Module 3

Permanent Mould casting Processes

Permanent mold casting is a process in which molten metal is poured into a metal mold made from steel or cast iron to create new metal pieces. The metal mold is called a permanent mold because it can be reused.

Advantages

- high production rates
- Complex shapes can be formed with low labor costs using highly automated processes.
- good surface finish and dimensional accuracy.

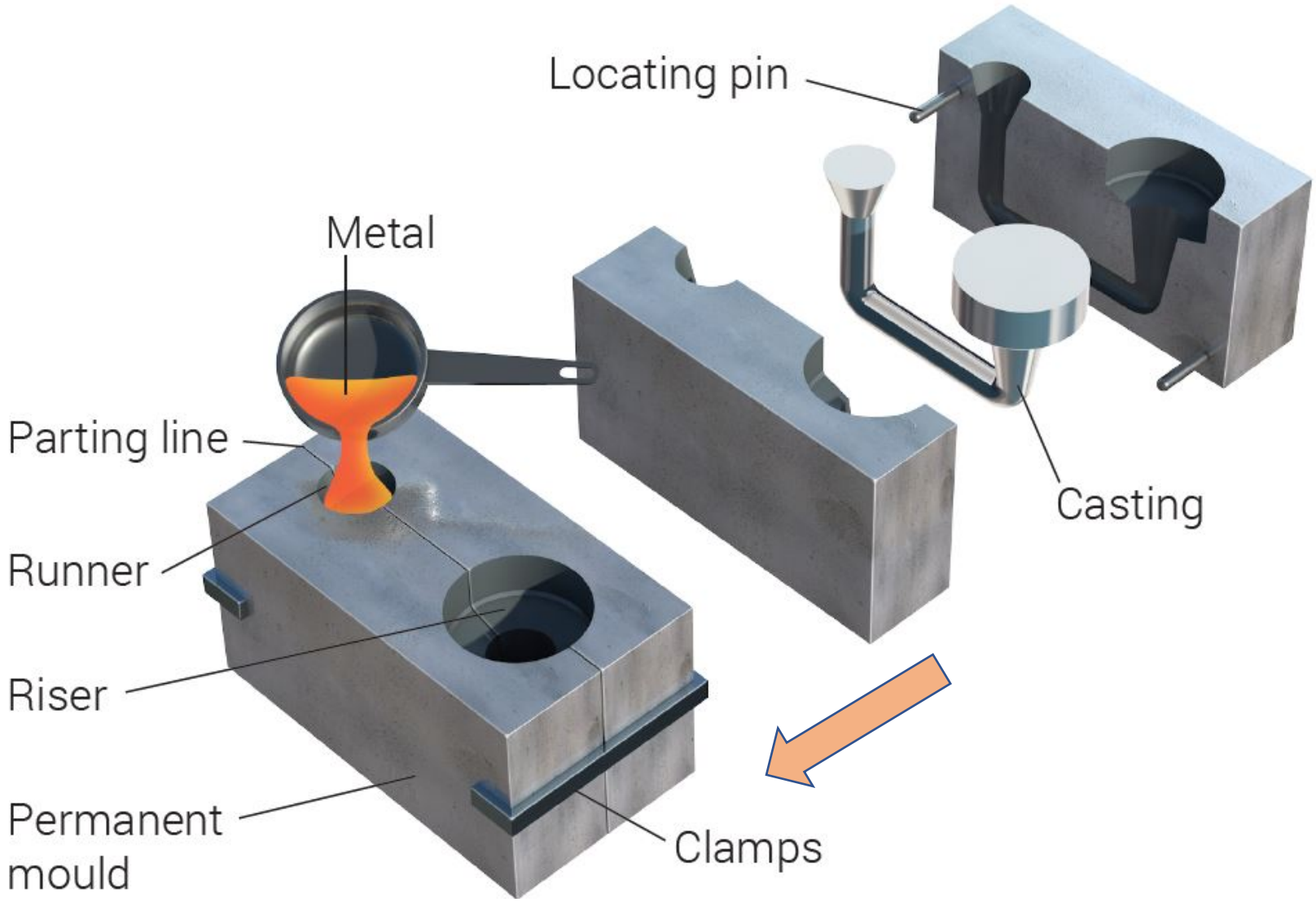
Disadvantages

- higher cost to create the metal molds
- only non-ferrous metals can be used due to their low melting points
- Molds also have a short shelf life due to erosion and thermal fatigue.

