

Lecture 3

Materials Processing

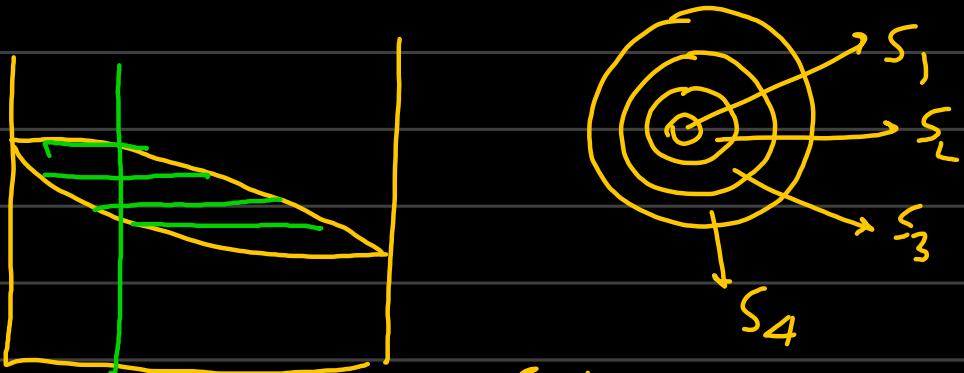
Casting:

↳ Microsegregation:

↳ contrast due to chemical inhomogeneity

↳ gradient in composition.

↳ phenomenon referred to as coring.



Coring in microstructure

Soln: Heat treatment of microstructure

↳ Homogenization treatment.

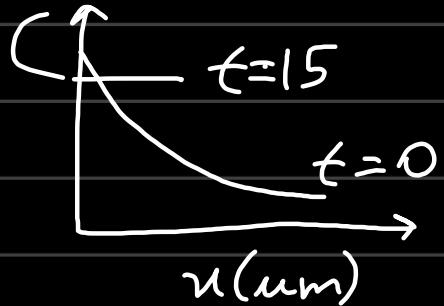
Segregation in micro scale: microsegregation

Segregation in macro scale: macrosegregation

Macrosegregation cannot be rectified by heat treatment.

↳ Cast has to be scrapped.

→ Homogenisation: annealing at high temperatures, where the diffusivity is higher.



→ To kill compositional gradient, ultrasonic treatment is done.

↳ ultrasound used to break up dendrites as they grow.

→ Most consumed material: Steel. (95%)

Continuous Casting:



Cu mold used
due to high
thermal conductivity

Mold made of Cu.
→
Rollers →
used to pull
semi-solidified
steel.

→ slab of varying length, uniform cross-section

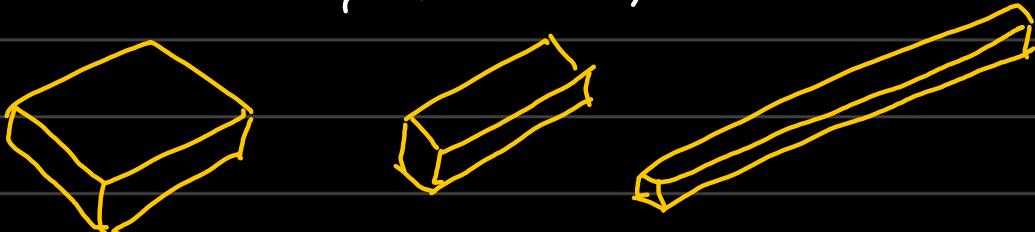
→ Tundish: ensures continuous flow of molten metal {reservoir}

↳ ensures clear supply of metal

↳ reduce segregation

→ Primary 3 shapes can be produced:

↳ Slab, Bloom, Billet



- Cu molts are oscillating (vibration)
 - ↳ breaks down segregation & ensures homogeneity
- Inner lining is coated with other high temperature alloys.
- allowed improvement in yield, quality productivity & cost efficiency.
- automation breakdown can have huge implication.

* Tundish maintains steady metal height.

Electro-magnetic stirring (EMS):

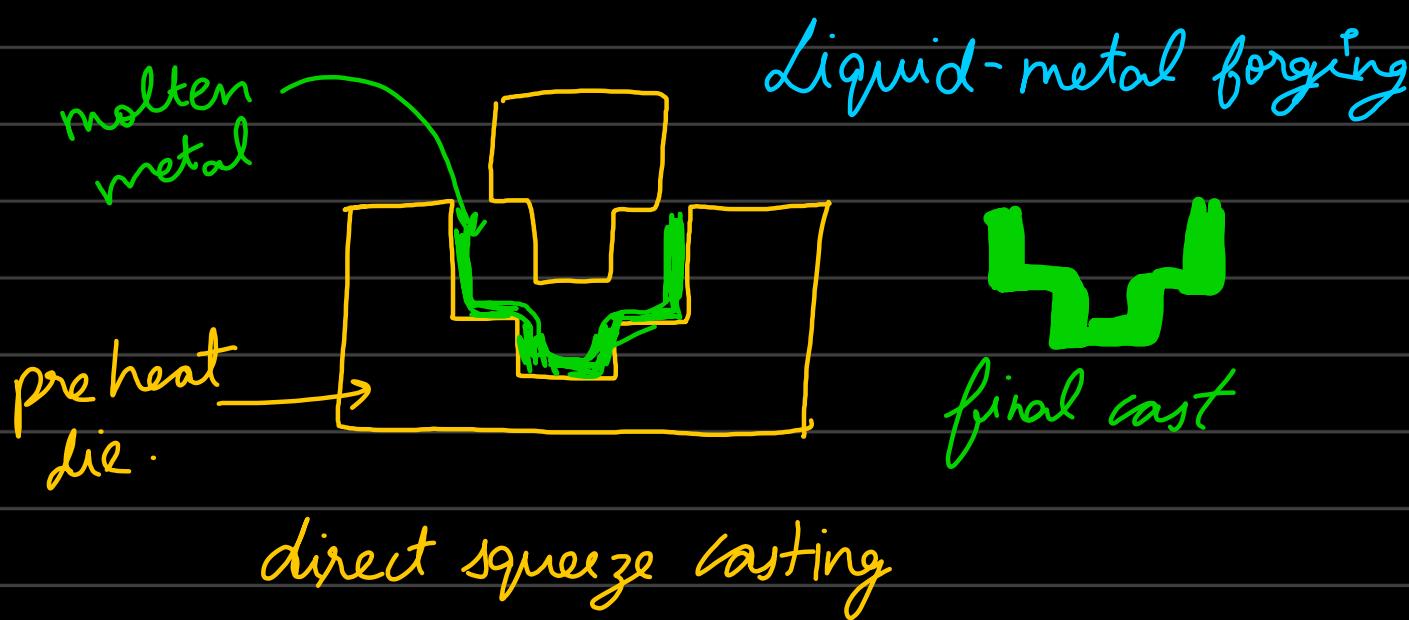
- ↳ avoid segregation
- ↳ improve inclusion removal (e.g; MnS_2)
- ↳ lowering temperature loss. hard intermetallic.

* inclusion: unwanted intermetallics.

↳ Mn not allowed to form MnS_2 with Sulphur.

→ MnS_2 kills the steel.

* gravity cum Squeeze casting



- The mechanical punch operation removes porosity:
→ air gets trapped in solidified microstructure.
- * Application of mechanical pressure can help weld these cracks (porosity air cracks)