

# **MSE200**

## **Lecture 12 (CH. 8.5-8.8)**

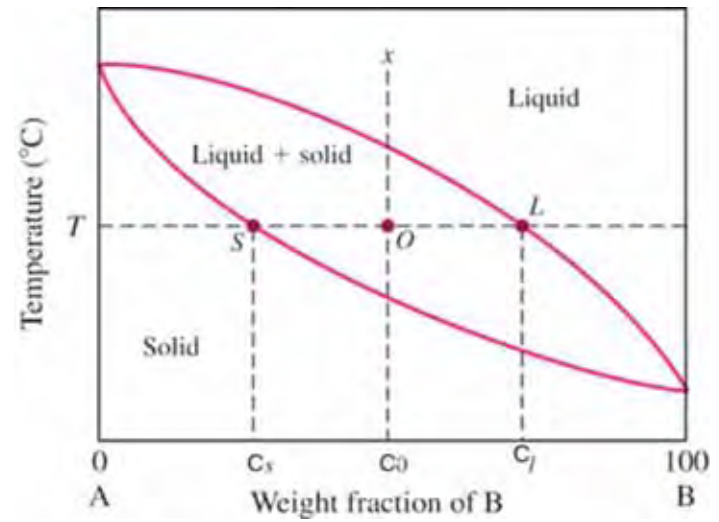
### **Phase Diagrams II**

**Instructor: Yuntian Zhu**

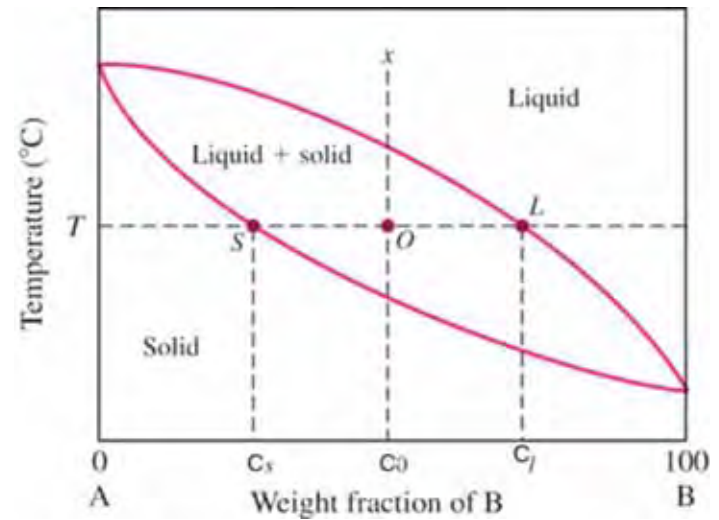
**Objectives/outcomes: You will learn the following:**

- **Lever rule**
- **Microstructure evolution during cooling**
- **Eutectic 3-phase reaction**
- **Peritectic 3-phase reaction**

