

Thapar Institute of Engineering & Technology –  
Patiala

# Manufacturing Processes

## UTA026



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# Manufacturing Processes

## UTA026

CORE & CHAPLETS  
Lecture - 20

# Core

- **A core** is a full scale model (sand or metal) that is inserted into a mold to produce the internal features of a casting, such as holes or passages for water cooling.
- **Cores** are produced in wood, metal, or plastic tooling, known as **core boxes**.
- A **core print** is a feature that is added to a pattern, core, or mold and is used to locate and support a core within the mold.

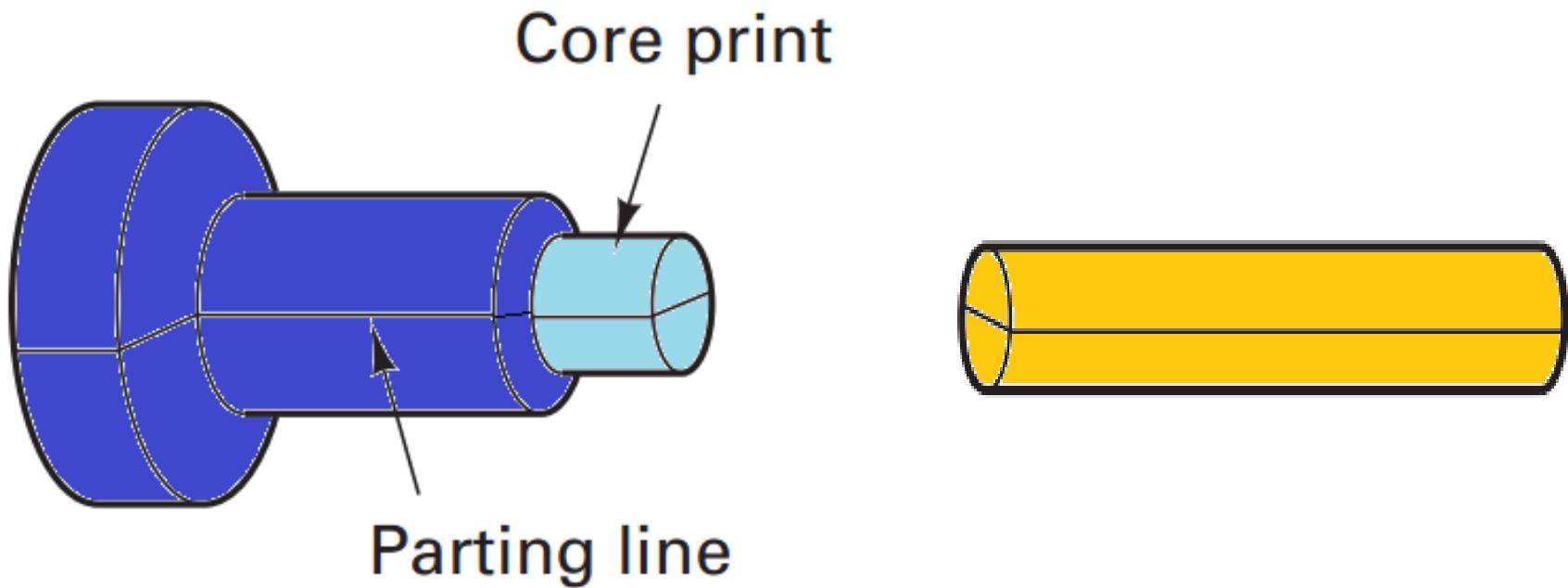
# Core

- The ***mold*** cavity provides the ***external surfaces*** of the cast part
- In addition, a casting may have ***internal surfaces***, determined by a ***core, placed inside*** the ***mold*** cavity to define the ***interior geometry*** of part
- Cores are Generally Made of the Sand and are Even Used in Permanent molds.

