



SNS COLLEGE OF ENGINEERING

Coimbatore-641 107

(An Autonomous Institution)

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Affiliated to Anna University, Chennai

DEPARTMENT OF PHYSICS

COURSE NAME :19PY101-ENGINEERING PHYSICS

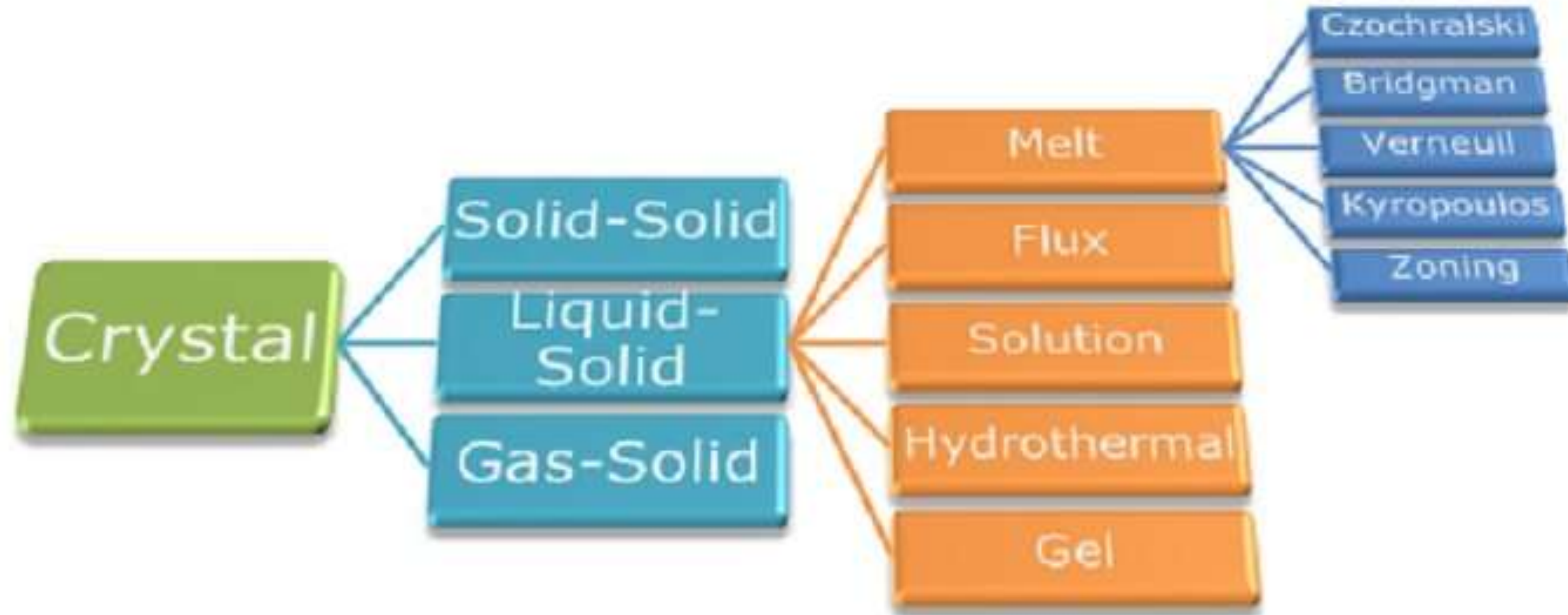
I YEAR / I SEMESTER

UNIT 4 – CRYSTAL PHYSICS

TOPIC 9 – GROWTH OF SINGLE CRYSTALS MELT GROWTH TECHNIQUES

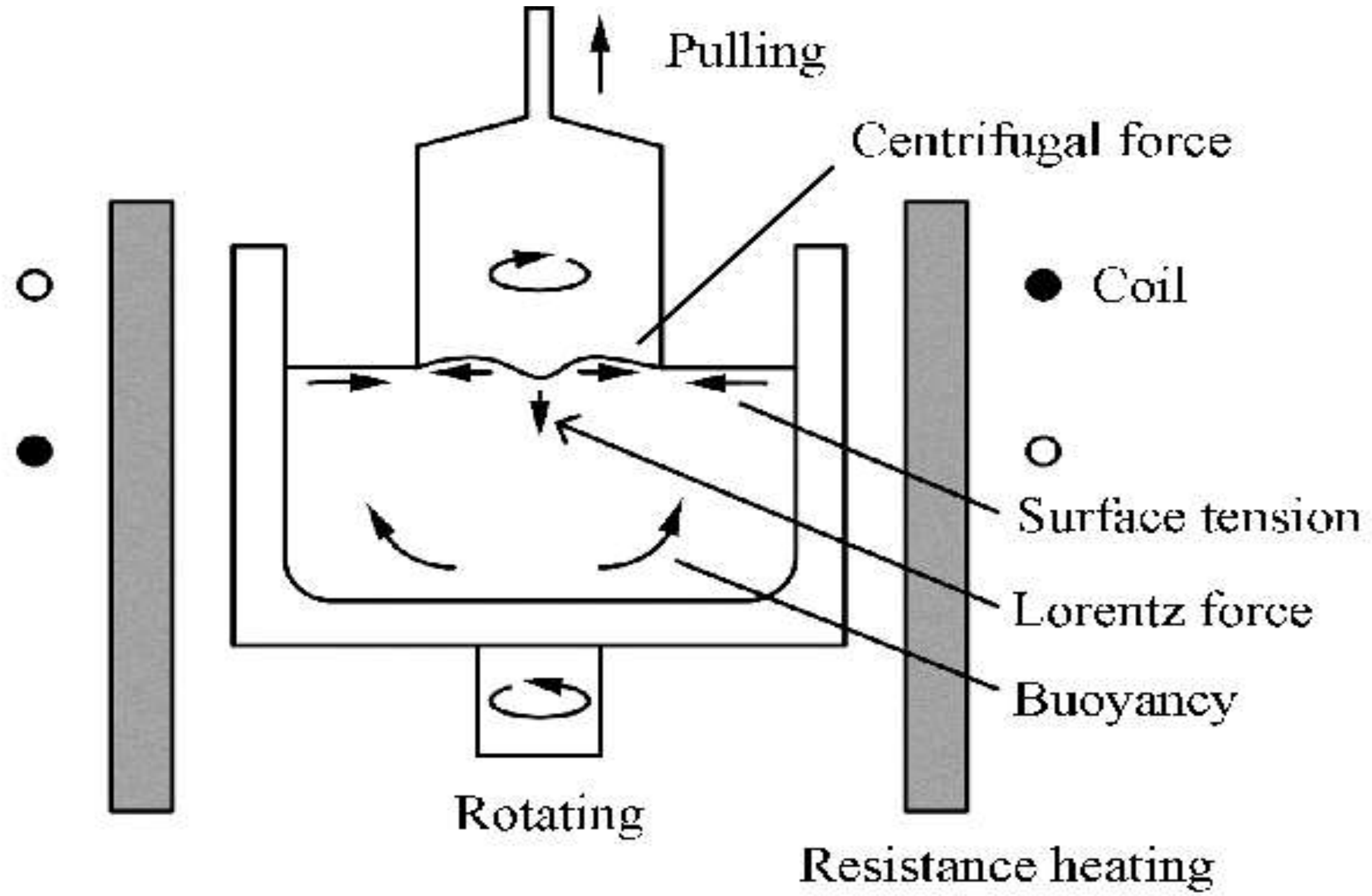
(CZOCHEWSKI METHOD)







- One of the major melt-growth techniques.
- It is widely used for growing large-size single crystals for a wide range of commercial and technological applications.
- One of the main advantages of Czochralski method is the relatively high growth rate.





- The material to be grown is first melted by induction or resistance heating under a controlled atmosphere in a non-reacting crucible.
- The melt is kept for a certain time at a temperature above the melting point and the temperature is then reduced to a value slightly above the freezing point.



- The freezing point is judged by cooling the melt until crystals start to appear on the surface.
- After a further lowering of the temperature a seed (cut in the appropriate orientation) is inserted into the melt.
- By pulling and rotating the seed simultaneously a crystallization center forms.
- The diameter of the pulled crystal is controlled by manipulating the temperature of the melt and the pulling rate.
- Suitable engineering of both axial and radial temperature gradients is needed to grow single crystals of desired dimensions reliably.



Important factors

1. The Pulling rate of the crystal
2. Temperature gradient of crystal
3. Temperature of the melt



Advantages :

1. Large diameter of crystal as 10cm or more can be obtained with a more crystal growth rate.
2. Crystal with desired orientation can be grown if a seed crystal at that particular orientation is used.
3. For the crystal growth adjustment in temperature and growing rate can be made if needed.
4. Dopant distribution is quite uniform.



Disadvantage:

More defects and stresses are introduced when the crystal are grown as larger diameter.



References

- <https://www.alineason.com/en/knowhow/crystal-growth/>
- <https://images.app.goo.gl/Ach4ca4jXkBLXoS97>

Thank You