Thapar Institute of Engineering & Technology – Patiala

Manufacturing Processes
UTA026

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Casting Intro

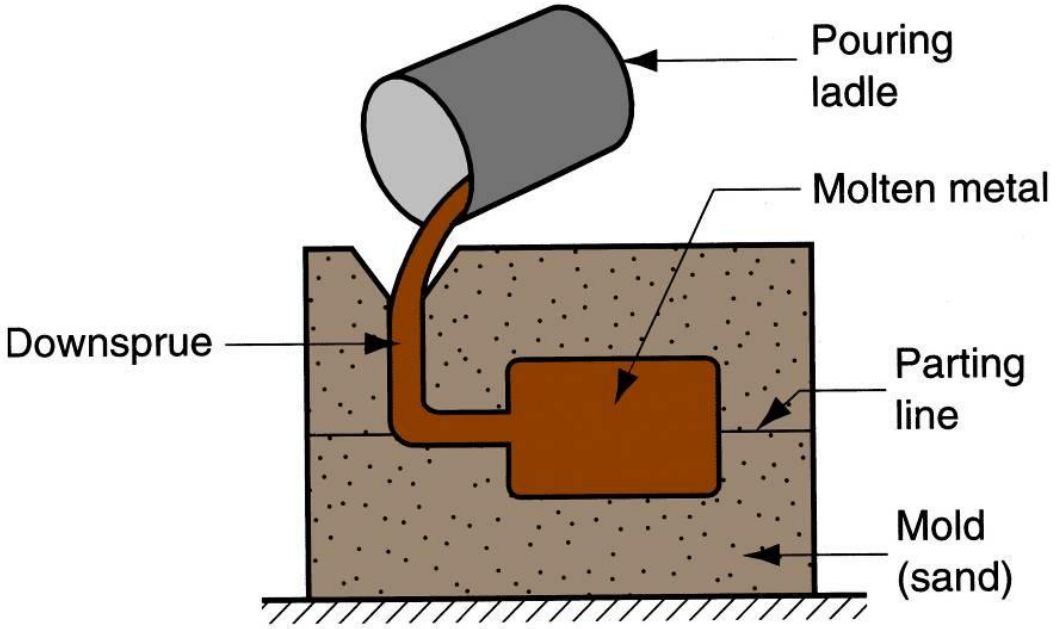
Casting

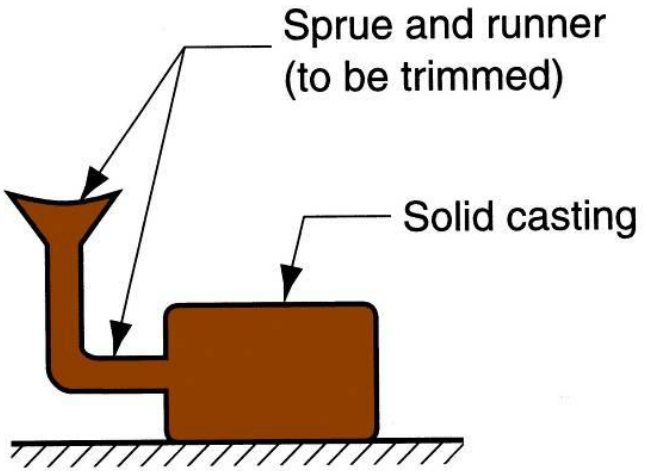
- In the ***casting processes***, a material is first melted, heated to proper temperature, and then poured into a ***cavity or mold*** that holds it in the desired shape during cool-down and solidification.

Casting

- ***Casting*** is a process in which ***molten metal*** flows by gravity or other force into a ***mold*** where it ***solidifies*** in the shape of the ***mold cavity***.
- ***The term casting is also applied to the part that is made by this process.***
- It is one of the ***oldest*** shaping processes, dating back ***6000 years.***
- The variety of casting processes use different ***pouring*** methods ***(gravity, vacuum, low pressure, or high pressure)***

Casting


Pouring ladle
Molten metal
Downsprue
Parting line
Mold (sand)


Sprue and runner (to be trimmed)
Solid casting

Capabilities and Advantages of Casting

- Can create ***complex part geometries***
- Can create both ***external and internal*** shapes
- Some casting processes are ***net shape;*** others are *near net shape*
- Can produce very ***large parts***
- Some casting methods are suited to ***mass production***