# Core Print

- The part of a foundry pattern which makes an opening in a mold to receive a core and to support it while the metal is being poured is called ***core print***.
- Core prints are provided so that the cores are ***securely*** and ***correctly positioned*** in the mold cavity.
- Design of core prints takes care of the ***weight*** of the core before pouring and the upward ***metallostatic*** pressure of the melt after pouring.

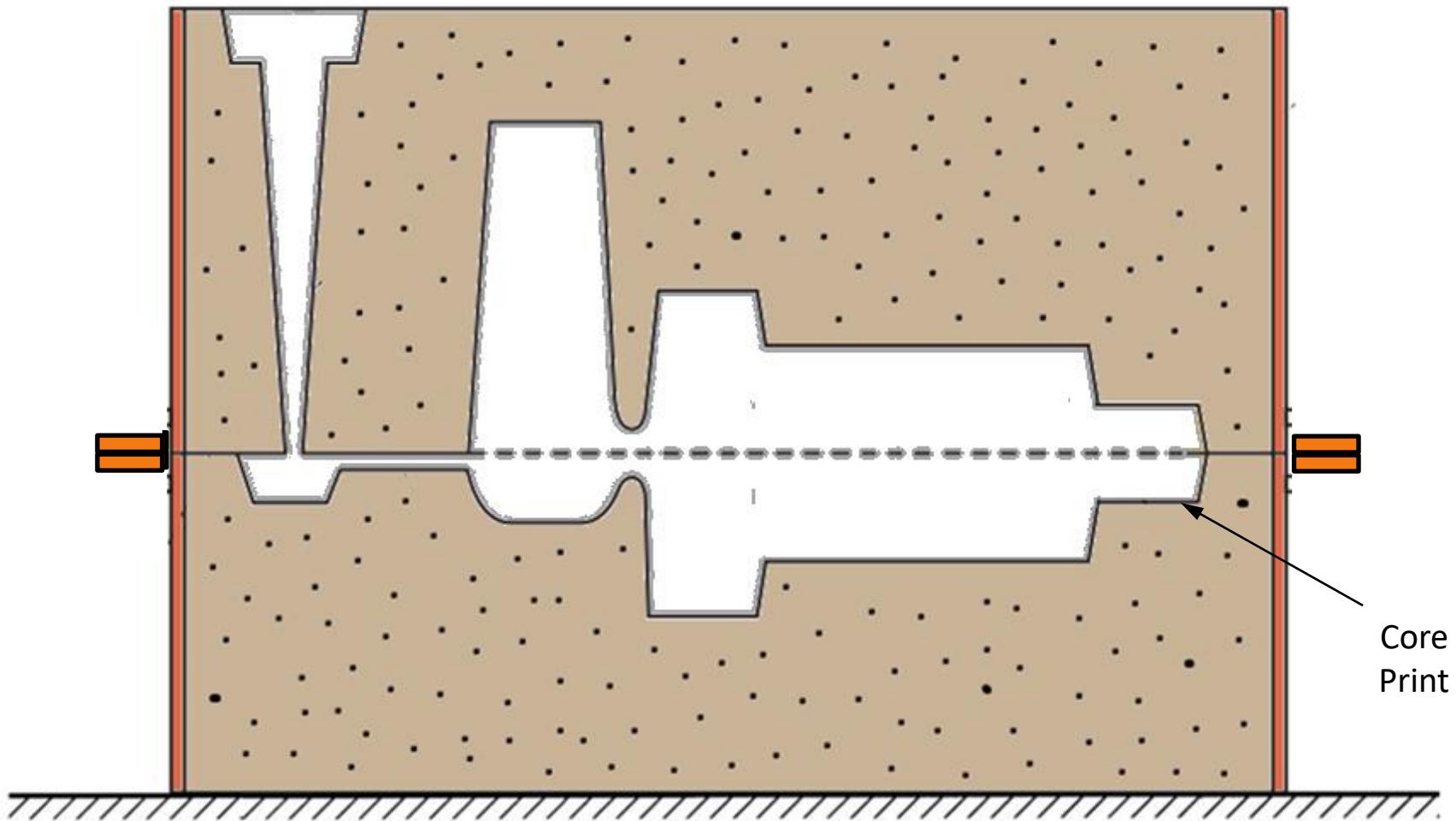
# Use of a Core in the Mold Cavity



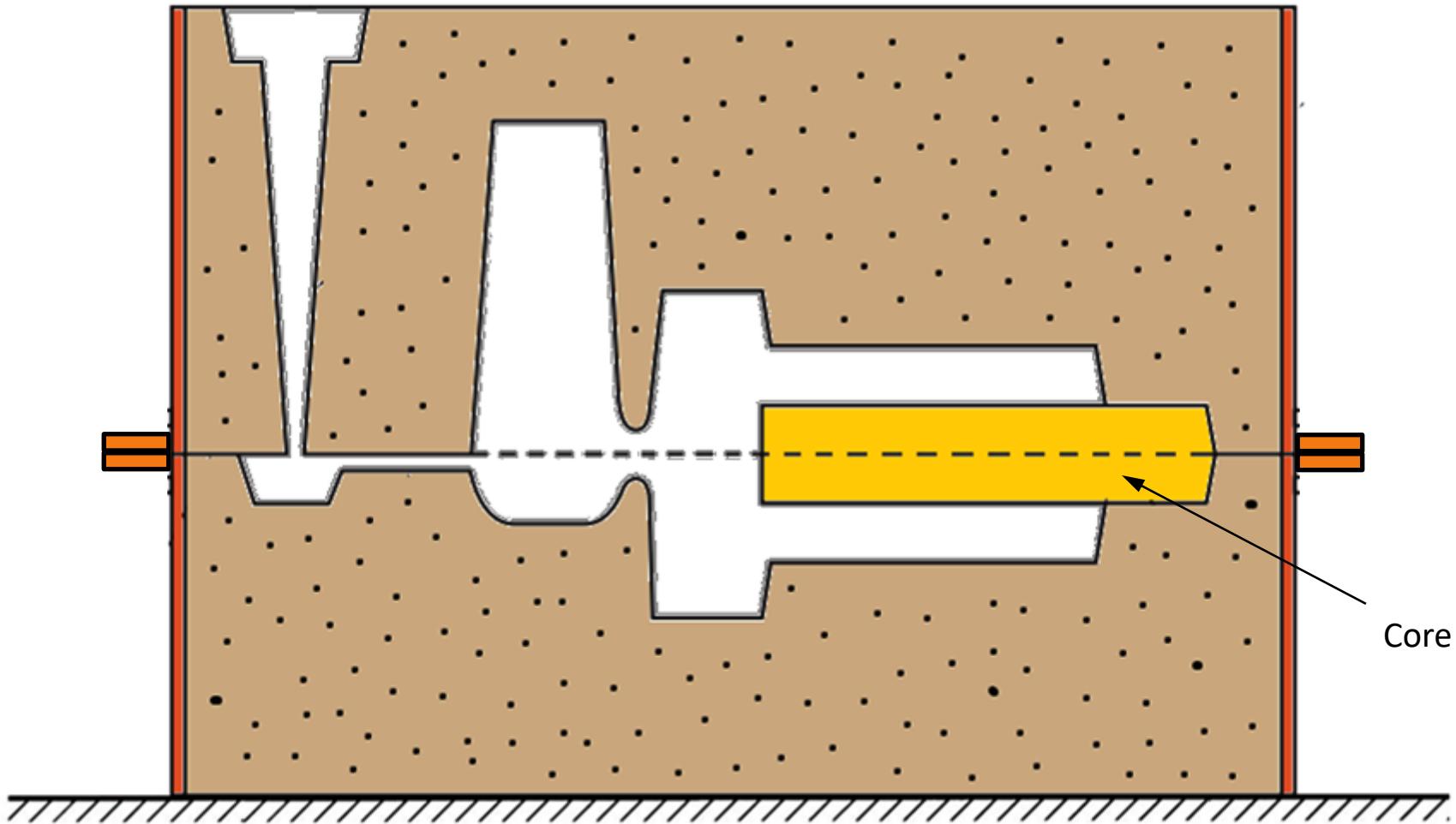
***Split Pattern with a  
Core Print***

***Core***

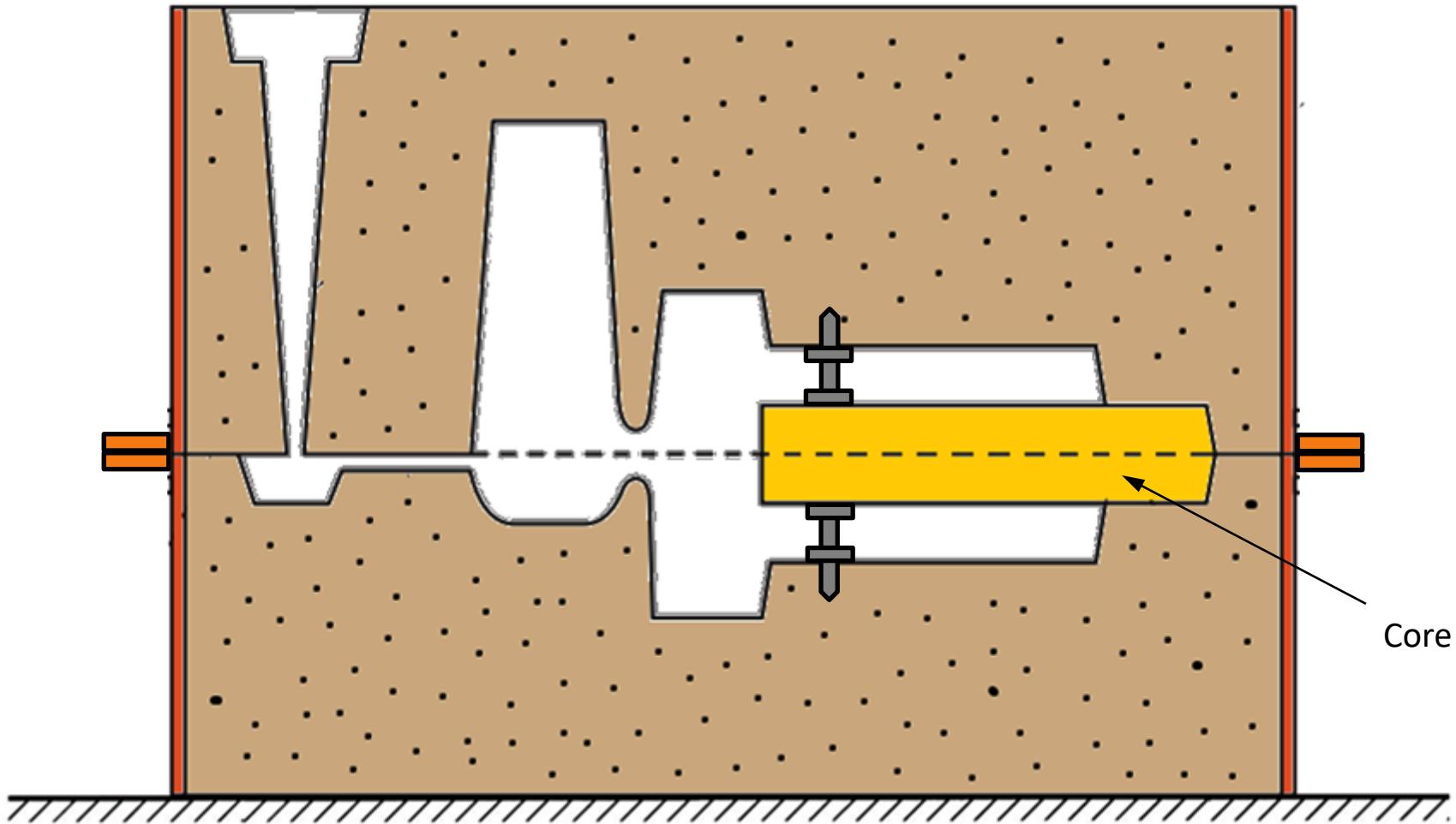
