Phase Transformation in Metals

MSE-S304

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Phase Transformation in Metals

- **Why STUDY Phase Transformation?**

How one or more than one phases in an alloy *change* into a new phase or mixture of phases.

- **Why does Phase Transformation happen?**

The initial state of the alloy is *unstable* relative to the final state.

Phase Transformation in Metals

Phase **Transformation**

Thermodynamics

↓ **{ Probability }**

Driving Force

↓ **{ Magnitude }**

Rate

↓

Kinetics

Phase Transformation in Metals

Some Definitions

Phase

A phase in a material is a region that differs in its microstructure and/or composition from another region.

Identify the *Phases* of these?

Austenite

Pearlite

α-Ferrite

Cementite

δ-Ferrite

Ledeburite

Phase Transformation in Metals

Phase

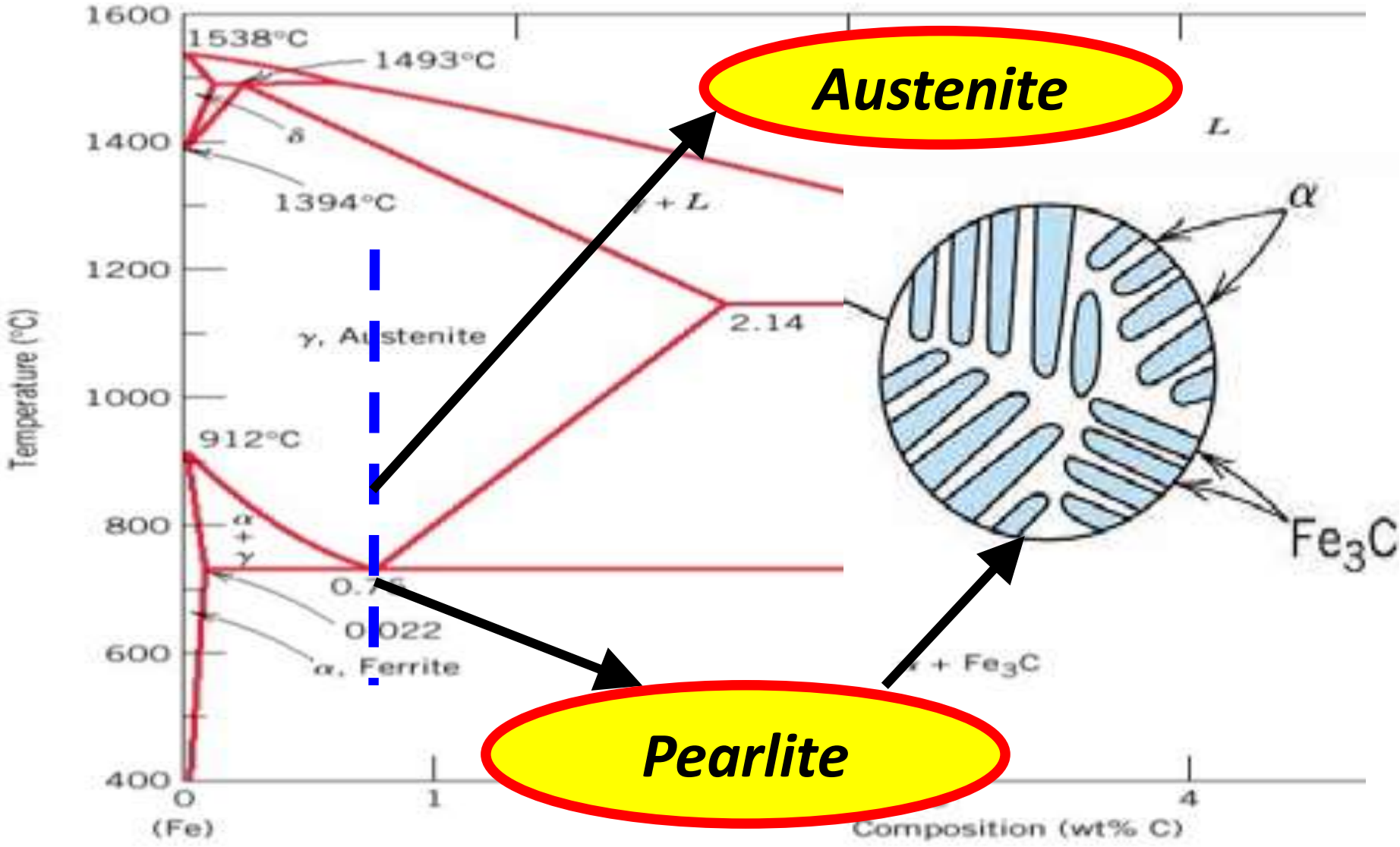
Physically distinct + **Chemically Homogeneous**

