



IIT ROORKEE



NPTEL ONLINE
CERTIFICATION COURSE

TECHNOLOGY OF PATTERNMAKING

Pattern Materials

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INTRODUCTION

- A pattern is an approximate (modified in accordance with the requirements of the casting process, material being cast, and the molding technique being used) replica or duplicate of the object to be made by the casting process. It is the principal tool during the casting process.
- Design and construction of a pattern is first step in making a casting
- Quality of the casting produced depends largely on the pattern material, its design and construction.

- Use of expensive patterns can be justified only when the quantity of castings required is relatively substantial.
- When only few castings are needed, a loose pattern made from a soft variety of wood serves the purpose.
- The pattern material is determined primarily by the number of castings to be made but is also influenced by the size and shape of the casting, the desired dimensional precision, and the molding process.

SELECTION CRITERIA FOR PATTERN MATERIALS

- Type and form of material to be used
- Method of molding
- Constructional details like provision of loose pieces, core prints
- Allowances to be used
- Method of gating and feeding to be followed
- Provision of various foundry aids

DESIRED CHARACTERISTICS OF THE PATTERN MATERIAL

- Easily worked, shaped, and joined
- Light weight
- Hard and durable
- Resistant to wear and abrasion, corrosion, and chemical action
- Dimensionally stability
- Cheap and easy availability
- Repairable/re-used
- Ability to take a good surface finish

TYPES OF PATTERN MATERIALS

- **Wood and Wood Products**
- **Metals and Alloys**
- **Plasters**
- **Plastics and Rubber**
- **Wax**

WOOD AND WOOD PRODUCTS

- Wood can be easily shaped or worked and joined to form any complex shape, light weight, easily available, and costs less than other materials.
- Wood contains 50-60% cellulose and 20-35% lignin and smaller amounts of other carbohydrates.
- Frequently used when small quantities of castings are required

- Drawback: it may warp or swell with changes in humidity.
- To prevent excessive shrinkage or swelling, wood can be seasoned.
- Woods commonly used in making pattern are pine, mahogany, teak, walnut, and deodar.
- **Pine wood:** Light, ease of working, and ability to take good finish.

- **Mahogany:** Hard, Strong, and Durable Type of Wood With Negligible Shrinkage or Swelling after Seasoning. Takes a Very Fine Natural Polish, Stains Well, and Glues Excellently.
- **Teak:** Hard and Strong Variety of Wood, Unaffected by Fungus, and Easily Available in the Country.
- **Deodar:** Soft Variety, Slightly Harder than Pine But Easily Machinable, and Takes Good Polish.
- Amongst Natural Woods, Mahogany is the Best Choice for Pattern Work. It is Ideal where the Number of Castings Required is Large and Involves Permanent Production Work on Moulding Machines.

SEASONING OF WOOD

- Seasoning minimizes the effect of subsequent moisture variations by adjusting the water content of wood near to equilibrium level under exposure to average atmospheric conditions.
- Seasoning can be done by **natural** or **artificial methods**.
- **Natural seasoning:** wood stacked in open spaces and subjected to air drying for a period of up to one full cycle of weather conditions. Timber may also be immersed in flowing water to wash away moisture by osmosis and further air drying it for a shorter duration.

- **Artificial seasoning:** Timber stacked in drying kilns and subjected to fast air drying by allowing hot air to pass through the kiln chamber.
- **Electrical seasoning:** exposed to a high frequency electric field which brings down the level of moisture to the desired level.
- **Chemical seasoning:** Wood is kept immersed in suitable salt solutions and then exposed to air for drying.

METALS AND ALLOYS

- Metal patterns are more expensive but more dimensionally stable and durable.
- used where repetitive production of castings is required in large quantities.
- commonly used metals are aluminium and its alloys, cast iron, steel and copper based alloys such as brass or bronze.
- Factors to be considered is availability, castability, machinability, surface finish, weight, brittleness, cost etc.

PLASTERS

- Gypsum plaster (Plaster of Paris) when mixed with a correct quantity of water sets in a given time and forms a hard mass having high compressive strength.
- Ordinarily available plasters expand on solidification. By choosing plaster of proper expansion rate, it is possible to completely offset the shrinkage of the casting.
- Gypsum plaster patterns can be prepared either by directly pouring the slurry of plaster and water into desired shape by the Sweep-and-Strickle method.

PLASTICS AND RUBBERS

- Hard plastics, such as urethanes, offer another alternative, and are often preferred with processes that use strong, organically bonded sands that tend to stick to other pattern materials.
- In the full-mold process, Expanded Polystyrene is used while investment casting uses wax patterns.

- Both thermosetting and thermoplastic materials are used for pattern making.
- Thermosetting plastics are used for making long-lasting and durable patterns
- Thermoplastic materials are used for short-runs or piece work.
- In the thermosetting variety, epoxy and polyester resins have found increasing use.
- In thermoplastic type, polystyrene has become very popular.
- Silicone rubbers have been used for making dies in special cases.

- Epoxy resin patterns have become very popular because of their Easily castable nature.
- High strength-to-weight ratio (5.4 compared to 4.0 of aluminum alloys and 1.2 of cast iron)
- Low cost of working
- Good resistance to wear and abrasion, and
- Complete immunity from the action of moisture and the effect of mild heating when in contact with sand.

WAXES

- Wax patterns are excellent for the Investment Casting Process.
- Commonly Used Waxes Paraffin wax, Camauba wax, Shellac wax, Bees wax, Cerasin Wax, and Microcrystalline Wax.
- Desired Properties in a Good wax pattern include
 - ❖ Low ash content (up to 0.05%),
 - ❖ High Tensile Strength and Hardness,
 - ❖ Good Wettability,
 - ❖ Resistance to Oxidation,
 - ❖ Low Shrinkage,
 - ❖ Low Melting Point
 - ❖ Resistance to the primary coat material used for investment,

- Blending or compounding of waxes and other additives is done to achieve desired properties.
- Wax patterns are normally formed by injecting liquid or semi-liquid wax into a split die.
- The patterns are generally small in size, a number of patterns are welded to form a common runner or sprue through in-gates.
- The whole assembly of patterns complete with runner, sprue, etc., Which is termed a tree is invested to prepare the investment mold.

THANKS