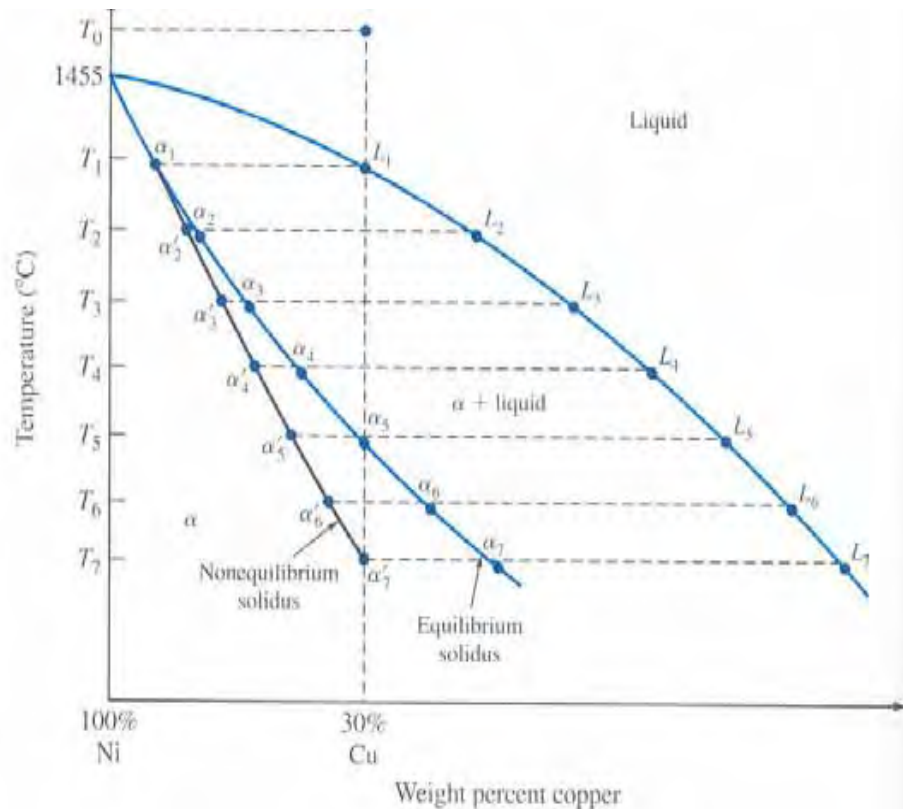
# Equilibrium cooling



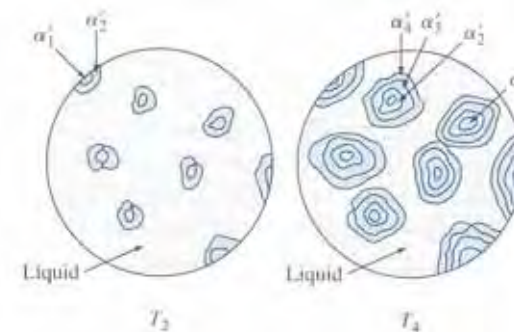
# The Lever Rule



# Non Equilibrium Solidification of Alloys



- **Homogenization:** Cast ingots heated to elevated temperature to eliminate **cored structure**.
- **Temperature of homogenization** must be lower than lowest melting point of any of the alloy components.

