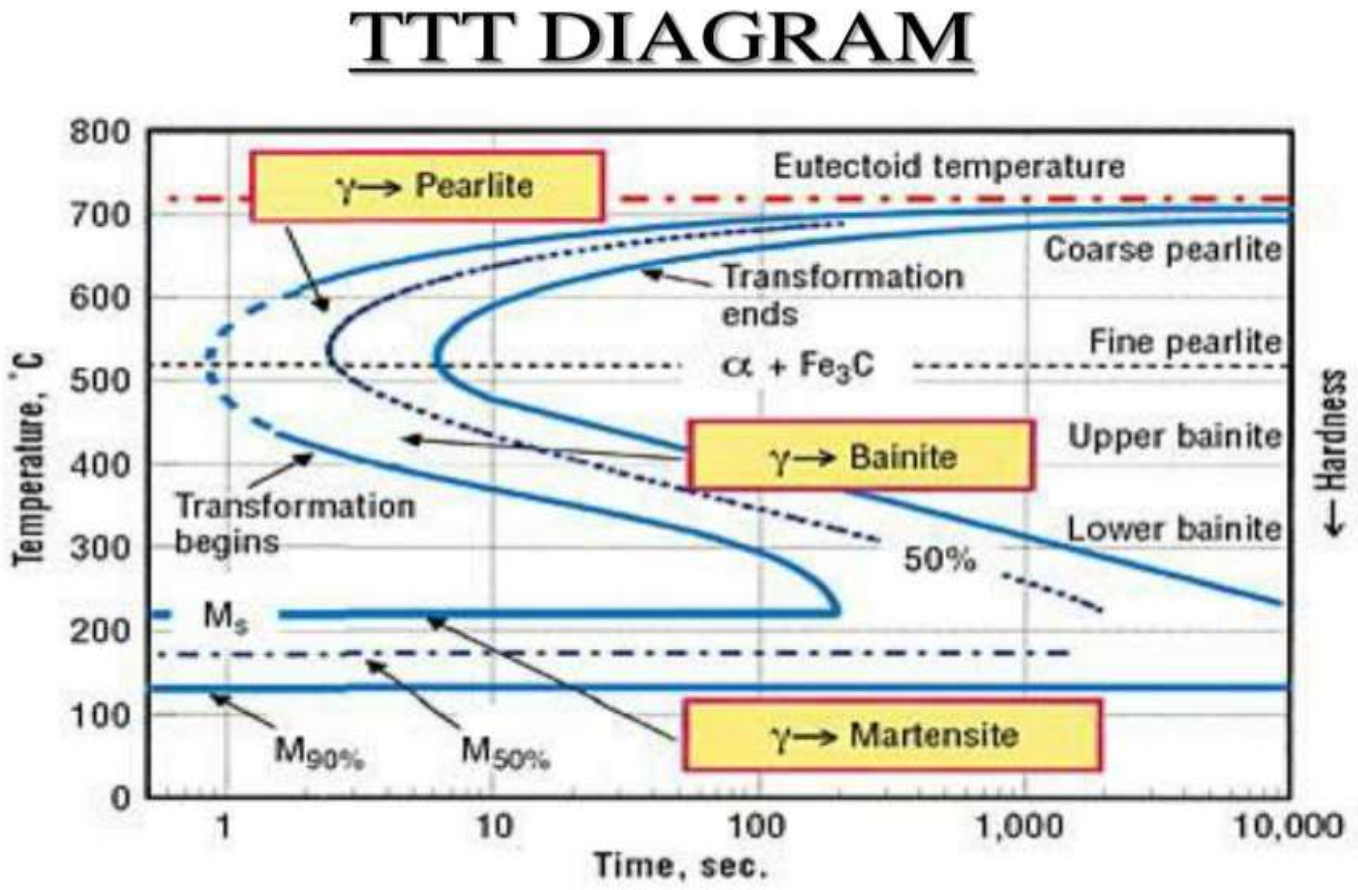
TTT diagram

TTT diagram is a plot of temperature versus the logarithm of time for a steel alloy of definite composition.

TTT diagram indicates when a specific transformation starts and ends and it also shows what percentage of transformation of austenite at a particular temperature is achieved.



Normalizing

The normalizing consists of heating steel to about 40-55 oC above critical temperature, and holding for proper item and then cooling in still air or slightly agitated air to room temperature.

Normalized steels are generally stronger and harder than fully annealed steels.

Normalizing is the effective way to eliminate the carbide network.

Normalized treatment is frequently applied to steel in order to achieve any one or more of the objectives

- ❑To refine the grain structure
- ❑To obtain uniform structure
- ❑To decrease residual stresses
- ❑To improve Machinability

Hardening

Hardening is a heat treatment process in which steel is rapidly cooled from austenitising temperature. As a result of hardening, the hardness and wear resistance of steel are improved.

Hardening treatment generally consists of heating to hardening temperature, holding at that temperature, followed by rapid cooling such as quenching in oil or water or salt baths.

The Process Variables:

Hardening Temperature

Soaking Time

Delay in quenching

Tempering

Tempering is a sub-critical heat treatment process used to improve the toughness of hardened steel.

Tempering consists of reheating of hardened steel to a temperature below Lower critical temperature and is held for a period of time, and then slowly cooled in air to room temperature.

At tempering temperature, carbon atoms diffuses out and form fine cementite and softer ferrite structure left behind. Thus the structure of tempered steel consists of ferrite and fine cementite.