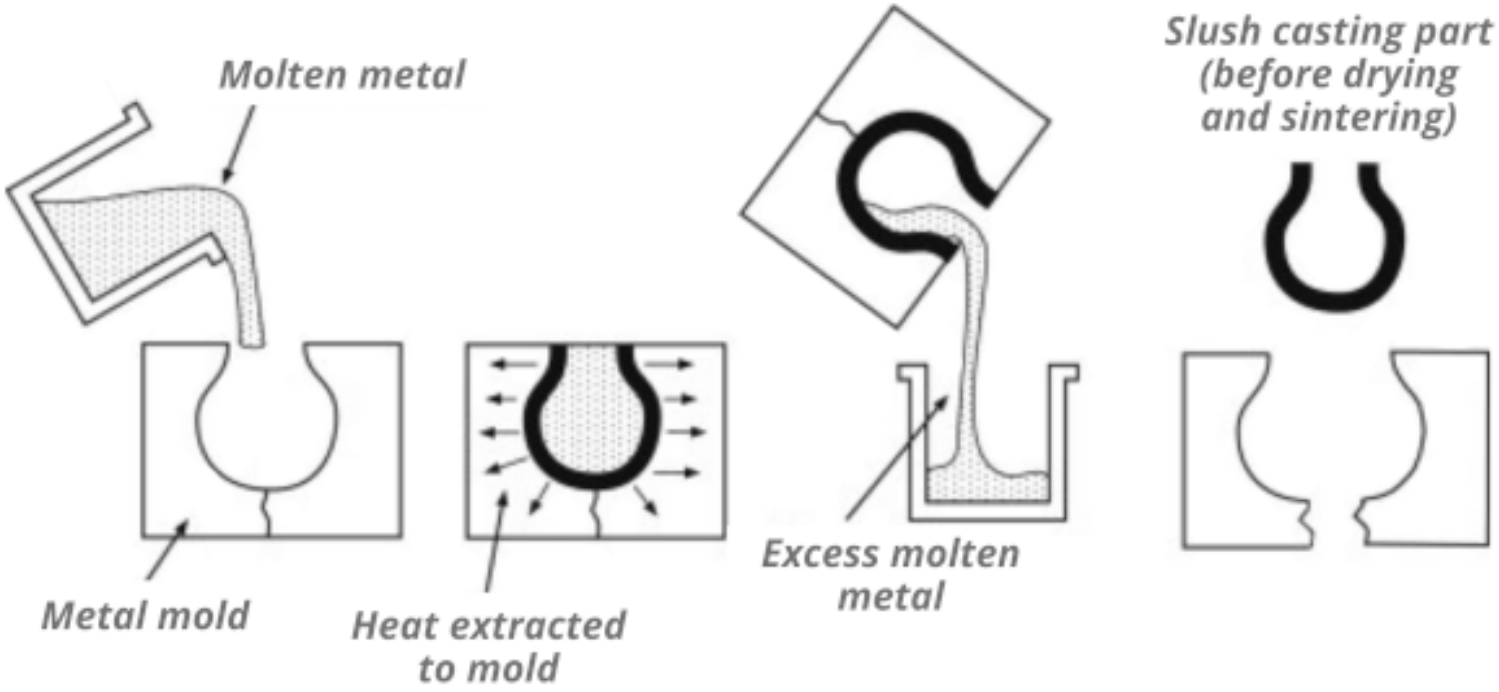
Applications Of Permanent Mold Casting

Permanent mold casting is used heavily in the automotive industry to create parts like gears, castings, suspensions, fuel injection housings, and engine pistons.
Aircraft parts are also often made via permanent mold casting.

Permanent mold casting



Slush Casting

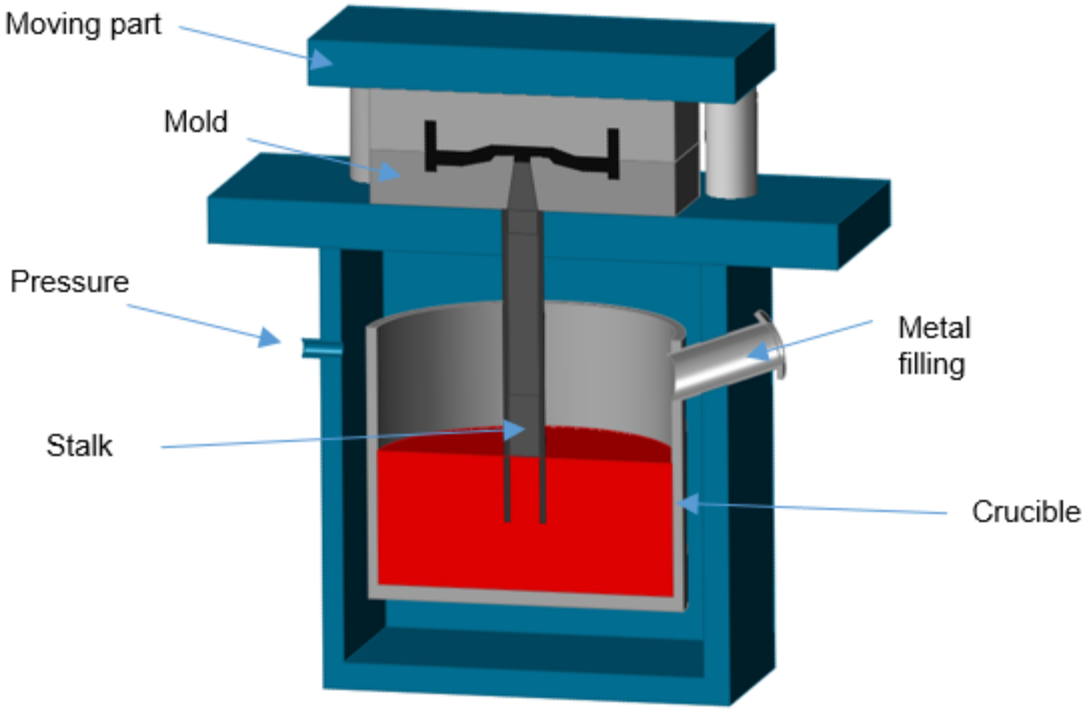


- **Cast Metals : Zn, Sn**
- **Exterior appearance is very important than interior finish and geometry**

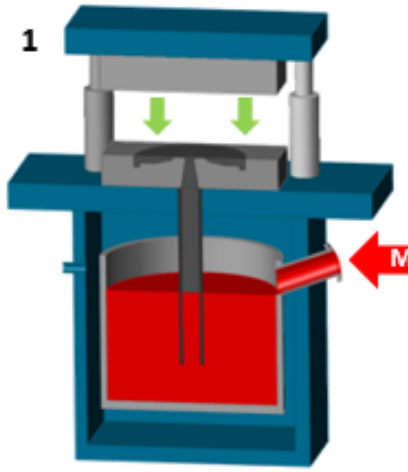
Applications

Decorative and ornamental objects:
vase, bowls, candlesticks, lamps bases, statues, jewelry, animal miniatures

