Chapter 10 :- Dispersion strengthening and Eutectic phase Diagrams

Effective Dispersion strengthening :-

(a) The percepitate should be hard & discontinous

(b) The dispersed phase particles should be small & numerous

(c) ~ ~ ~ ~ ~

~ round than needlelike

(d) large amounts of dispersed phase increase strengthening

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• Stoichiometric & non stoichiometric intermetallic compound

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- Stoichiometric :→ appears as a verticle line in some phase diagrams

→ have one fixed Composition

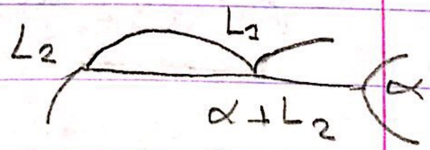
- Non stoichiometric :→ have a range of compositions

* Three phase Reactions

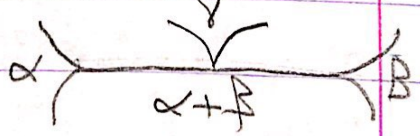
Eutectic $L \rightarrow \alpha + \beta$

periectic $\alpha + L \rightarrow \beta$

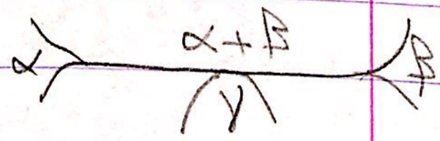
Monotectic $L_1 \rightarrow L_2 + \beta$



Eutectoid $\gamma \rightarrow \alpha + \beta$



Peretectoid $\alpha + \beta \rightarrow \gamma$



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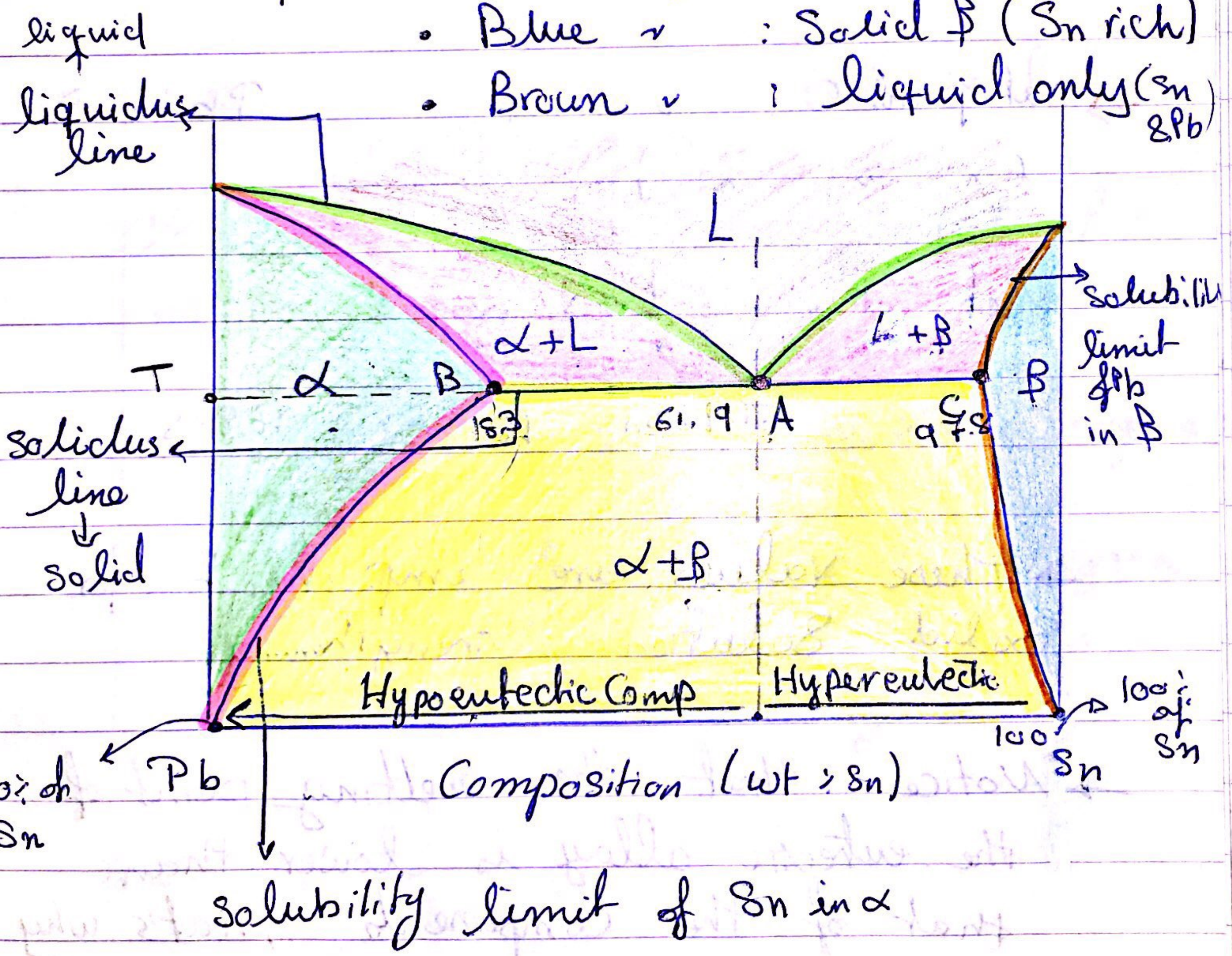
Easy to melt

