Lecture 5

Casting and its defects :-

1) Investment Casting: {Lost wax casting}
   - ↳ exhaustive method:
   - ↳ create plastic/wax mold
   - ↳ pattern assembly
   - ↳ slurry coating {dipped in ceramic}
   - ↳ pour molten metal:
     - ↳ all wax melts
   - ↳ shakeout: {ceramic coating broken}

→ intricate shapes can be produced
→ cost justified by high volume.
→ high surface finish & quality
→ high precision of cast.

→ tighter tolerances can be easily achievable.
→ high cost of dies renders limited production

☆ So far we have obtained polycrystal from solidification of molten metal.

☆ Czochralski Method: {Pull up process}

↳ single crystal obtained.

↳ seed crystal dipped in pure molten element.

↳ pull out rate really important.

→ We want to control the growth of crystal {temperature, pulling rate}

→ Used mainly for high precision applications

↳ single crystal semiconductors

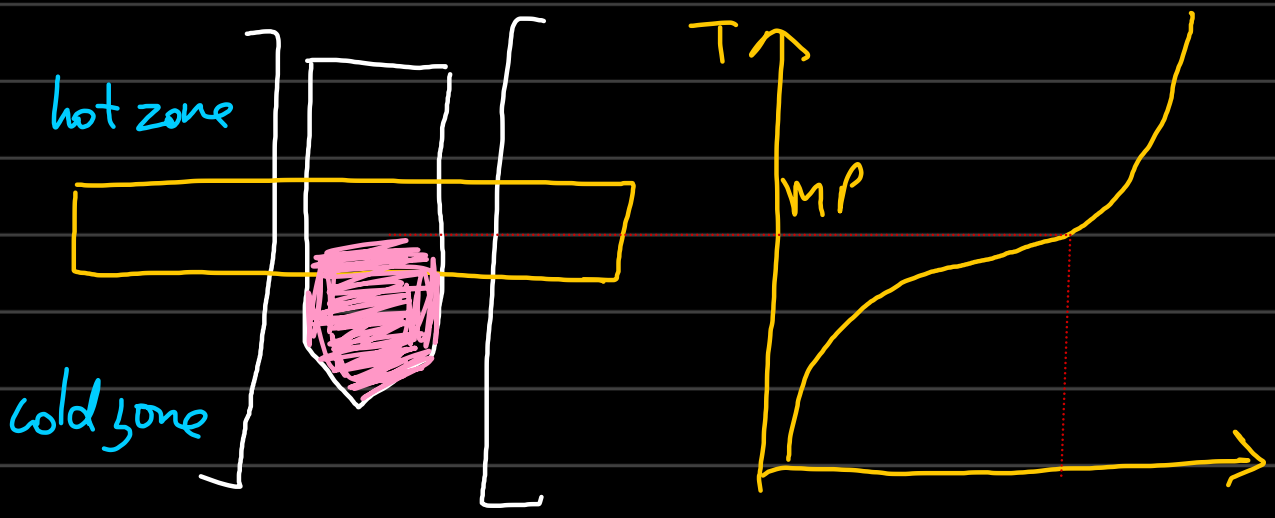
↳ Si, Ge, GaAs

→ growth of single crystals

2) Directional Solidification: Bridgman Method.

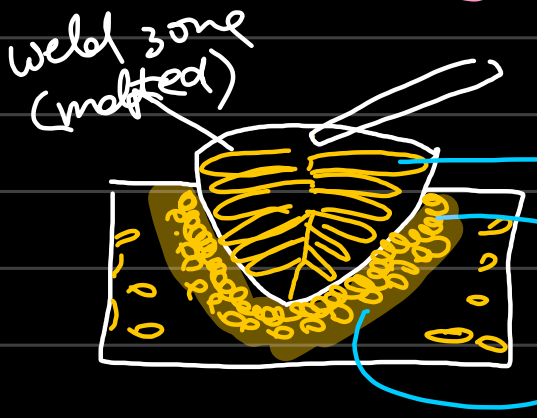
↳ quartz ampoule

→ hot zone & cold zone.



3) Cross-section of Fusion Weld:

↳ Weld microstructure:



↳ remains in solid state.

↳ grain growth

{ grain boundary area per unit volume decreases }

→ no chill zone formed { heat extraction is poor }

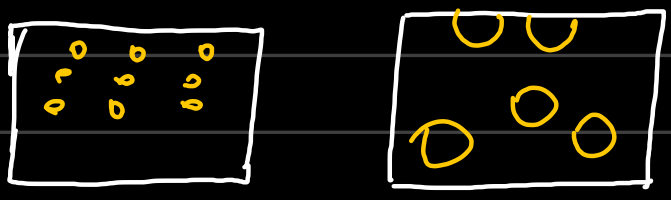
↳ columnar microstructure formed.

Casting defects:

1) Gas Porosity:

↳ in general, round in nature,

↳ two types: Pinholes, Blowholes



↳ Remedies:

↳ make sand mould is dry and permeable.

↳ provide enough vents for air to escape

2) Shrinkage defects:

↳ occurs because metals are less dense as a liquid than a solid

↳ A shrinkage cavity has irregular shape.

↳ shrinkage porosity with angular edges.

↳ Open & closed shrinkage.

↳ provide enough runners & gate system with supply molten metal

↳ moulds can be given padding.

↳ delays solidification so that shrinkage

can be taken care by pouring molten metal.

3) Cold Shut:

↳ occurs when metal flows into the mould from more than one point.

→ cold shut occurs as cracks
→ increase molten metal temperature
→ needs optimization.

> Hot Tears:

↳ major defect commonly encountered during cast.

↳ residual stress generated during solidification.

↳ common in alloys in which long freezing range.

↳ fracture of material due to residual stresses
{residual stress > fracture strength}