Two metals completely soluble in each other in the liquid state and partially soluble in the solid state

The partial solubility equilibrium diagram is derived from the previous two diagrams that indicated soluble and insoluble states. Few alloys exhibit total insolubility or total solubility and many metals combine to form a partial solubility system. The ends of the totally soluble system are amalgamated with the central portion of the insoluble or eutectic system to form the partially soluble in the solid state equilibrium diagram as shown in figure below. The partial solubility diagram looks very different to what we have encountered (happened) so far so we will work on its various components before we move on to seeing its uses. (**Lead-Tin**) combine to form solder and the equilibrium diagram is shown below. On this diagram we have included drawing of a typical microstructure for six different alloys of (Lead-Tin) these microstructures are fairly self-explanatory further explanations can be gotten by clicking on the relevant microstructure in figure below.

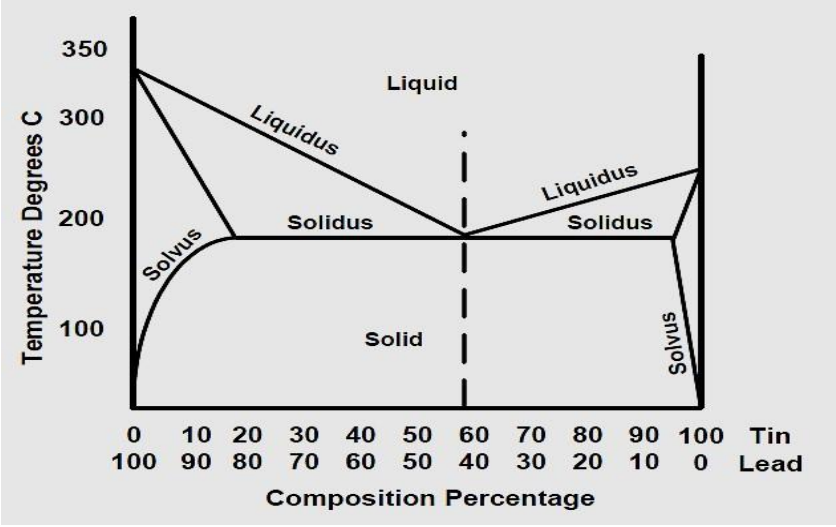
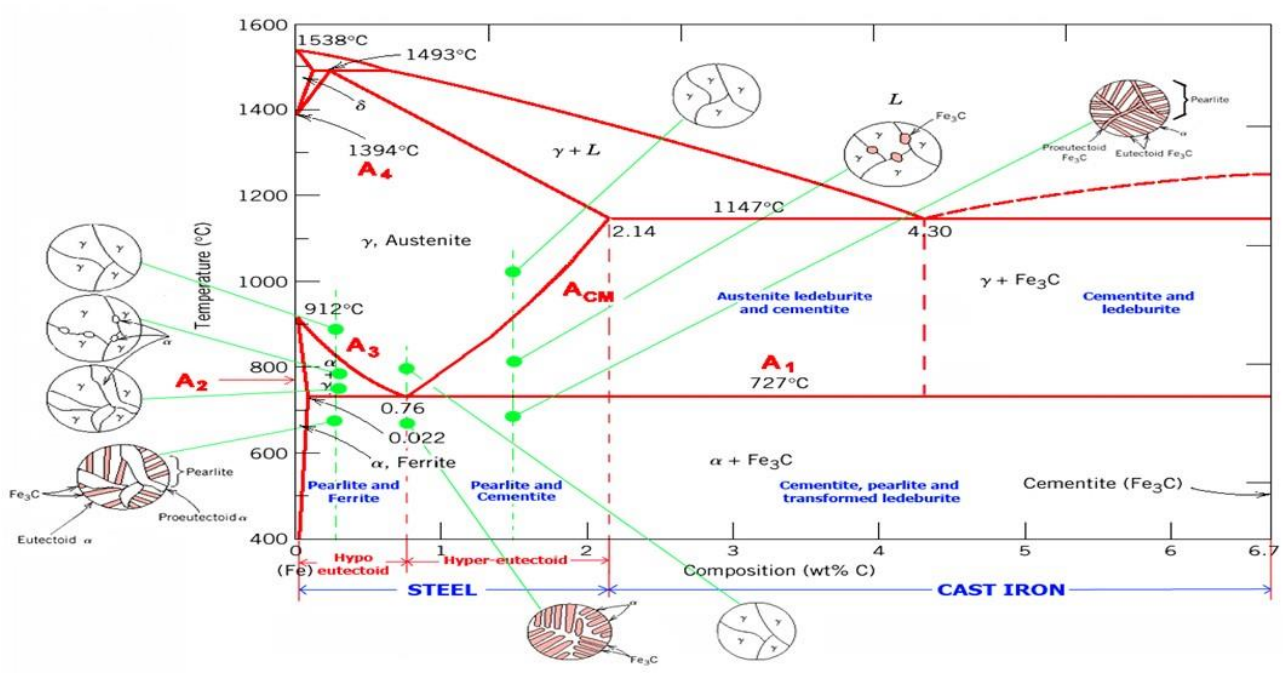


Figure. Liquids and Solidus lines.

Iron-Carbon Phase Diagram

The iron-carbon phase diagram is widely used to understand the different phases of steel and cast iron. Both steel and cast iron are a mix of iron and carbon. Also, both alloys contain a small amount of trace elements. The graph is quite complex but since we are limiting our exploration to Fe_3C, we will only be focusing on up to 6.67 weight percent of carbon.

This iron-carbon phase diagram is plotted with the carbon concentrations by weight on the X-axis and the temperature scale on the Y-axis. The carbon in iron is an interstitial impurity. The alloy may form a face-center cubic (FCC) lattice or a body-center cubic (BCC) lattice.



Types of Ferrous Alloys on the Phase Diagram

The weight percentage scale on the X-axis of the iron-carbon phase diagram goes from 0% up to 6.67% Carbon. Up to a maximum carbon content of 0.008% weight of Carbon, the metal is simply called iron or pure iron.

From 0.008% up to 2.14% carbon content, the iron-carbon alloy is called steel. Within this range, there are different grades of steel known as low-carbon steel, medium carbon steel, and high-carbon steel.

Eutectic Point

Eutectic point is a point where multiple phases meet. For the iron-carbon alloy diagram, the eutectic point is where the lines A1, A3 and ACM meet.

α-ferrite

Existing at low temperatures and low carbon content, α-ferrite is a solid solution of carbon in BCC Fe. This phase is stable at room temperature. In the graph, it can be seen as a sliver on the left edge with Y-axis on the left side and A2 on the right. This phase is magnetic below 768°C.

γ-austenite

It has a maximum carbon content of 0.022 % and it will transform to γ-austenite at 912°C as shown in the graph.

Fe_3C or cementite

Cementite is a metastable phase of this alloy with a fixed composition of Fe3C. It decomposes extremely slowly at room temperature into iron and carbon (graphite).

Fe-C liquid solution

Marked on the diagram as 'L', it can be seen in the upper region in the diagram. As the name suggests, it is a liquid solution of carbon in iron. it is evident that the melting temperature of iron decreases with increasing carbon content.