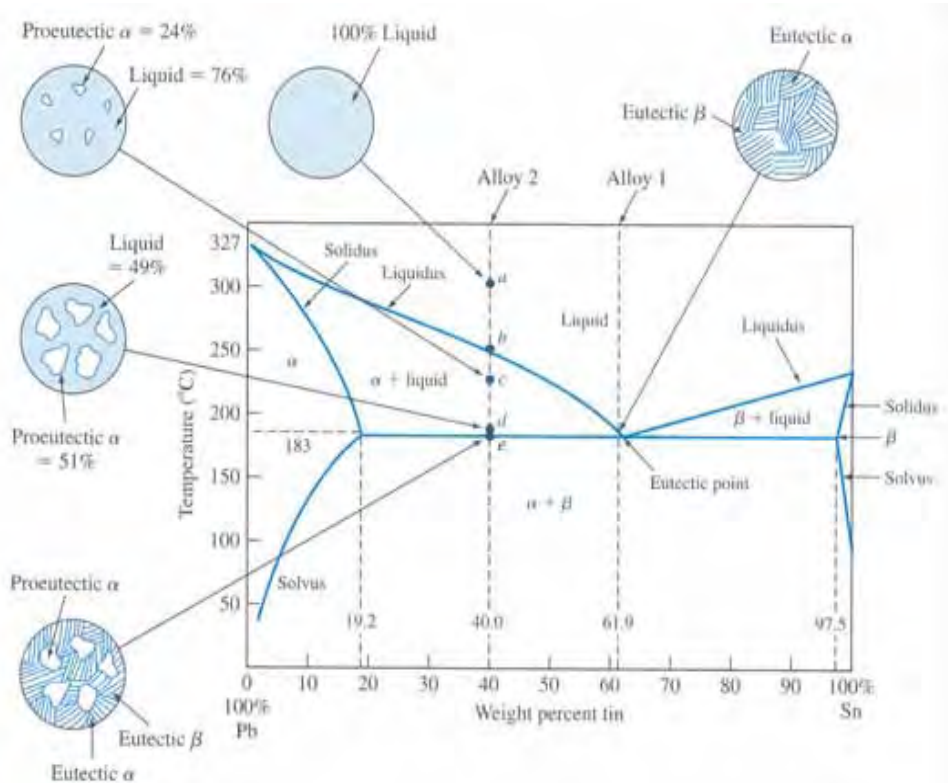


# Binary Eutectic Alloy System

- In some binary alloy systems, components have limited solid solubility.**

Hypoeutectic

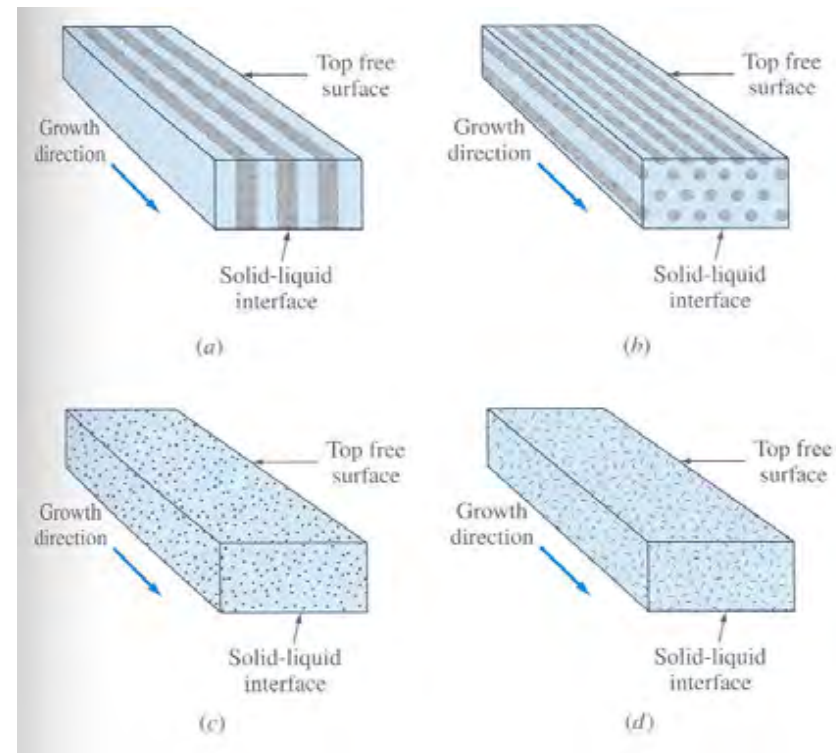
Hypereutectic



**Liquid** Eutectic temperature →  **$\alpha$  solid solution +  $\beta$  solid solution**  
Cooling

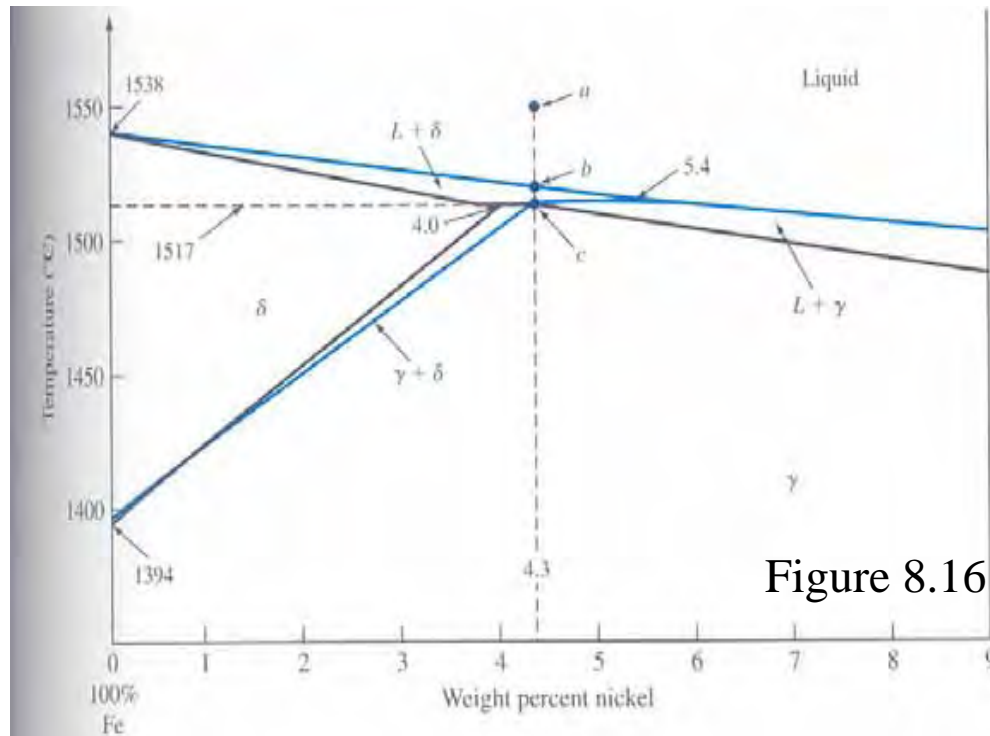
# Various Eutectic Structures

- Structure depends on factors like **minimization of free energy** at  $\alpha / \beta$  interface.
- Manner in which two phases **nucleate** and grow also affects structures.
- Most common structure



## Binary Peritectic Alloy System

- **Peritectic reaction:** Liquid phase reacts with a solid phase to form a new and different solid phase.