(Separate) ***(Same Concentration)***

➢ **Let's consider *Pearlite* for example**

▪ **During cooling of *austenite (γ-ferrite)* having *0.8%C* at constant *eutectoid temperature(727°C)* undergoes *eutectoid transformation* to form a mixture of *alternate lamellae* of *ferrite (0.02%C)* and *cementite (Fe_3C)*.**

Transformation of eutectoid plain carbon steel with slow cooling



Phase Transformation in Metals

Some Definitions

Phase Transformation

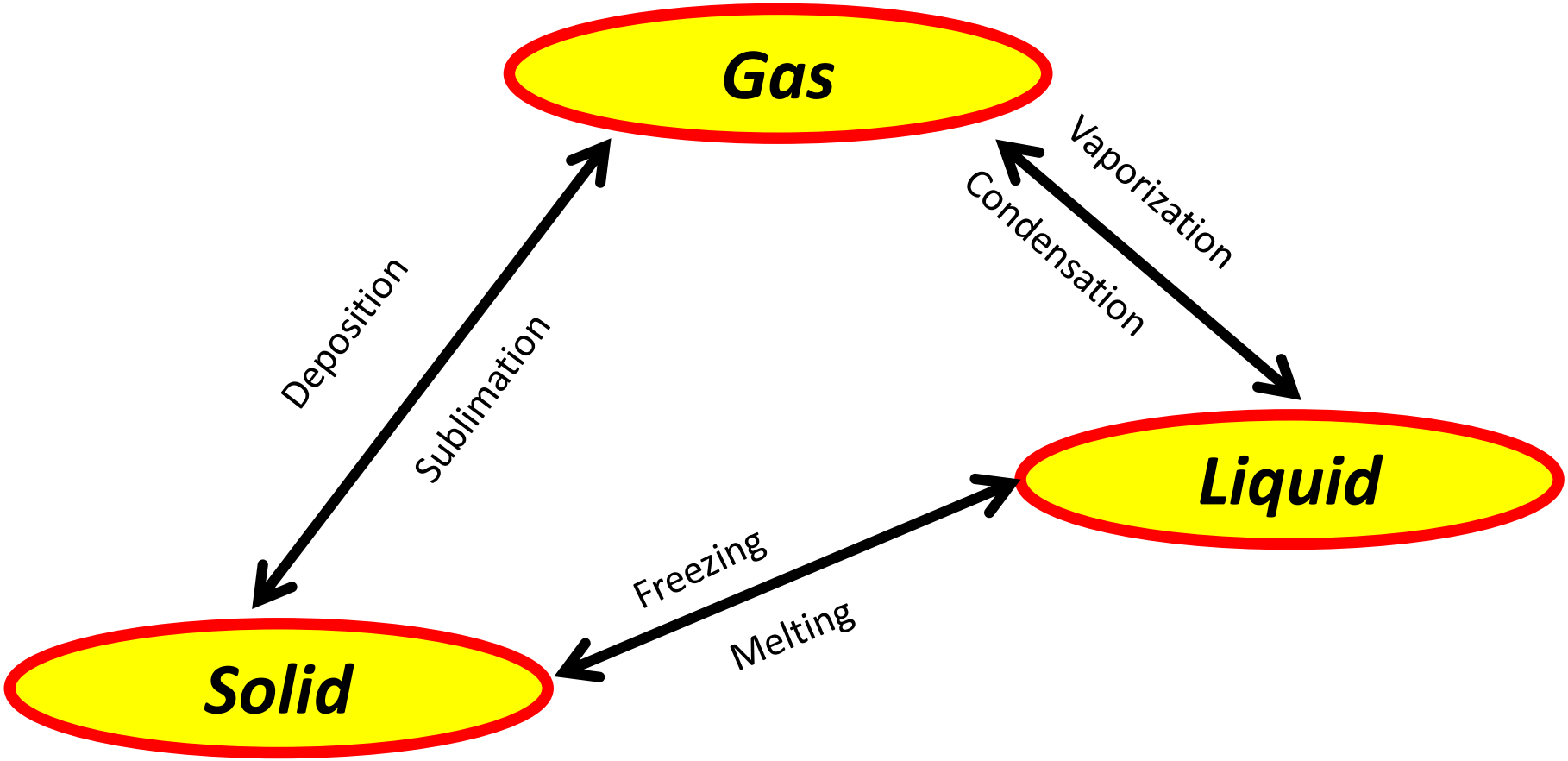
If the variation in free energy leads to change in structural details of a phase, a *"Phase transformation or Phase transition"* is said to occur.

Phase → ***Microstructure***

Phase Transformations → ***Microstructural Transformations***

Phase Transformation in Metals

Types of Phase Transformation



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Types of Phase Transformation

Solid-Solid Transitions **are transitions between different crystalline forms of the same compound.**

Example: