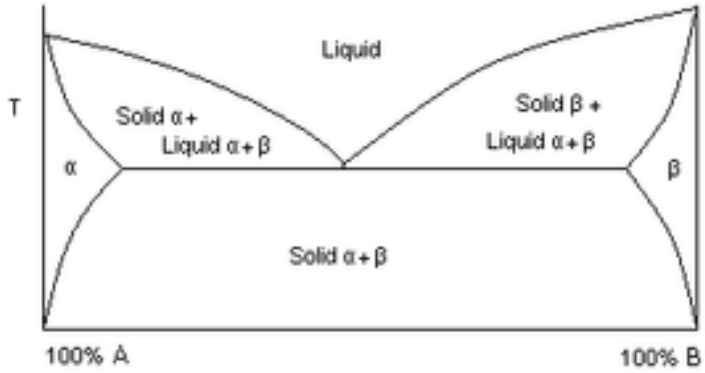
Eutectic Point.

Phase Diagram.



A eutectic or eutectic mixture is a mixture of two or more phases at a composition that has the lowest melting point, and where the phases simultaneously crystallise from molten solution at this temperature. The proper ratios of phases to obtain a eutectic is identified by the eutectic point on a phase diagram. The term comes from the Greek **'eutektos'**, meaning **'easily melted.'**

The phase diagram at right displays a simple binary system composed of two components, A and B, which has a eutectic point. The phase diagram plots relative concentrations of A and B along the X-axis, and temperature along the Y-axis. The eutectic point is the point at which the liquid phase borders directly on the solid ? + ? phases (the solid forms of pure A and B), representing the minimum melting temperature of any possible alloy of A and B. The temperature that corresponds to this point is known as the eutectic temperature.

Not all binary system alloys have a eutectic point: those that form a solid solution at all concentrations, such as the gold-silver system, have no eutectic.

Solid products of a eutectic transformation can often be identified by their lamellar structure, as opposed to the dendritic structures commonly seen in non-eutectic solidification. The same conditions that force the material to form lamellae can instead form an amorphous solid if pushed to an extreme.

Metallic eutectics.
The term is often used in metallurgy to describe the alloy of two or more component materials having the relative concentrations specified at the eutectic point. When a non-eutectic alloy freezes, one component of the alloy crystallizes at one temperature and the other at a different temperature. With a eutectic alloy, the mixture freezes as one at a single temperature. A eutectic alloy therefore has a sharp melting point, and a non-eutectic alloy exhibits a plastic melting range. The phase transformations that occur

while freezing a given alloy can be understood using the phase diagram by drawing a vertical line from the liquid phase to the solid phase on a phase diagram; each point along the line describes the composition at a given temperature.

Some Uses Include:

- Eutectic alloys for soldering, composed of tin (Sn), lead (Pb) and sometimes silver (Ag) or gold (Au).
- Casting alloys, such as aluminum-silicon and cast iron (at the composition for an austenite-cementite eutectic in the iron-carbon system).
- Brazing, where diffusion can remove alloying elements from the joint, so that eutectic melting is only possible early in the brazing process.
- Temperature response, i.e. Wood's metal and Field's metal for fire sprinklers.
- Non-toxic mercury replacements, such as galinstan.
- Experimental metallic glasses, with extremely high strength and corrosion resistance.
- Eutectic alloys of sodium and potassium (NaK) that are liquid at room temperature and used as coolant in experimental fast neutron nuclear reactors.