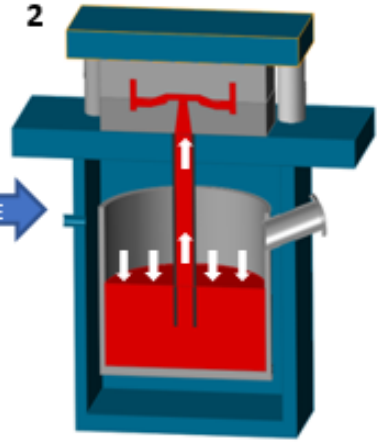
Low Pressure Casting



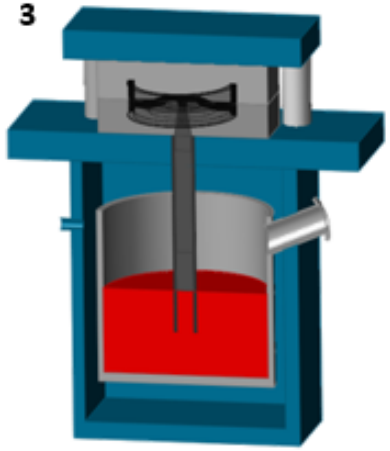
Pressure 0.1 MPa (15 psi)



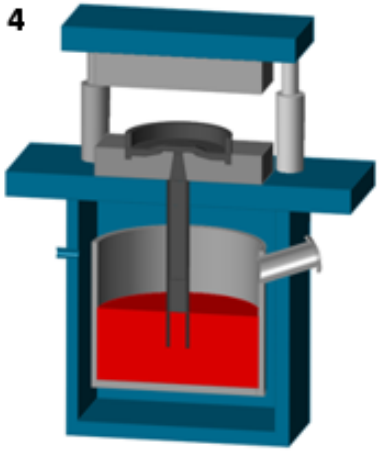
Close the mold and fill the crucible.



The liquid will reach the mold, controlled through increasing pressure.

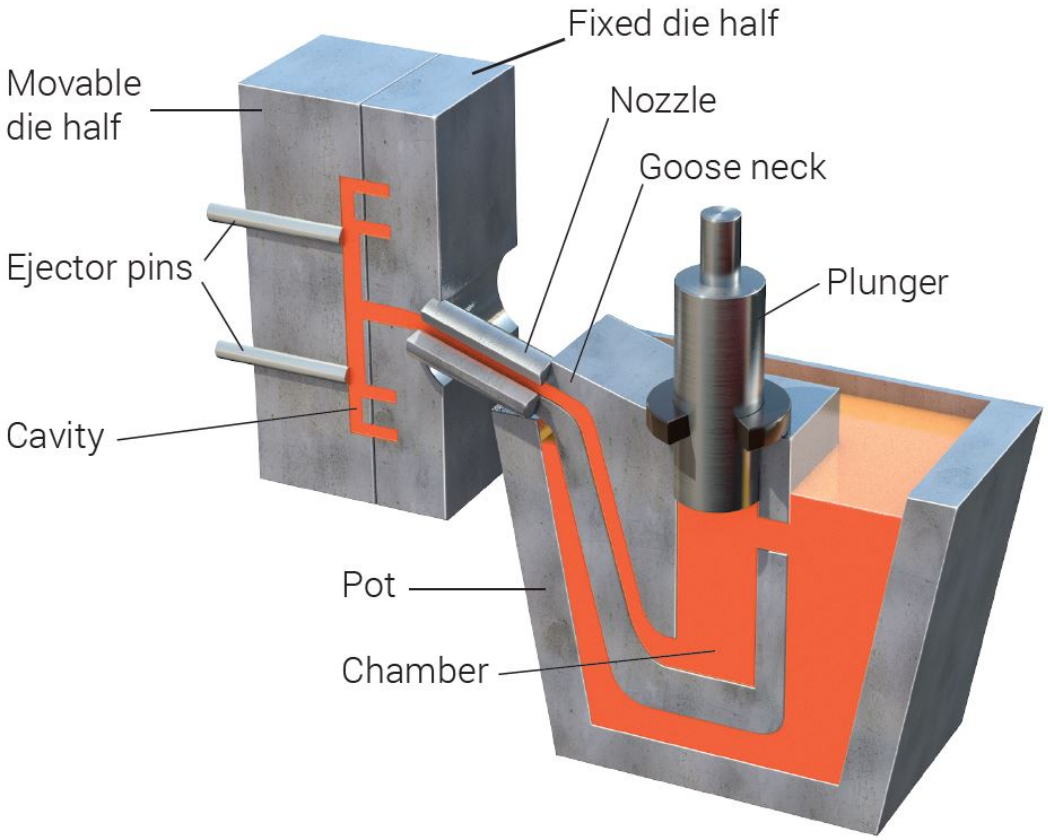


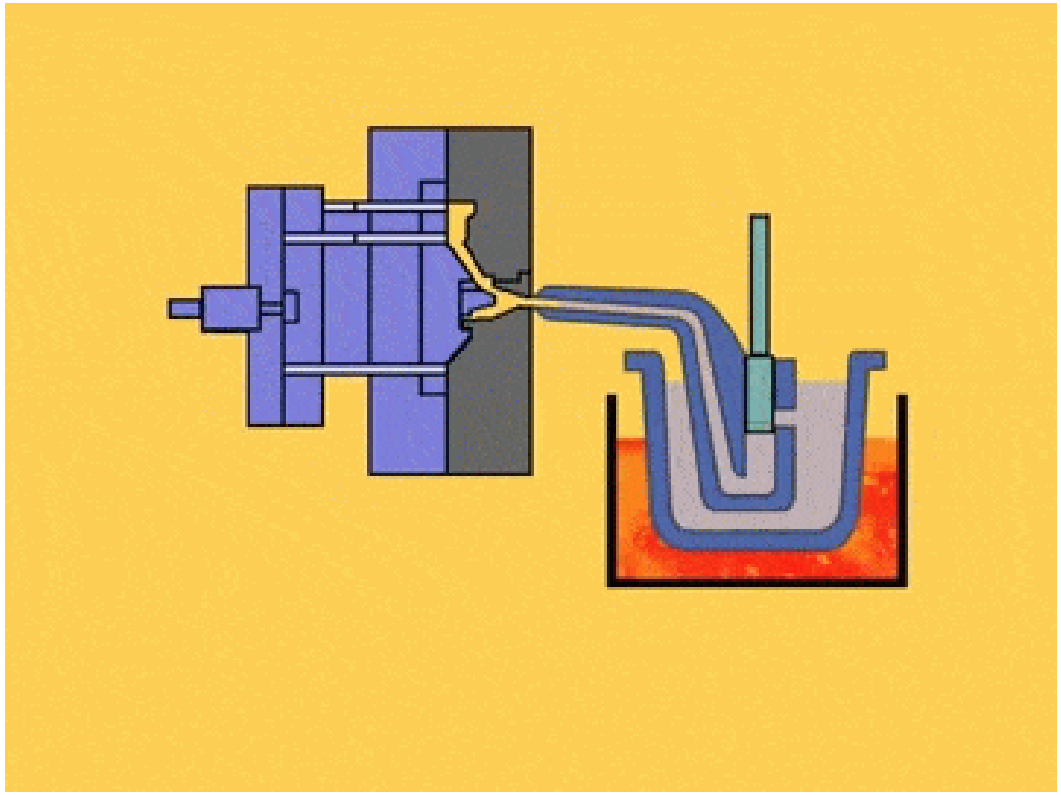
Maintain the pressure during solidification.