- Peritectic reaction occurs when a slowly cooled alloy of Fe-4.3 wt% Ni passes through **Peritectic temperature of 15170C.**

# Peritectic Alloy System/equilibrium

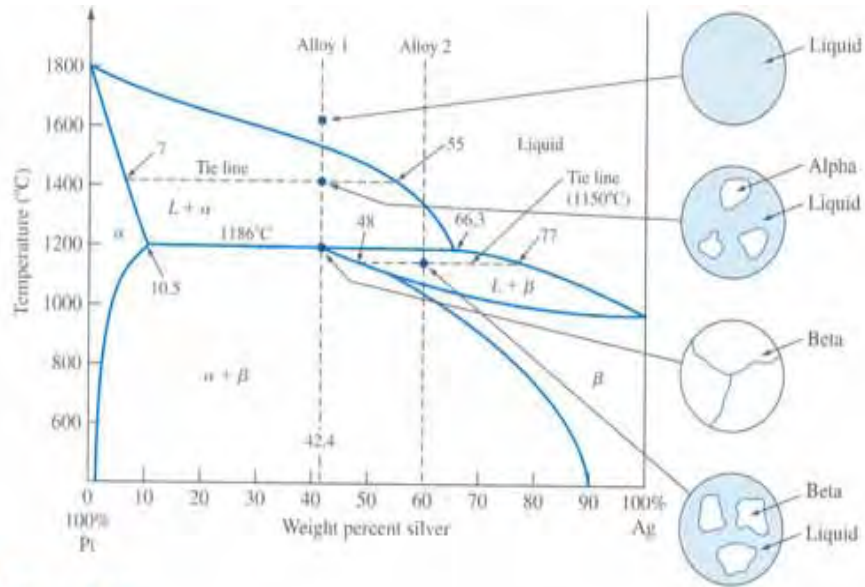
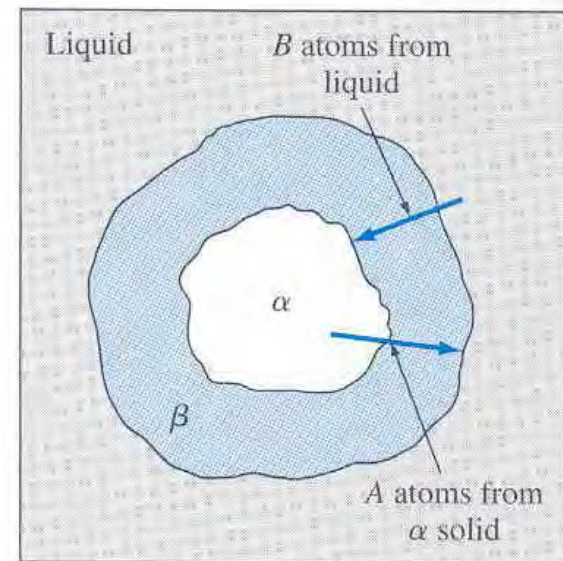
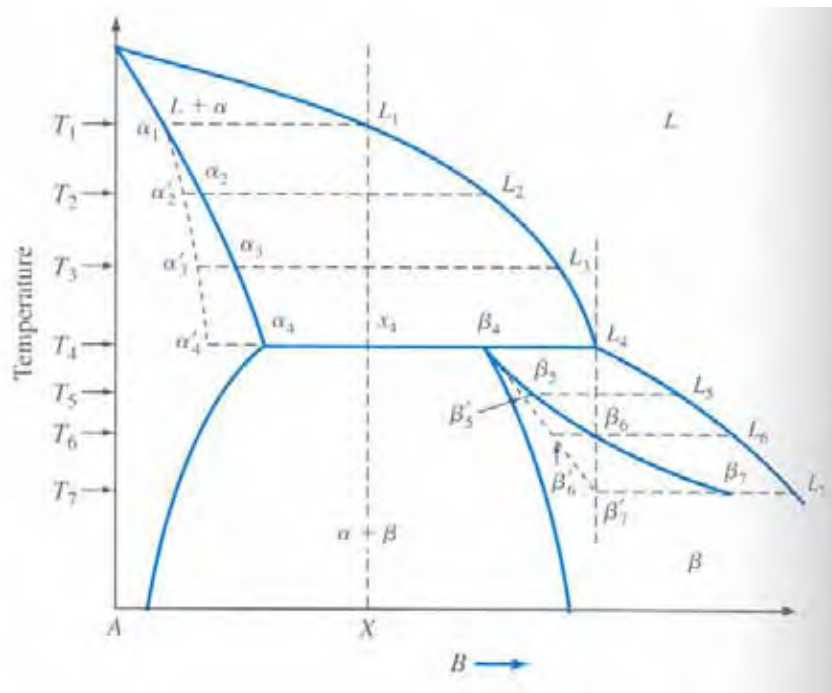


Figure 8.17

## Rapid Solidification in Peritectic System

- **Surrounding or Encasement:** During peritectic reaction,  $L + \alpha \rightarrow \beta$ , the beta phase created surrounds primary alpha.
- Beta creates **diffusion barrier** resulting in coring.



# Homework

- Example problems: 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7,
- Chapter 8: 10, 15, 16, 17, 18, 19, 20, 21,
- Reading assignment: 8.9-8.11, 9.2