Properties of Materials
BTM 2413

CHAPTER 10:
Equilibrium Diagram

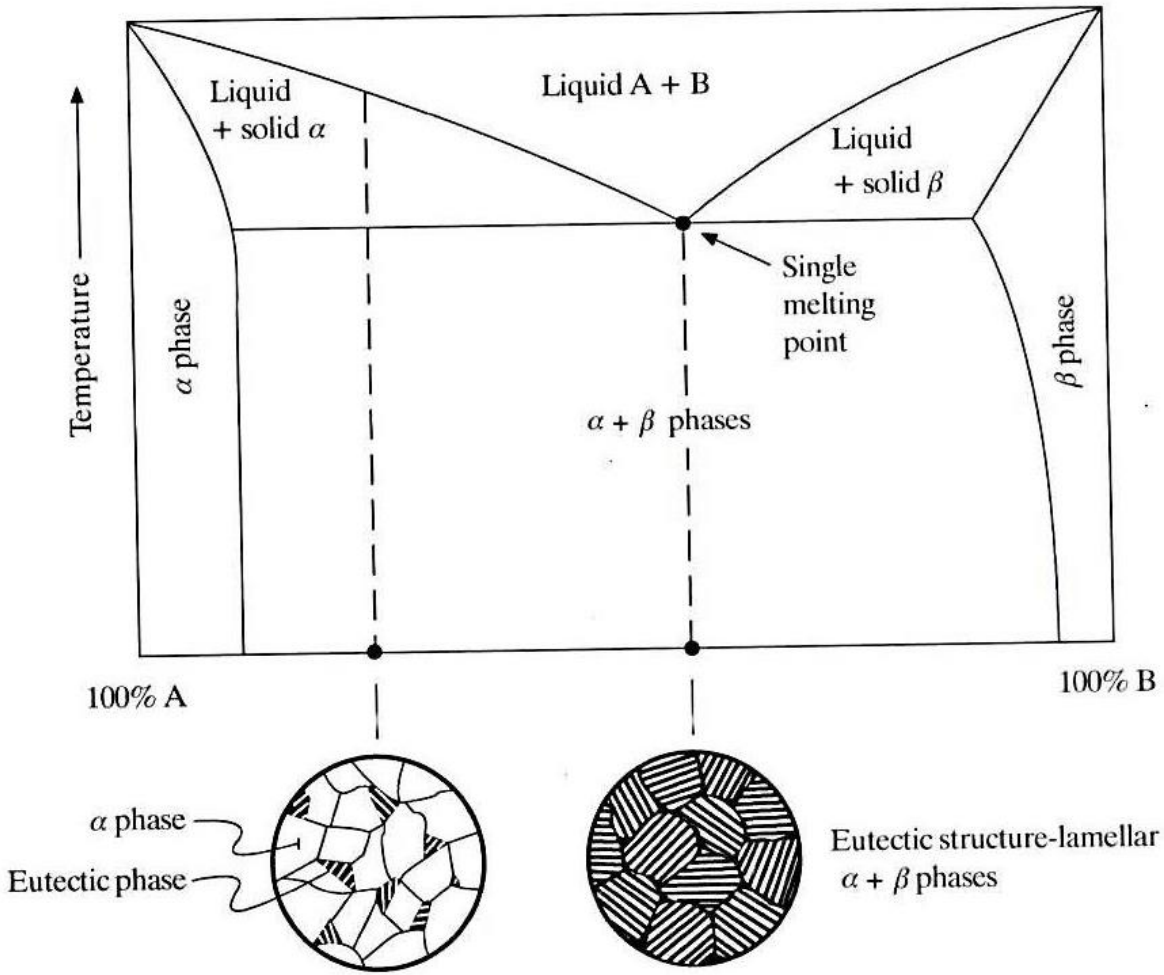
by
Dr Ratnakar Kulkarni
Faculty Engineering Technology
kulkarni@ump.edu.my