Open the mold and extract the component.

Hot Chamber Die casting

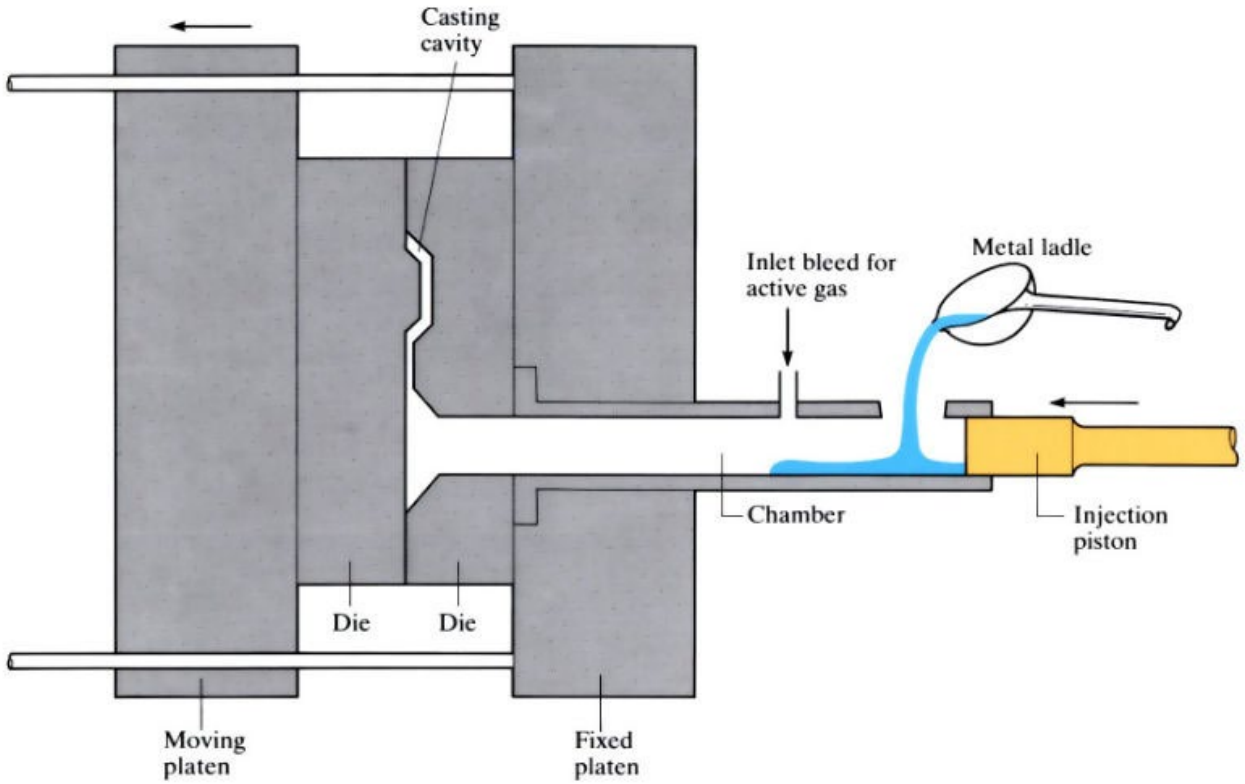




Pressure range for Hot Chamber Die Casting is from 7 to 35 MPa.

- **limited in its applications to lowmelting point metals that do not chemically attack the plunger and other mechanical components.**
- **The metals include zinc, tin, lead, and sometimes magnesium.**

Cold Chamber Die casting



Pressure range for Cold Chamber Die Casting is from 14 to 140 MPa.

- **Cold-chamber machines are typically used for casting aluminum, brass, and magnesium alloys.**