# Core Print in Mold Cavity



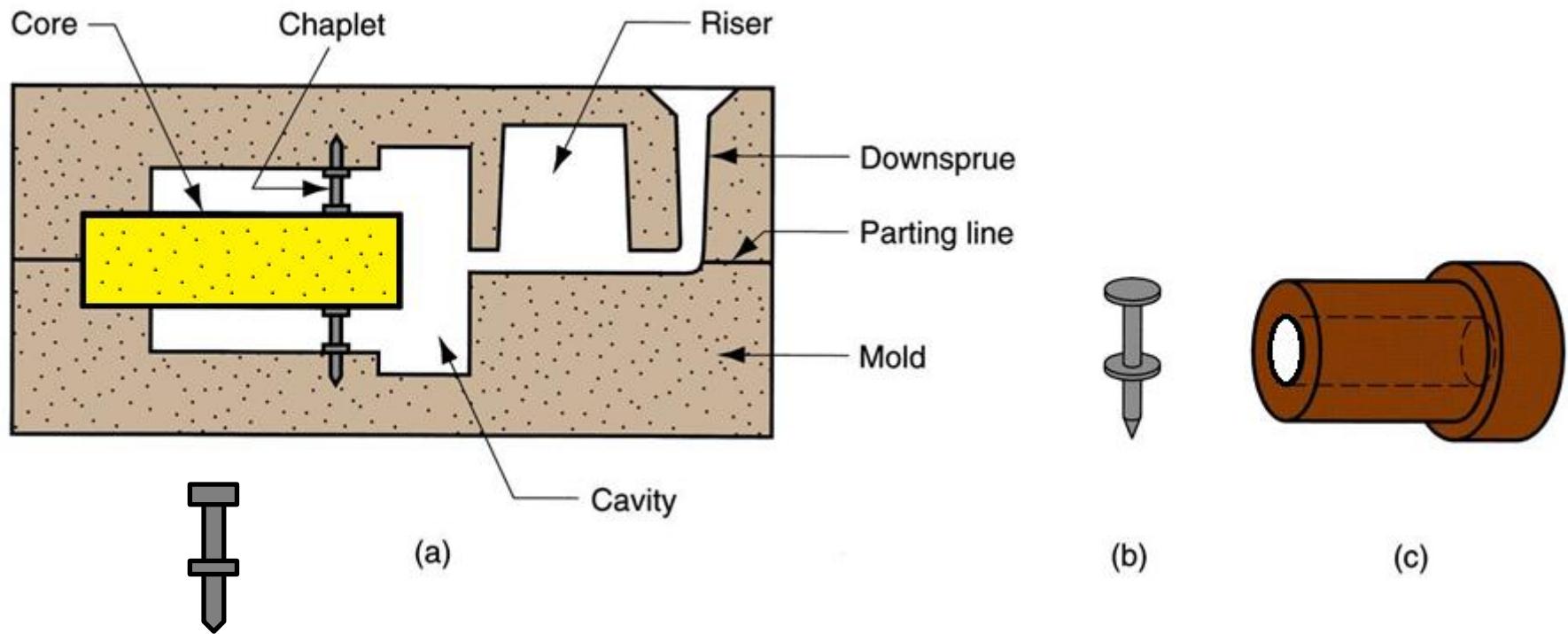
# Core in Mold Cavity



# Chaplets



# Chaplets



(a) Core held in place in the mold cavity by chaplets, (b) possible chaplet design, (c) casting with internal cavity.

