Heat Treatment of Metals

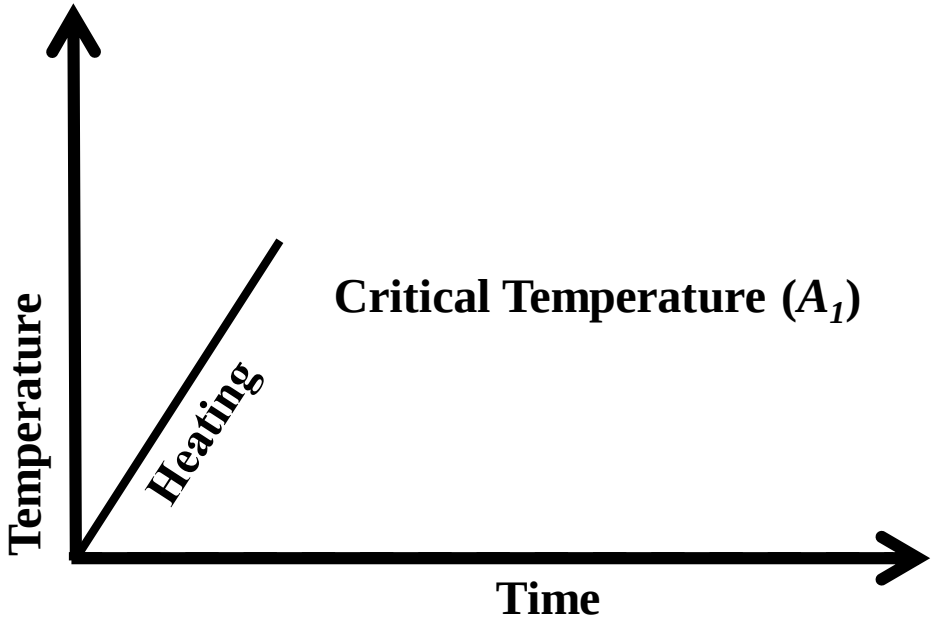
MSE-S305

Ankur Katiyar
Assistant Professor, MSME Department
UIET, CSJM University

Mechanism of Formation of Austenite of eutectoid steel

Eutectoid steels

➢**If a plain carbon steel contains *0.8%C*, it is called *Eutectoid steel*.**

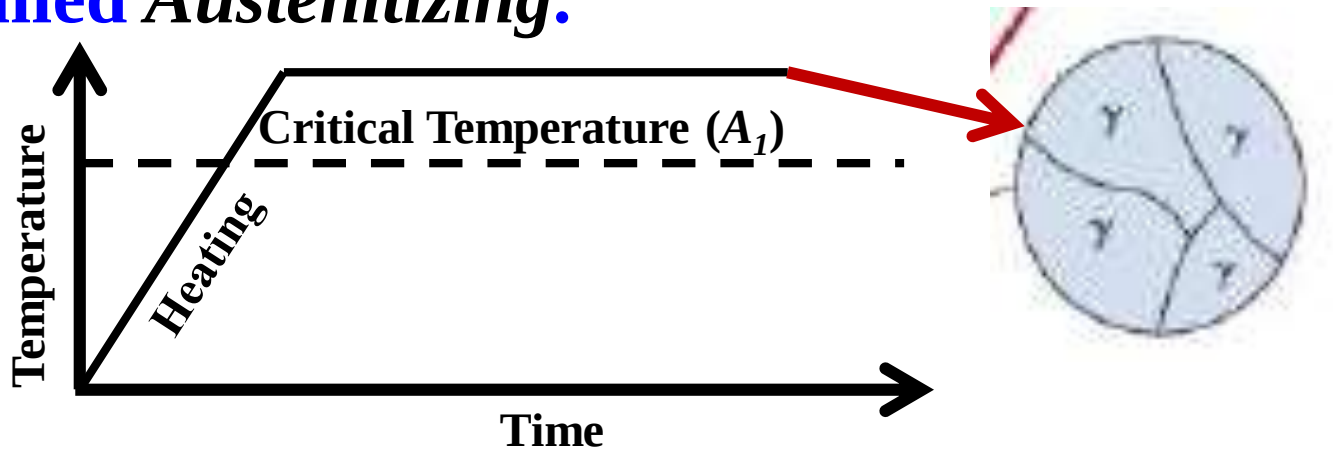


Heat Treatment Cycle

Mechanism of Formation of Austenite of eutectoid steel

Austenitizing

➢**If a eutectoid plain carbon steel is heated to *austenitic temperature* for a sufficient time, it's structure will become *Homogeneous austenite*. This Process is called *Austenitizing*.**



Heat Treatment Cycle

Mechanism of Formation of Austenite of eutectoid steel

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Formation of Austenite on Heating →

→ In many heat treatment process, the first step consists of heating the steel into the austenitic range, the process known as austenitization.

→ Austenite is formed on heating an aggregate of ferrite + pearite, ferrite + cementite or cementite + pearlite, depending on whether the steel is of hypoeutectoid, eutectoid or hypereutectoid type, respectively.

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→ Formation of austenite in eutectoid steel is different from that of hypoeutectoid & hypereutectoid steels in the sence that in the case of eutectoid steel, it occurs at particular temp^{r} (A_{C_1}) while in the case of hypoeutectoid & hypereutectoid steels, it ~~occurs~~ takes place over a range of temp.^{r} hypo (A_{C_1} to A_3) & hyper (A_{C_1} to A_{cm}).

Mechanism of Formation of Austenite of eutectoid steel

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Eutectoid Steel →

→ Let us consider the formation of austenite from a mixr of ferrite-cementite in a eutectoid steel. Normally, this mixr in eutectoid steel occurs as pearlite.

→ Carbon diffusion rates are practically insignificant up to 200°C. As the temp.r incl to higher values, but below eutectoid temp, carbon atoms have a tendency to diffuse into ferrite. But still diffusion rate is very slow & meaningless for practical purposes.

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→ 0.008% carbon in ferrite at room temp.r & it is abt 0.025% at eutectoid temp.r. On heating to eutectoid temp.r, BCC iron (α-Fe) lattice changes to FCC iron (γ-Fe) lattice.

→ At the theoretical temp.r for the formation of austenite in eutectoid steel (eutectoid temp.r), regions around the cementite layer will be enriched with carbon because of diffusion & the max.m diffusion

Mechanism of Formation of Austenite of eutectoid steel

21 TUE must be at ferrite-cementite interface.

→ As sufficient interfaces are available, austenite nuclei will be formed at the interface.

→ The formation of primary austenitic grains & their growth by dissolving ferrite, continue till all ferrite & cementite dissolves to form austenite.

→ 

22 WED (Steps associated with transformation of pearlite to austenite)

→ The growth rate of austenite is higher than the rate of dissolution of the cementite into austenite. This explains that dissolving of ferrite is completed before that of cementite. The austenite thus formed at eutectoid temp^{r} is not homo-geneous.

→ Chemically homogeneous austenitic grains are obtained by holding steel above the eutectoid temp^{r}. The holding time should be sufficient so that carbon atoms may diffuse & result in uniform distribution of carbon atoms.

Notes