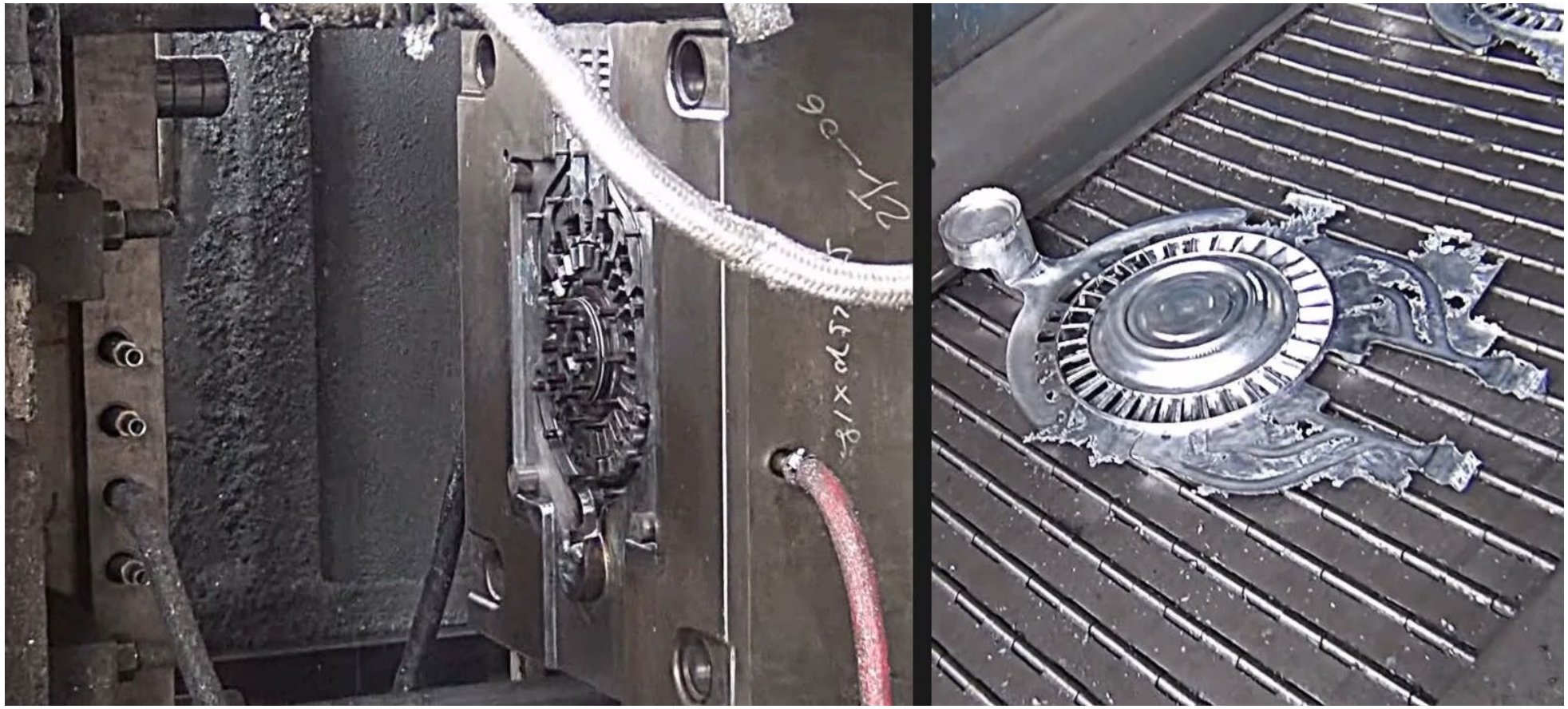
Advantages of die casting

- high production rates possible;
- economical for large production quantities;
- close tolerances possible, on the order of 0.076mm
- good surface finish
- thin sections are possible, down to about 0.5mm
- rapid cooling provides small grain size and good strength to the casting

Limitation of die casting

- shape restriction.
- The part geometry must allow for removal from the die cavity