# Chaplets

- **Chaplets** are the supports provided to hold the core in its position in the mold cavity during pouring.
- Because the chaplets are positioned within the mold cavity, they ***become an integral part of the finished casting.***
- Chaplets should therefore be of the ***same***, or at least comparable, ***composition*** as the material being poured.

# Chaplets

- They should be *large enough* that they do not completely melt and permit the core to move, *but small enough* that their *surface melts* and *fuses* with the *metal being cast*.
- Since chaplets are one more source of possible defects and may become a location of weakness in the finished casting, efforts are generally made to minimize their use.

# Desirable properties of cores

- ***Sufficient strength and hardness.*** Strength could be of two types:
  - Green strength : A core made of green sand should be strong enough to retain the shape till it goes for baking.
  - Dry strength: core should have adequate dry strength so that when the core is placed in the mold, it is able to resist the cast material pressure acting on it.
- ***A smooth surface.*** Surface of the core should be smooth so as to provide a good finish to the casting surfaces in contact with the cores.

# Desirable properties of cores

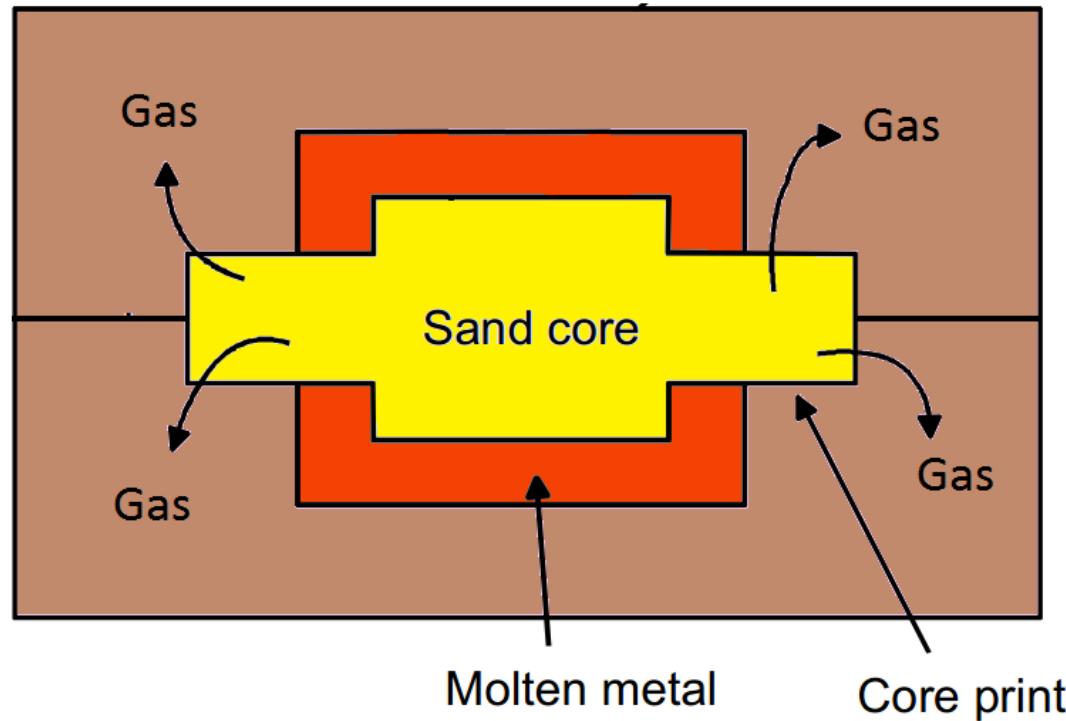
- **Adequate refractoriness.** Being surrounded by hot metal, cores can become quite a bit hotter than the adjacent mold material. They should not melt or adhere to the casting.
- **Collapsibility.** As the casting cools, it shrinks, and so the core should have good collapsibility (ability to decrease in size). Lack of collapsibility may provide resistance against shrinkage and can cause the casting defect of hot tears.

