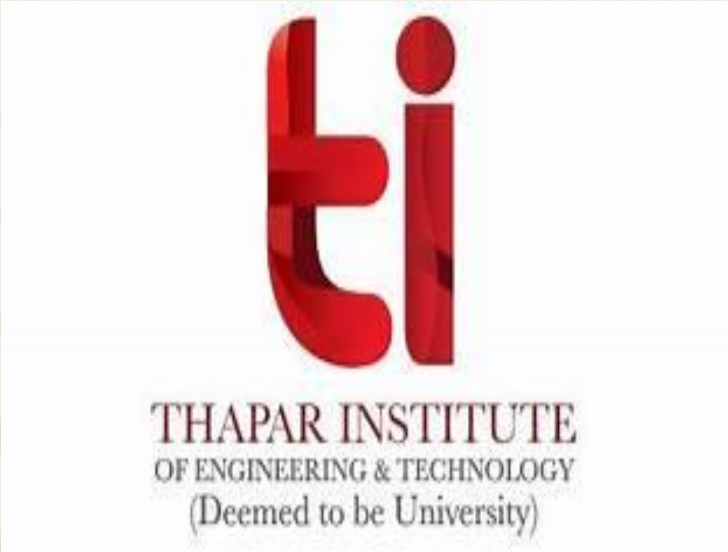
APPLIED CHEMISTRY

Phase Rule



by
Dr. Priya Vashisht
School of Chemistry and Biochemistry
Thapar Institute of Engineering and Technology
Patiala -147004, India

LEARNING OUTCOMES

By the end of this session participants should be able to:

