapid hardening containing not more than 10% tricalcium aluminate.
- Sand having quartzite with grain size more than 2 mm is used. Additives are used to keep the water content low. Lignosulphates are used as additives.
- The advantages of ferrocement are high flexural strength, resistance to corrosion, high surface area and it can be built without any skilled labor.
- Raw materials are easily available and cost of construction is less than timber and steel.

Boat building

F. Ferrocement

- Ferrocement craft can be built without highly skilled labor.
- No expensive plant is needed as in the case of steel construction and to a lesser extent with timber construction.
- It is not necessary to use a mold for ferrocement construction as in the case of building with FRP as no temperature control is necessary.
- Local manufacturing can be done without sophisticated facilities.
- The raw materials necessary for ferrocement construction are easily available in most countries.
- FRP raw materials are relatively expensive and requires storage facilities.
- Damaged area can be chipped away until surrounding area is fine.
- Ferrocement mix applied both in interior and exterior area is left little pruned and finally ground off.
- In addition, ferrocement has good heat insulation properties

Thank
You