# Desirable properties of cores

- ***Low gas emission***: because the cores are subjected to very high temperature, the evolution of gases from the inside are very high at that temperature. These gases are otherwise likely to produce gas inclusion defects. So the cores should be made such that the evolution of gases is minimum.

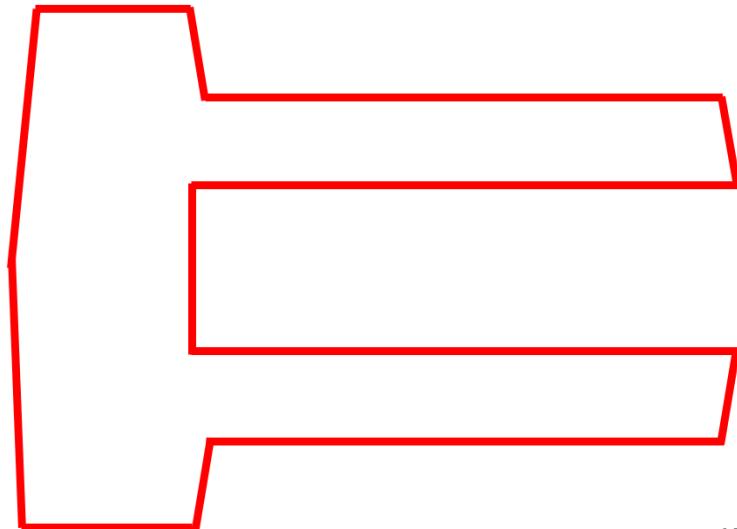
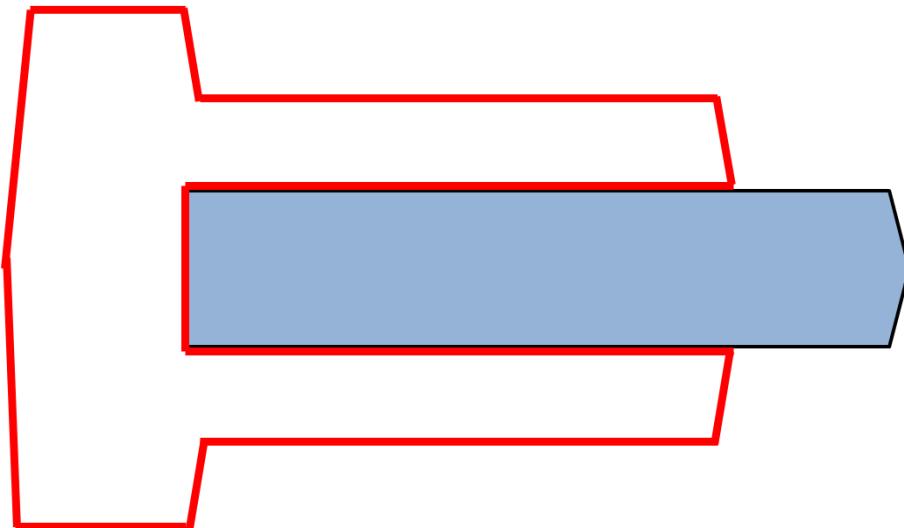
# Desirable properties of cores

