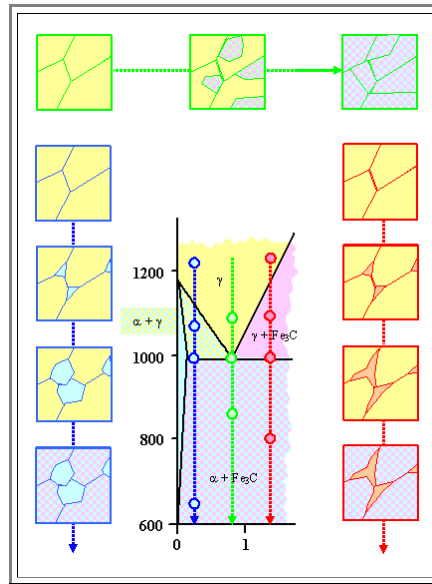


Kinetics of the Phase Formation in the Fe - C System

Illustration

Below the important part of the **Fe - C** phase diagram is shown. Three lines indicate hypoeutectic, eutectic and hypereutectic compositions.

If we look at what we will find at the indicated points, this is what we would expect:



In all three cases we start with some polycrystalline γ - structure: It is drawn identically in each cases to point out that the basic phenomena are the same (and to save work).

For the blue *hypoeutectic* case, we start to grow some α phase as soon as we cross the boundary between the pure γ region and the $\alpha + \gamma$ mixed phase.

- It is pretty safe to assume that nucleation of the α grains starts at the grain boundaries, in particular at the nodes.

- At the eutectic temperature, the α grains have their maximal size. As soon as we cross over to the $\alpha + \text{Fe}_3\text{C}$ eutectic, the pure γ grains must now transform to $\alpha + \text{Fe}_3\text{C}$, i.e. to perlite.

For the red *hypereutectic* case, pretty much the same thing happens

- We start to grow some Fe_3C , i.e. cementite, as soon as we cross the boundary between the pure γ region and the $\alpha + \text{Fe}_3\text{C}$ mixed phase.

- It is pretty safe to assume that nucleation of the Fe_3C grains starts at the grain boundaries, but it is also sage to assume that it will be somehow different from the way the α grains did it. This is indicated schematically; we simply assume growth along the boundaries.

- How nucleation and growth takes place in reality, however, cannot be told from the phase diagram alone; we need some additional information.

- At the eutectic temperature, the cementite grains have their maximal size. As soon as we cross over to the $\alpha + \text{Fe}_3\text{C}$ eutectic, the pure γ grains must now transform to $\alpha + \text{Fe}_3\text{C}$, i.e. to perlite.

It only remains to discuss what happens if we have the precise eutectoid composition; this is shown in green.

- It is simple enough. Below the eutectoid temperature, the the pure γ grains transform to $\alpha + \text{Fe}_3\text{C}$, i.e. to (pure) perlite.

- However, this does not happen everywhere all at once, again, some nucleation and growth takes place as indicated.

One important point becomes clear, no matter exactly what happens: The original grain structure of the γ phase determines very much what kind of grain structure we will have in the room temperature structure.