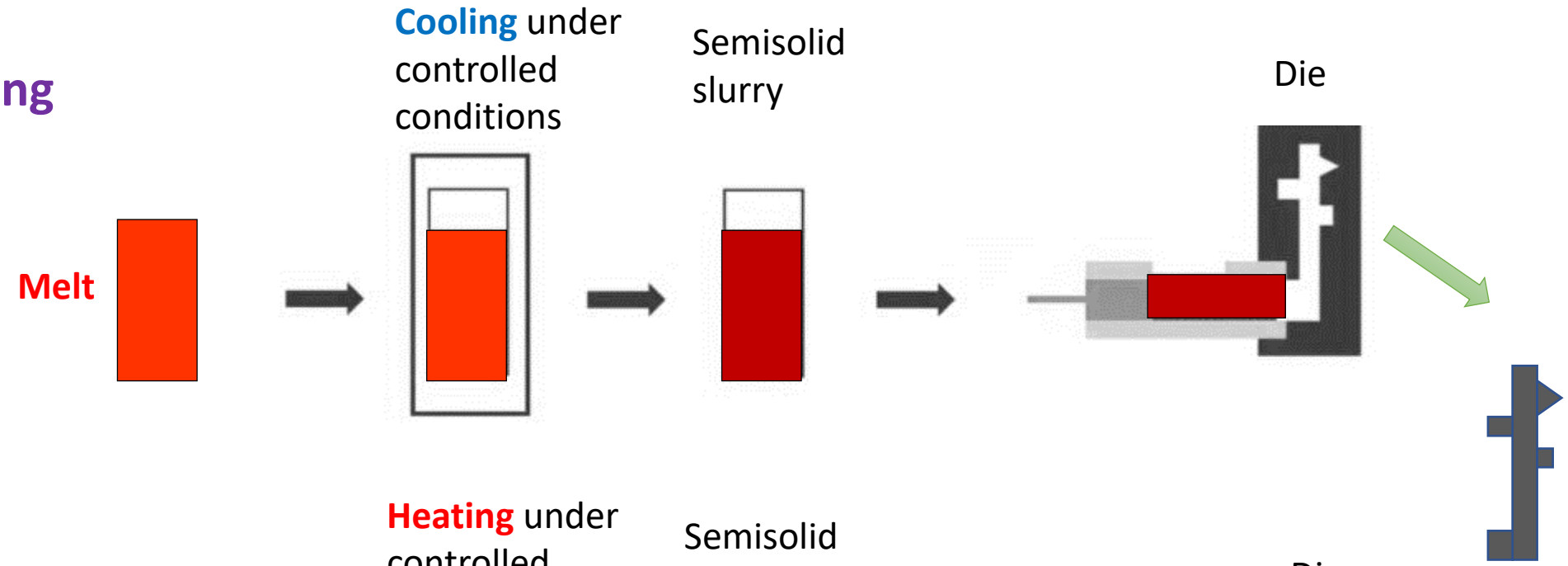
Flash defect in Die casting



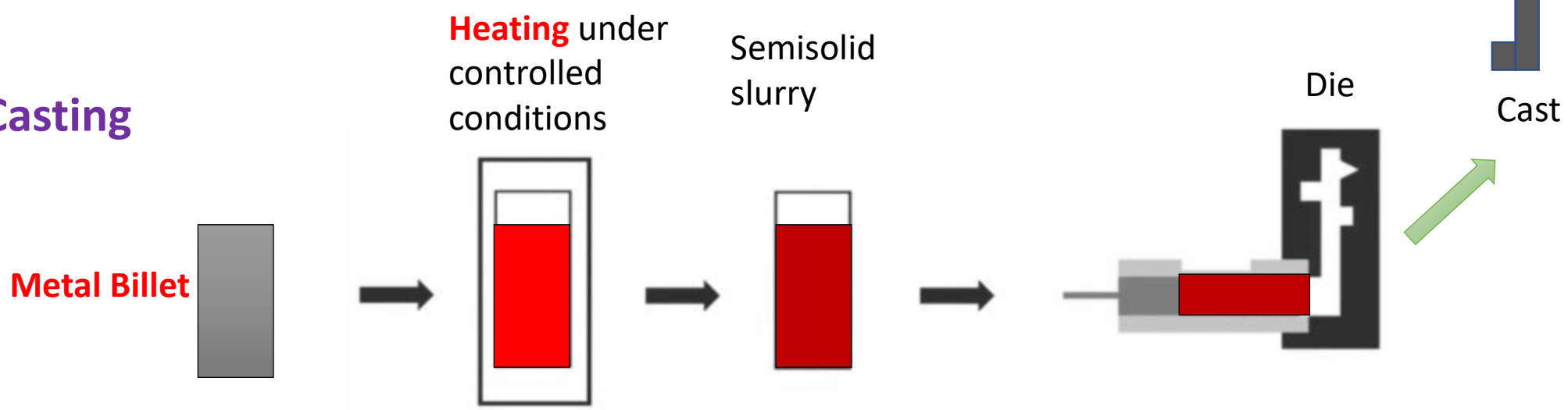
Volkswagen shows off first megacast - Trinity EV Aluminium front and rear bodies

Semi Solid Die casting

Rheo Casting

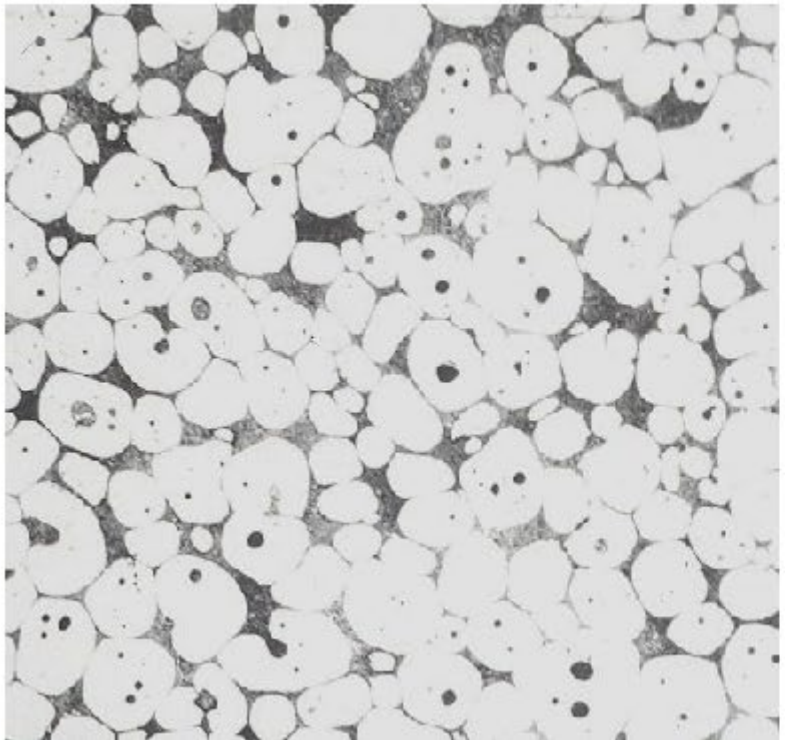


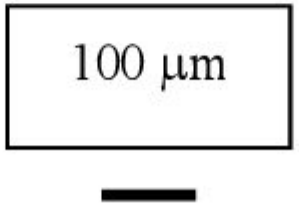
Thixo Casting



Comparison of microstructures of Aluminum alloy 357 by Thixocasting and Rheocasting

a)