Introduction

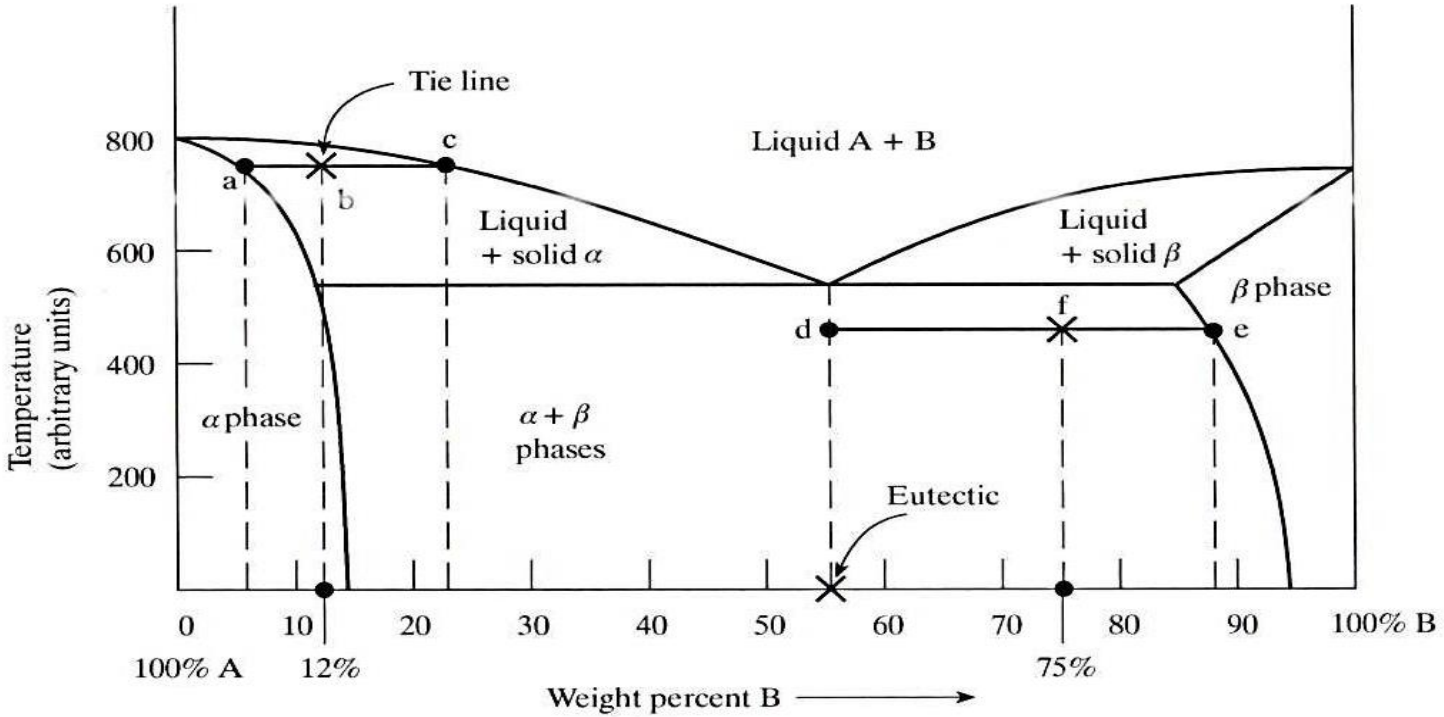
- Aims
  - To introduce the equilibrium diagram and its importance .
- Expected Outcomes
  - Explain the equilibrium diagram
  - Distinguish between the different phases of steel
- Other related Information
- References

- Kenneth G Budinsky & Michael G Biddinsky, Engineering Materials: Properties and Selection, Ed 9, Prentice Hall

Phase Diagram of Partial Solubility



Relative Percentages of Phases



$$\%\ \alpha \text{ phase at } 750° = \frac{c-b}{c-a} = \frac{22-12}{22-5} = \frac{10}{17} = 58.8\%; \text{ liquid} = \frac{b-a}{c-a} = \frac{12-5}{22-5} = \frac{7}{17} = 41.2\%$$

in an alloy with 12% B

$$\%\ \beta \text{ phase (primary) at } 420° \doteq \frac{f-d}{e-d} = \frac{75-55}{88-55} = \frac{20}{38} = 60.6\%; \text{ eutectic} = \frac{e-f}{e-d} = \frac{88-75}{88-55} = \frac{13}{33} = 39.4\%$$

in an alloy with 75% B

Phase diagram function

- Calculate the percentage of various phases presents → will add in predicting microstructures that should be present in an alloy under equilibrium
- Determine whether one metal or element is soluble in another → used in welding
- Select materials for new alloys
- Help predict the long-term stability of an alloy