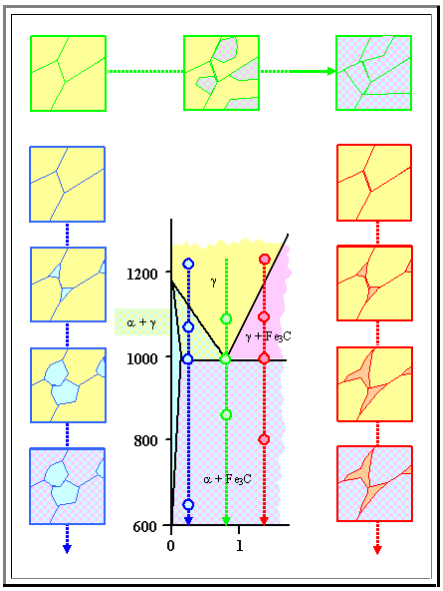
Kinetics of the Phase Formation in the Fe - C System

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 *hypo*eutectic case, we start to grow some α phase as soon as we cross the boundary between the pure γ region and the α **+** γ 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 α **+ Fe_3C** eutectic, the pure γ grains must now transform to α **+ Fe_3C**, i.e. to perlite.
- For the red *hyper*eutectic 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 α **+ Fe_3C** mixed phase.
  - It is pretty safe to assume that nucleation of the **Fe_3C** grains starts at the grain boundaries, but it 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 α **+ Fe_3C** eutectic, the pure γ grains must now transform to α **+ Fe_3C**, 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 α **+ Fe_3C**, 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.