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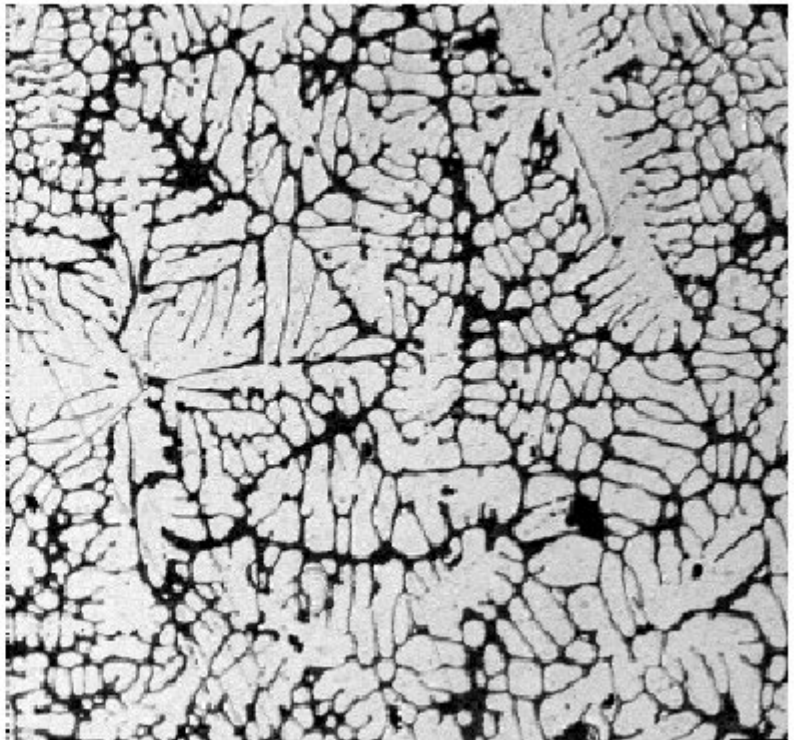
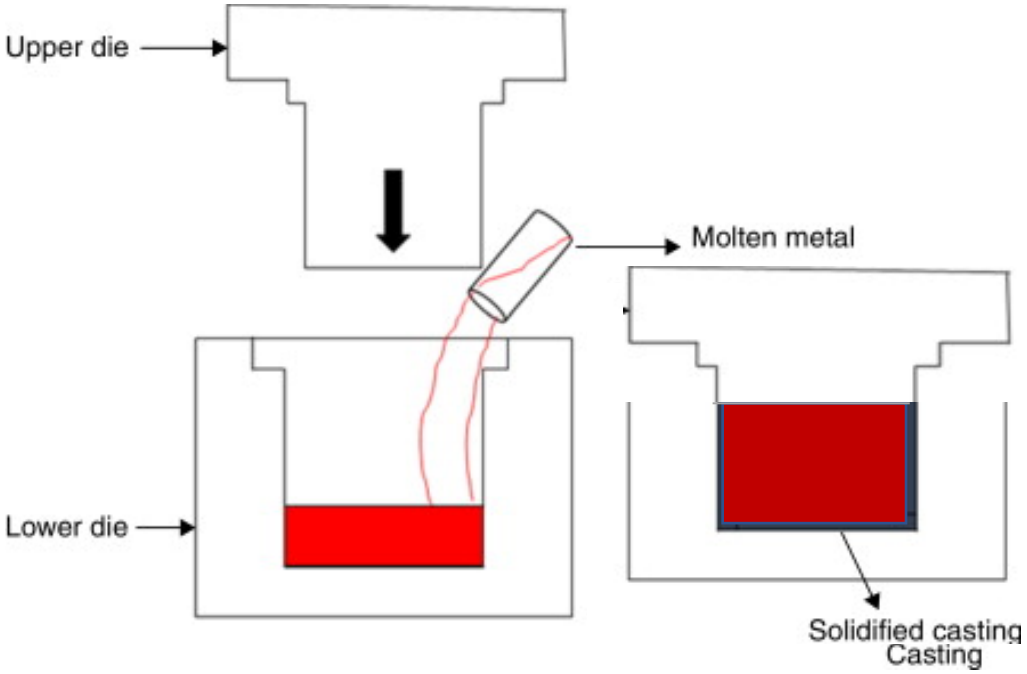