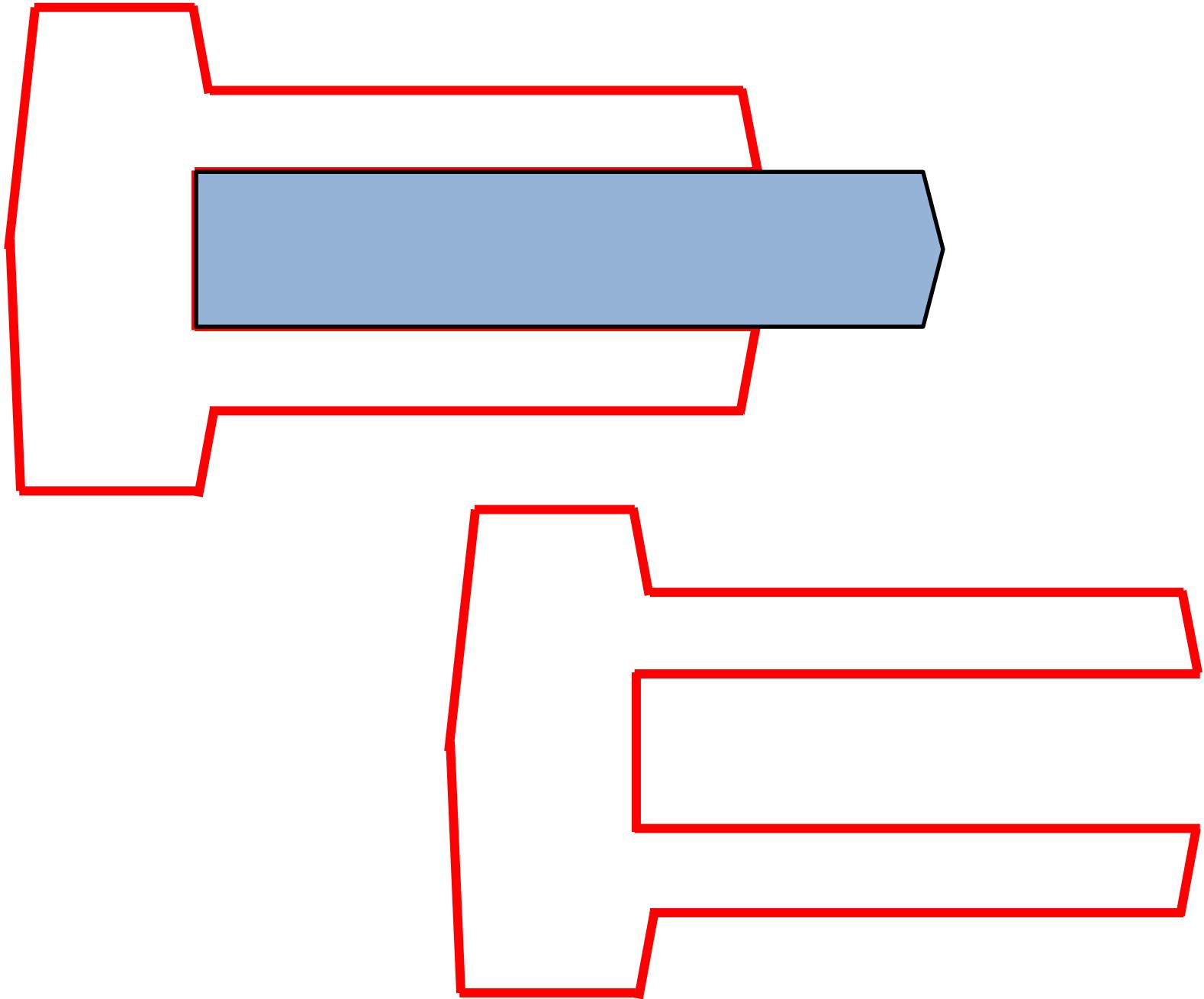
- **Adequate permeability** to permit the escape of gas. Since cores are largely surrounded by molten metal, the gases must escape through the core.



# Desirable properties of cores

- ***Friability*** (ability to crumble ): after the casting is completely cooled, the core should be removed from the casting before it is processed further. Hence the friability is also an important consideration.





# References:

- M. P. Groover, Fundamentals Of Modern Manufacturing: Materials, Processes, and Systems, Wiley (2016), 5th edition.
- Degarmo, E. P., Kohser, Ronald A. and Black, J. T., Materials and Processes in Manufacturing, Prentice Hall of India (2008) 8th ed.
- Kalpakjian, S. and Schmid, S. R., Manufacturing Processes for Engineering Materials, Dorling Kingsley (2006) 4th ed.

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