The Eutectic phase Diagram

Importance: It Gives a present phase in a given Temp & pressure, chemical comp of phases, and phase weight fraction.

Example :-
- Green Region: Solid α (Pb rich)
- Blue ″ : Solid β (Sn rich)
- Brown ″ : liquid only (Sn & Pb)



- purple and red Regions: Slush (mix of solid α, β and liquid L)

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→ at point A: The eutectic Reaction occurs and T is the eutectic Temp (C_E : eutectic concentration)

→ at point B: Max solubility of Sn in α (on the x-axis)

→ at point C: " " " Pb in β
(" " ")

at T: L → α + β

61.9 % Sn   18.3 % Sn   97.8 % Sn

→ These values are important for Solid Solution Strengthening

→ Notice that the melting point of the eutectic alloy is lower than that of the components that's why we call it Easy to melt

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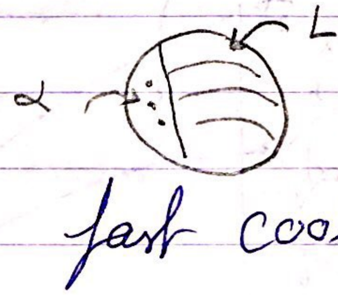
→ There is no complete melting (not isomorphous)

→ Difference between fast & slow Cooling



~ More time → better arrangement of atoms

α → primary α : in α+L Region
α → eutectic α , in α+β Region

eutectic β in α+β Region

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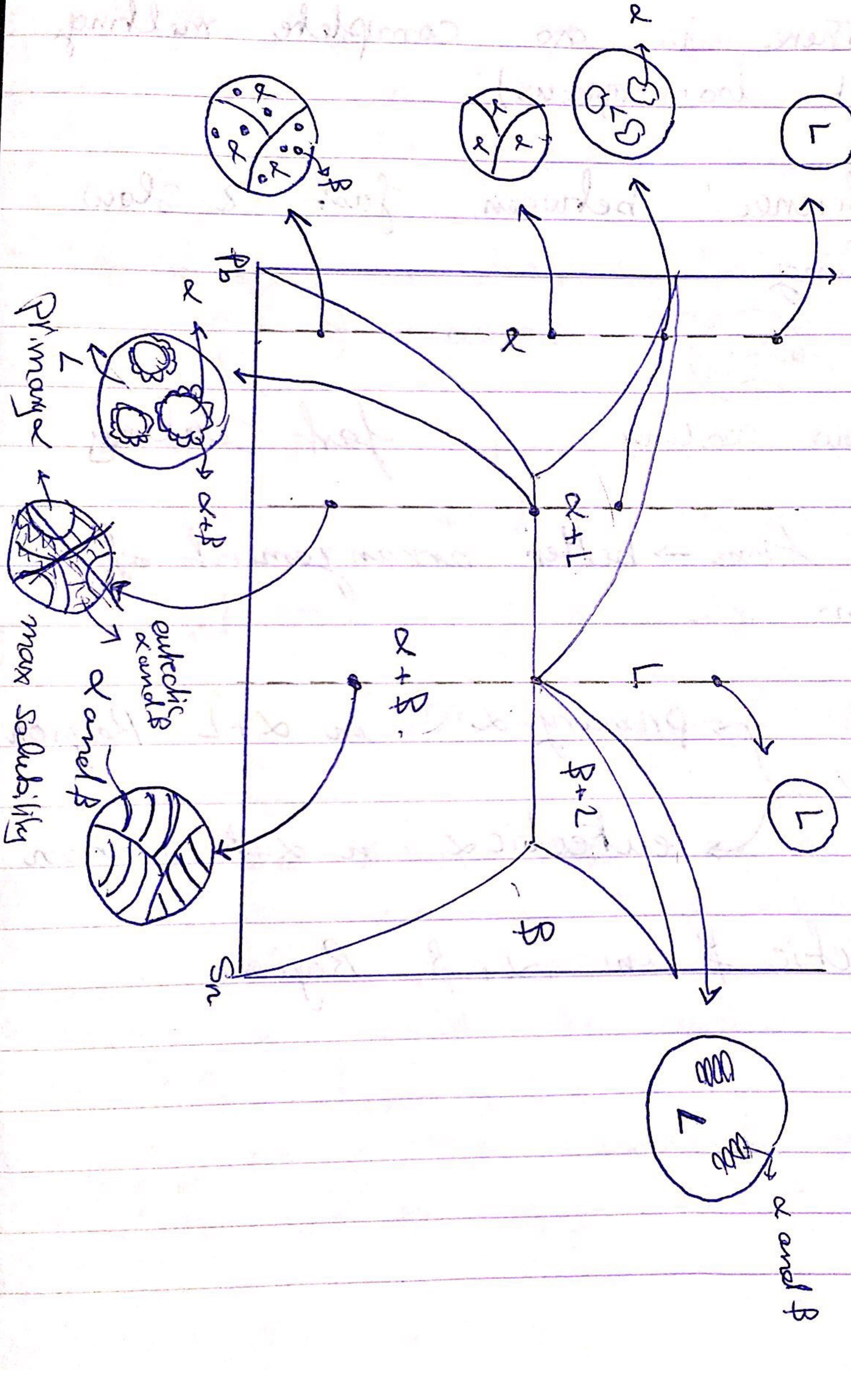

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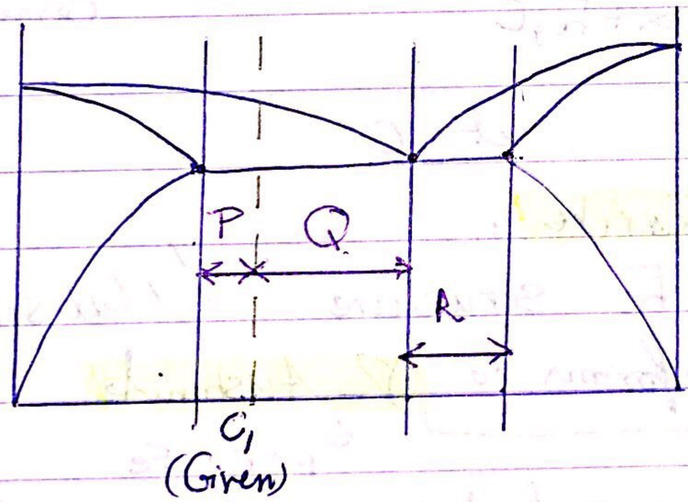
lever Rule for eutectic Reaction