Understand and Interpret

- ✓ Lead-Silver system
- ✓ Desilverisation of lead
- ✓ Pattinson's process

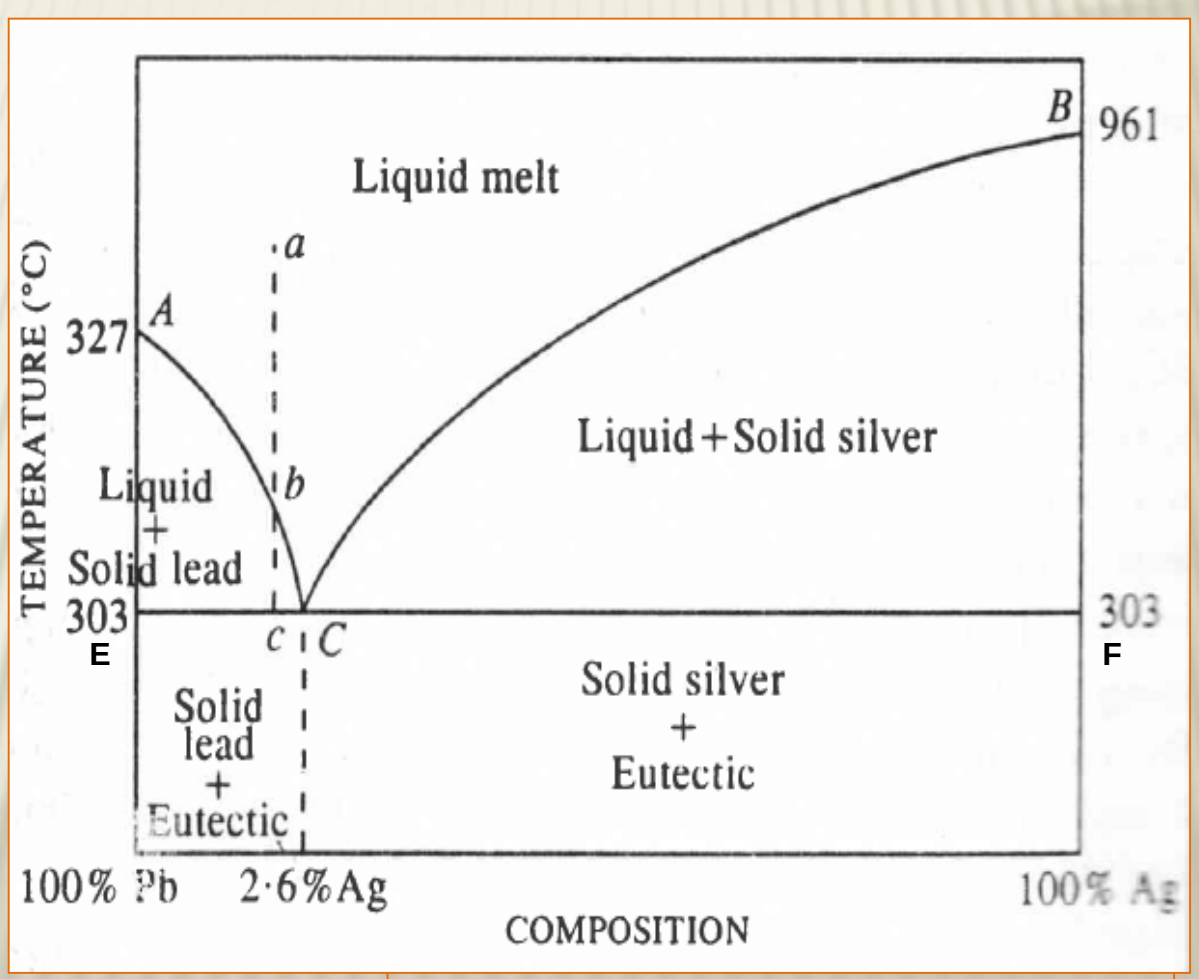
Outline : Lecture 4

- Simple Eutectic system- Lead-silver system
- Desilverisation of lead
- Pattinson's process

Phase Rule

LEAD-SILVER SYSTEM

The metals Pb and Ag are completely miscible in the liquid state and do not result in any compound formation.



Principles of physical chemistry by Puri Sharma Pathania

Phase Rule

Significance of lead-silver system (**Desilverisation of lead)**

Argentiferous lead - lead that contains silver

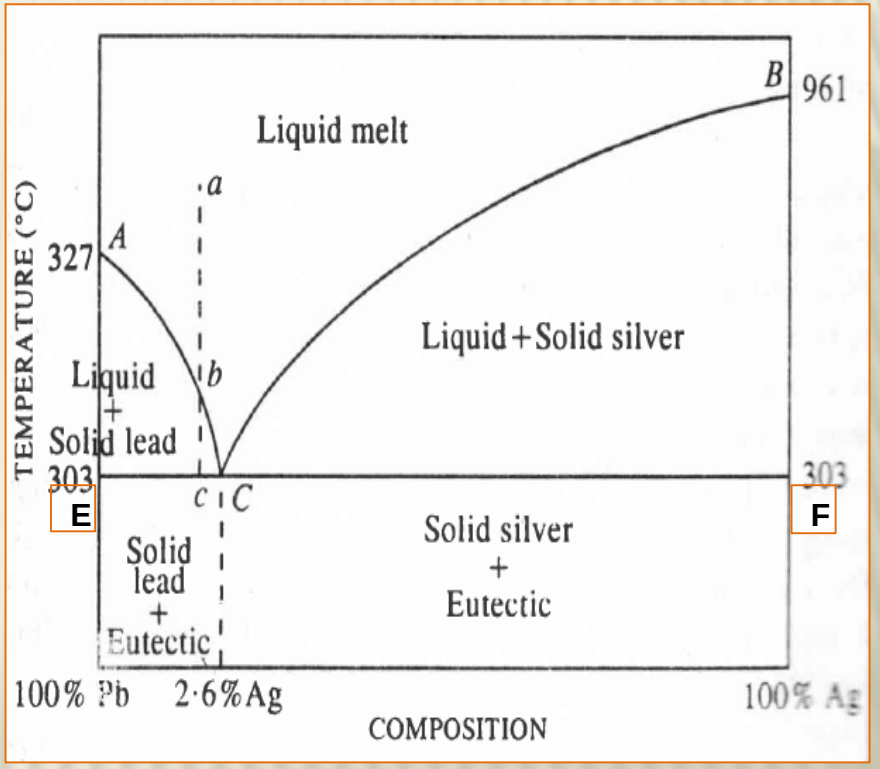
Desilverisation of lead - To separate silver from lead

Pattinson's process for Desilverisation of lead

This is the process of recovery of silver from Argentiferous lead. The process involves desilverisation of lead governed by the phase diagram of lead -silver system. The process of heating argentiferous lead containing a very small amount of silver and cooling to get pure lead and liquid richer in silver is known as Pattinson's process