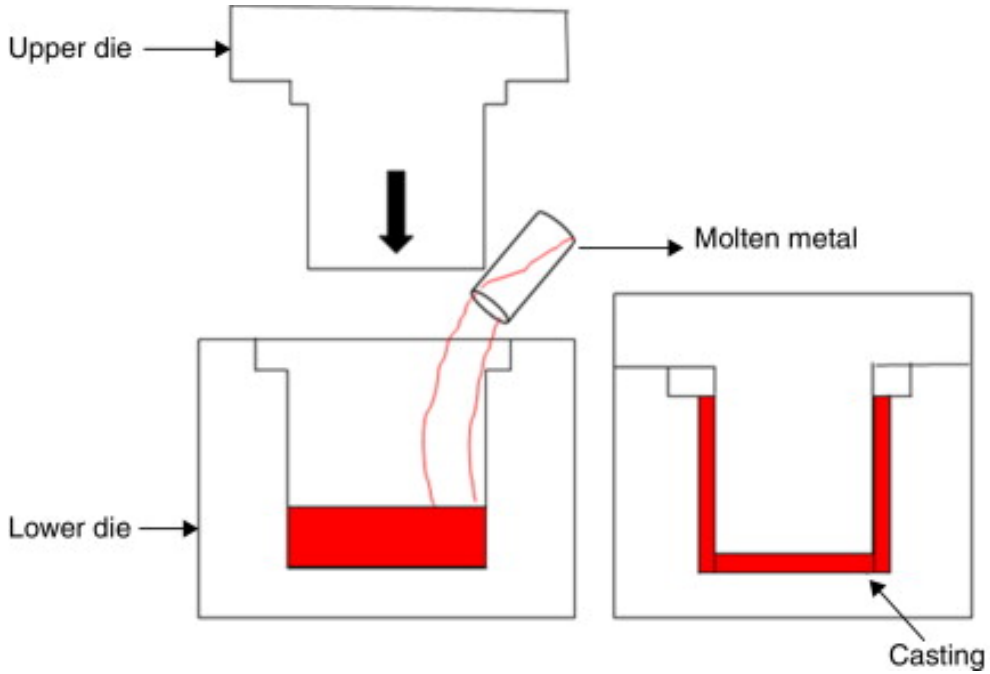
Squeeze Casting

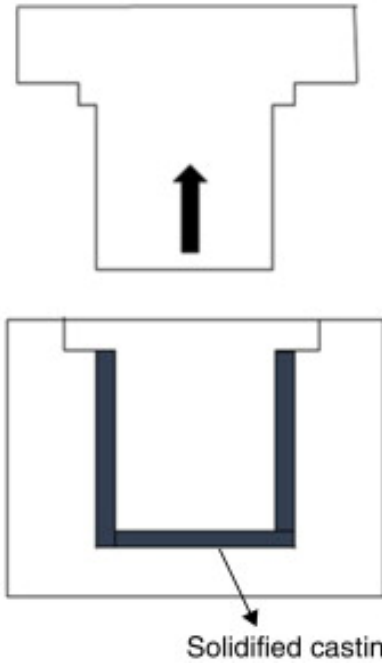
Solid Cast

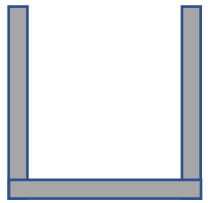


Cast

Hollow Cast







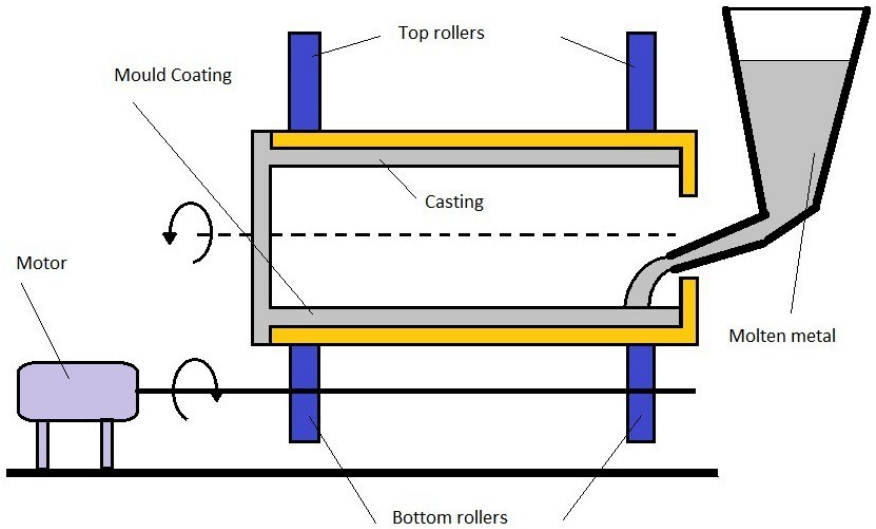
Cast

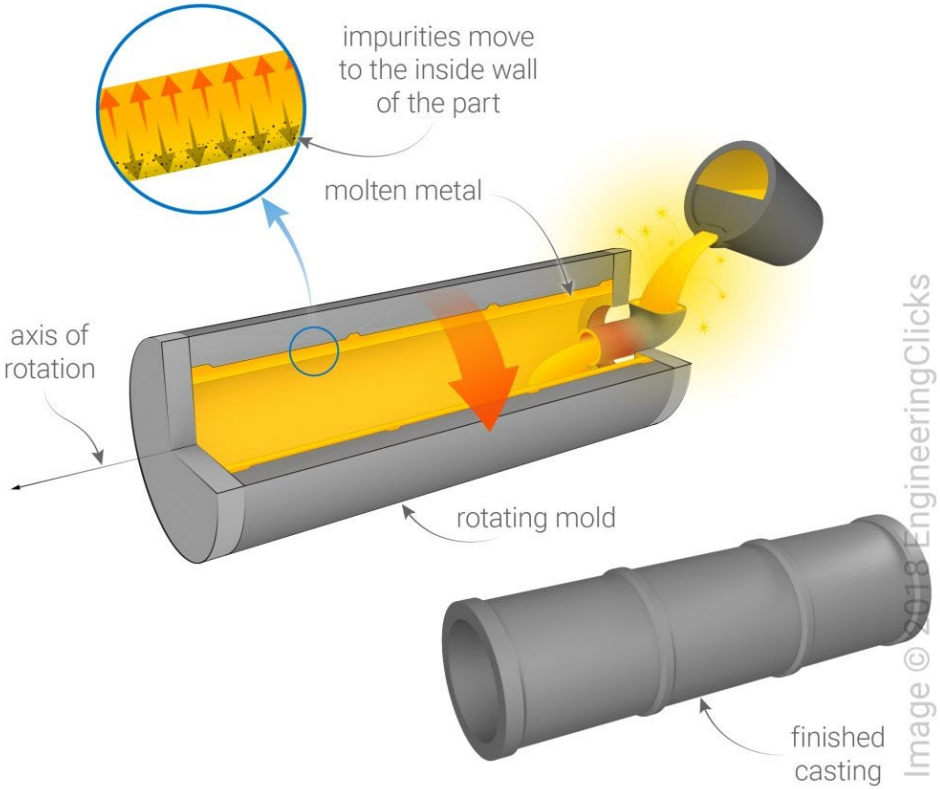
Centrifugal Casting

- True Centrifugal casting
- Semi centrifugal casting
- Centrifuging

Centrifugal Casting Animation True Centrifugal Casting, Semi Centrifugal Casting, Centrifuging - YouTube

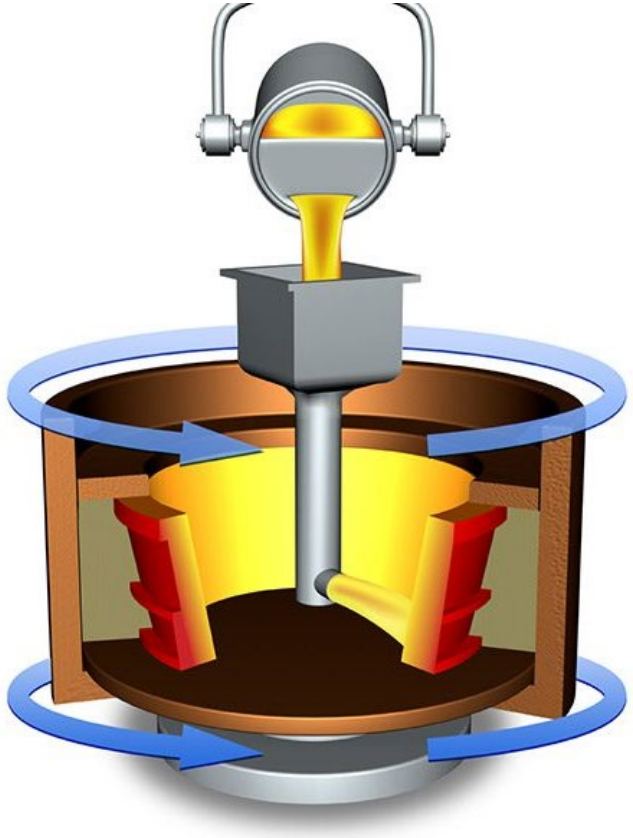
Horizontal centrifugal casting





Vertical centrifugal casting

Semi centrifugal casting



Centrifuging