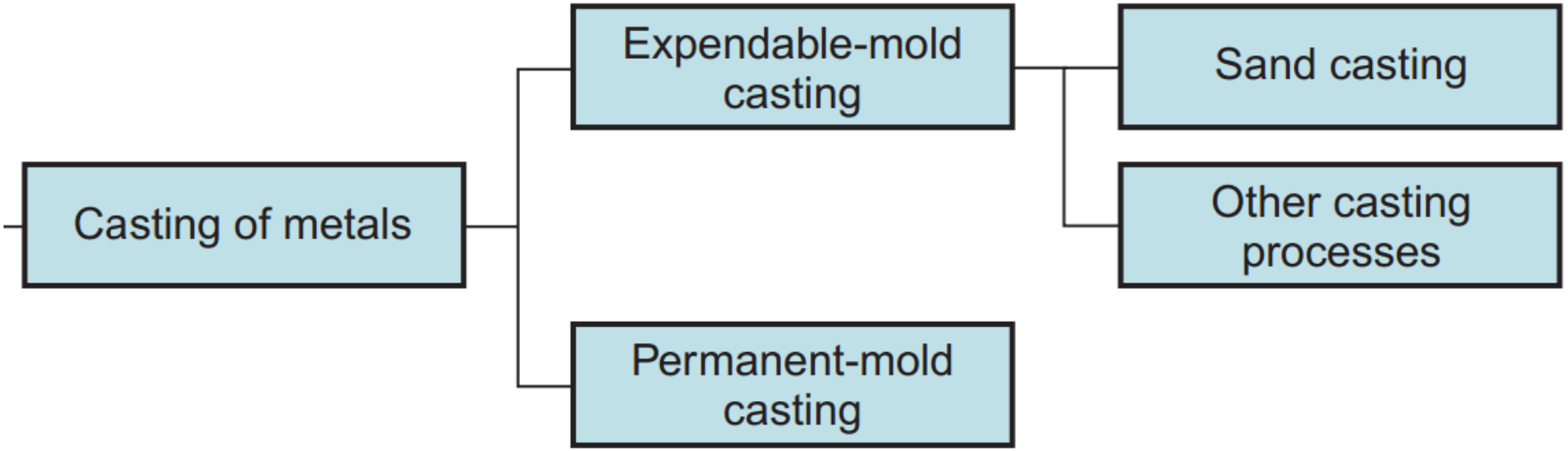
Disadvantages of Casting

- Different disadvantages for different casting processes:
  - ***Limitations*** on ***mechanical properties***
  - ***Poor dimensional accuracy*** and ***surface finish*** for some processes; e.g., ***sand casting***
  - ***Safety hazards*** to workers due to hot molten metals
  - ***Environmental problems***

Parts Made by Casting

- ***Big parts***
  - Engine blocks and heads for automotive vehicles, wood burning stoves, machine frames, railway wheels, pipes, church bells, big statues, pump housings
- ***Small parts***
  - Dental crowns, jewelry, small statues, frying pans
- ***All varieties of metals can be cast, ferrous and nonferrous***

Two Categories of Casting Processes



Two Categories of Casting Processes

1. ***Expendable mold processes*** - mold is sacrificed to remove part
   - ***Advantage***: more complex shapes possible
   - ***Disadvantage:*** production rates often limited by time to make mold rather than casting itself
2. ***Permanent mold processes*** - mold is made of metal and can be used to make many castings
   - ***Advantage***: higher production rates
   - ***Disadvantage***: geometries limited by need to open mold

Expendable mold processes

Overview of Casting Technology

- Casting is usually performed in a foundry
- ***Foundry*** = factory equipped for making molds, melting and handling molten metal, performing the casting process, and cleaning the finished casting
- Workers who perform casting are called ***foundrymen***

Casting Steps

- Steps in casting seem simple:
  - ***Melt*** the metal
  - ***Pour*** it into a mold
  - Let it ***freeze***

Casting Steps

1. *Pour the molten metal into sand mold*
2. *Allow time for metal to solidify*
3. *Break up the mold to remove casting*
4. *Clean and inspect casting*
   - *Separate gating and riser system*
5. *Heat treatment of casting is sometimes required to improve metallurgical properties*

Sand Casting Production Sequence