$W_{\alpha 1}$ = percent of primary α = $\frac{Q}{P+Q}$

W_e = percent of eutectic = $\frac{P}{P+Q}$

W_α = percent of α-phase = $\frac{Q+R}{P+Q+R}$

W_β = " " β - " = $\frac{P}{P+Q+R}$



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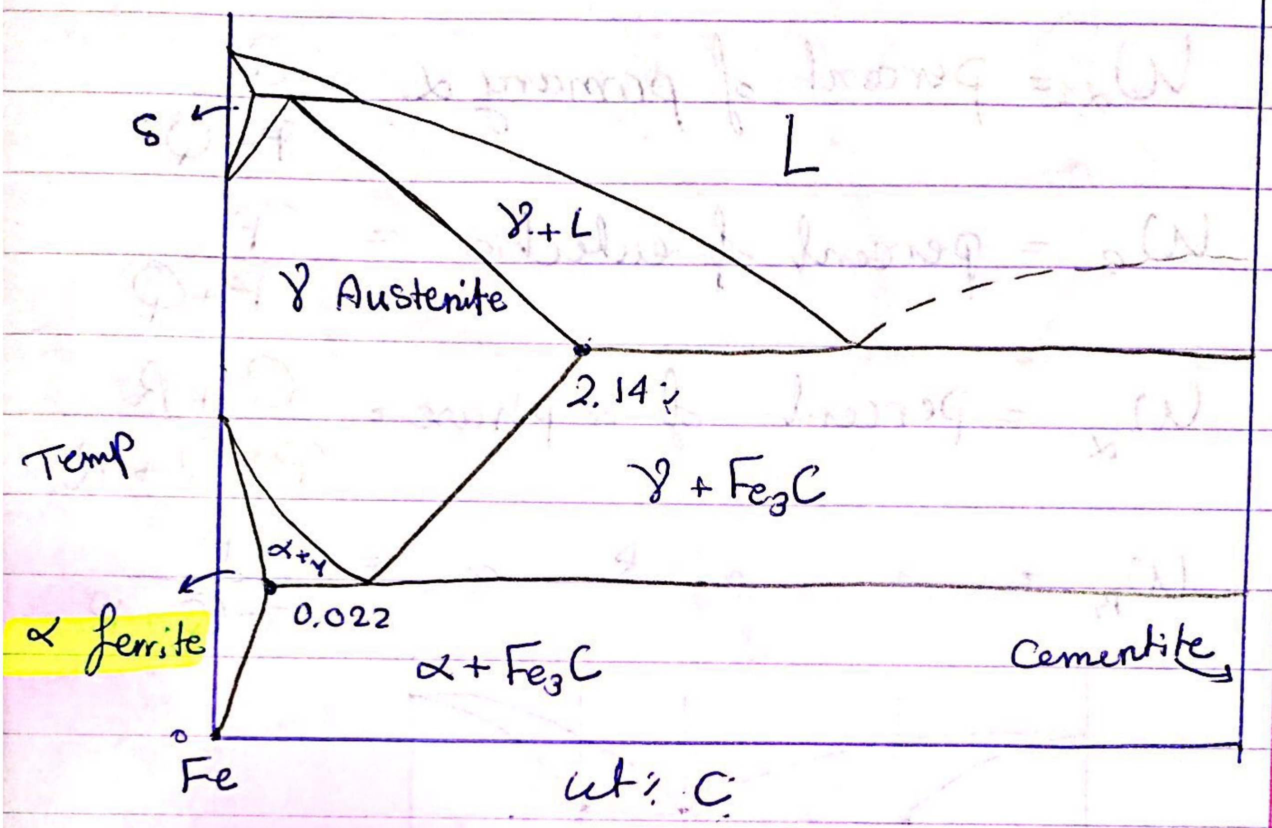
Fe–Fe_3C phase diagram



α Ferrite :
- BCC Fe structure / Max sol of C = 0.022
- transforms to γ – Austenite at T = 912°C
  - ↓ FCC Fe
  - Max solubility of C in it = 2.14
- γ – Austenite transforms to BCC δ ferrite at 1395°C
  - ↓ melts at 1538°C

Fe_3C : intermetallic Compound
↓ cementite / iron carbide

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- Strength of Eutectic alloys

We can control it by:-

1- Eutectic Colony size
2- intermellar spacing
3- Amount of Eutectic
4- Microstructure of the Eutectic

35
°C
C

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