Phase Rule

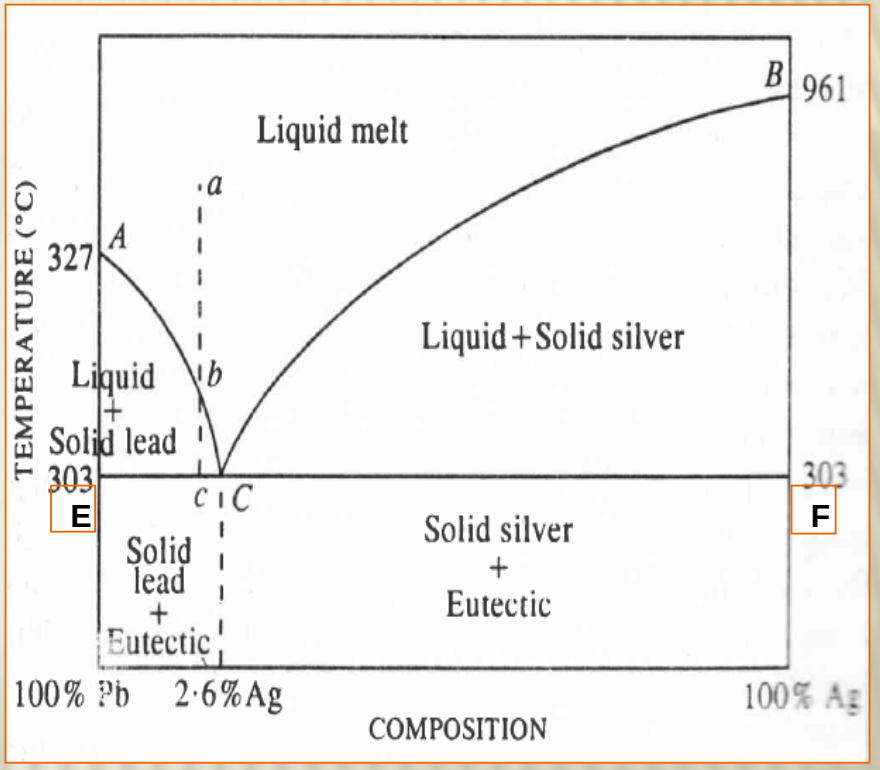
- Pure Pb melts at 327°C & Pure Ag melts at 961°C
- Argentiferous lead consisting of very small percentage of silver is heated to a temperature above its melting point
- The system consists of only liquid phase – Point ‘a’
- It is then allowed to cool



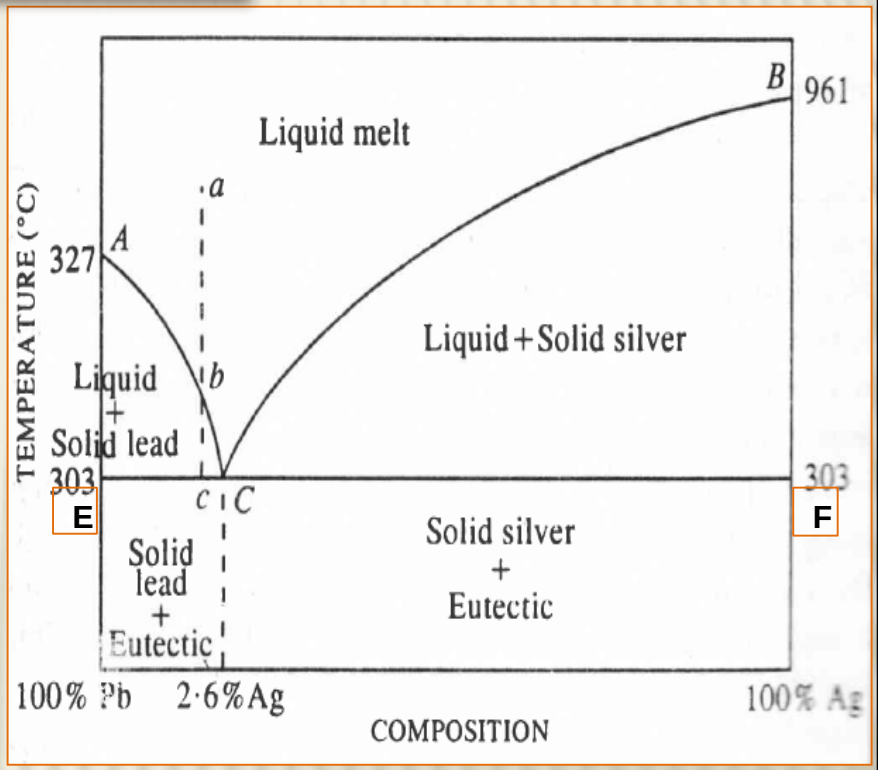
Phase Rule

Observations

- Temperature of the melt will fall along the line ‘ab’
- At point b, lead will begin to crystallize out and the solution will contain relatively increasing amount of silver
- Further cooling will shift the system along the line ‘bC’
- Lead continues to separate out and is constantly removed



Phase Rule



- Melt continues to be richer in silver until point 'C' is reached. The percentage of silver raises to 2.6 %.
- Solid silver also begins to separate out at point 'C'- Eutectic point, (303 °C) -Eutectic temperature
- On further cooling the mixture, Ag and Pd will separate out simultaneously.

Conclusions:

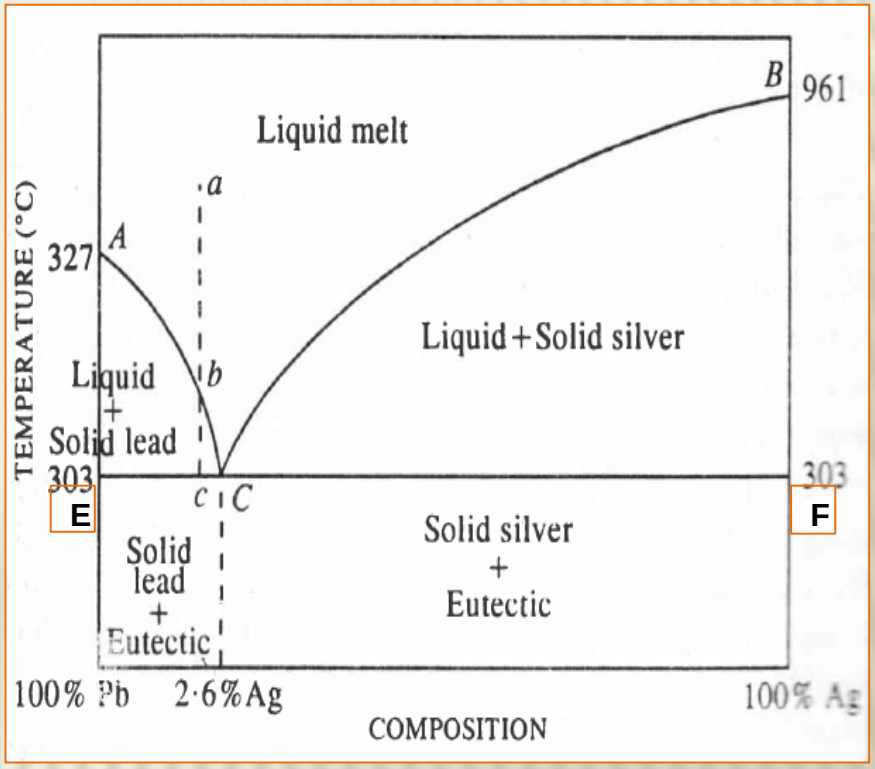
- Solid lead can be separated only till the liquid melt has 2.6 % of Ag.
- Original argentiferous lead which might have contained 0.1% of silver, has now 2.6% of silver, hence its relative proportion is raised in the alloy – Pattinson's process

Phase Rule

- AC (Freezing point curve of Lead) represents variation of melting point of lead on addition of silver

- AC- Solid Lead & solution (liquid melt) coexist: P = 2 (solid Pb and melt of Ag-Pb), C = 2. Hence, F' = C- P + 1 = 1 (Univariant)

Area ACE

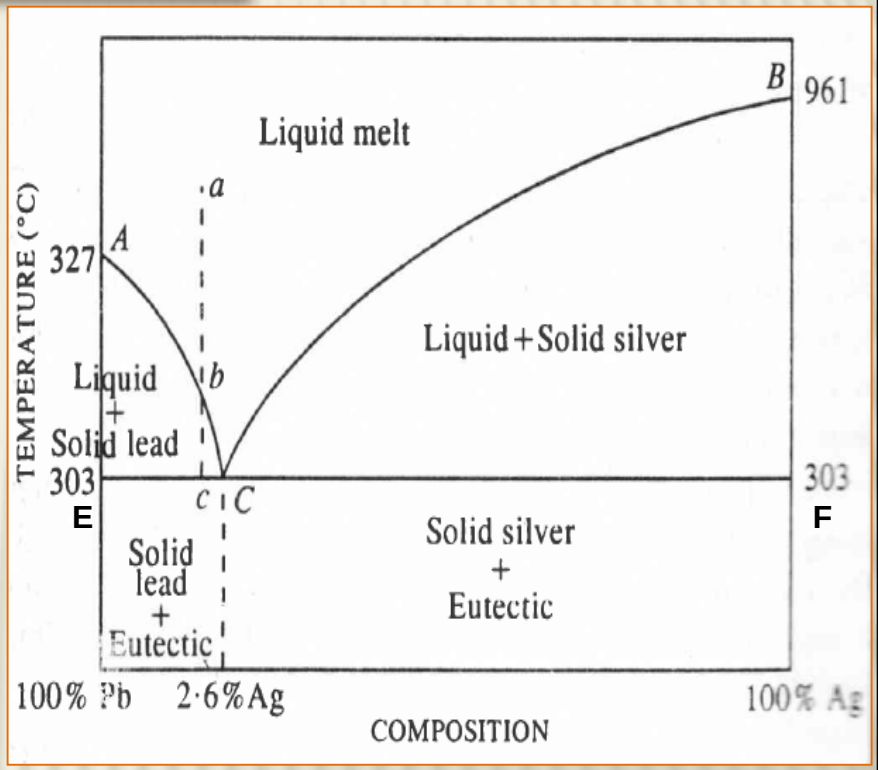


Two phases – solid Pb and melt of Ag in Pb, Univariant

Phase Rule

- **BC (Freezing point curve of silver) represents variation of melting point of silver on addition of lead**

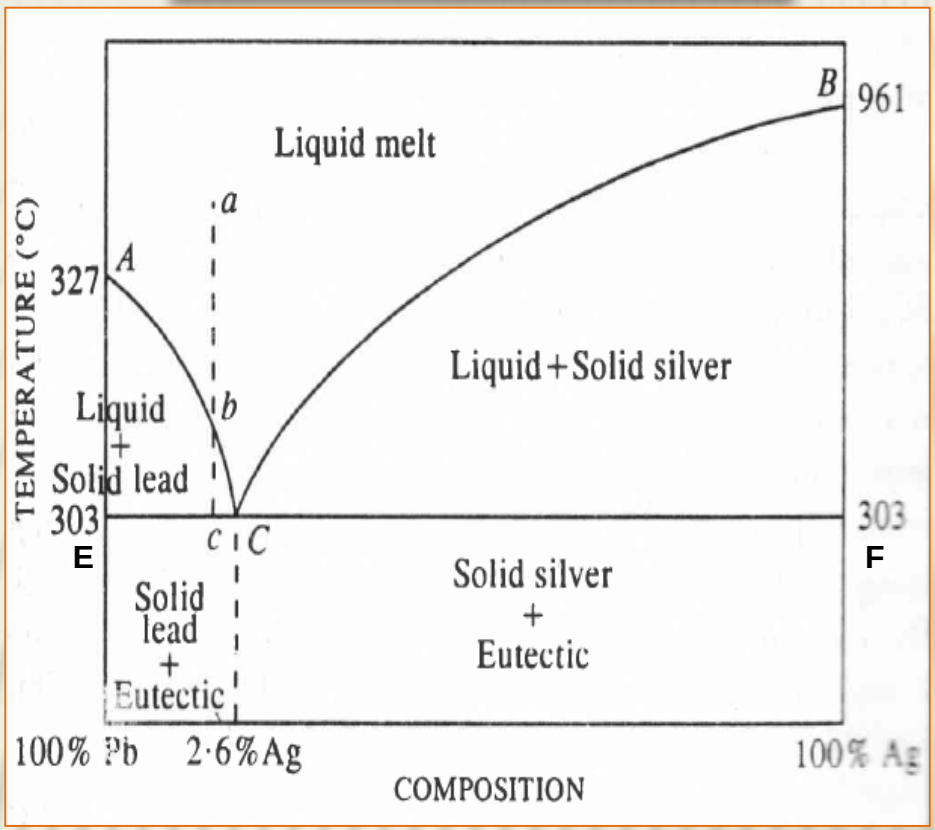
- **BC- Solid silver & solution (liquid melt) coexist: P = 2 (solid Ag and melt of Ag-Pb), C = 2. Hence, F' = C- P + 1 = 1 (Univariant)**



Area BCF

Two phases – solid Ag and melt of Pb in Ag Univariant

Phase Rule



- **Eutectic point 'C'-: Invariant point**

The three phases solid lead ↔ solid silver ↔ their liquid solution coexist

- **Eutectic point – Temperature – 303°C;**

Composition – 2.6% Ag - 97.4% Pb


THANK YOU