Nucleation Science

Science

It's phase transformations that make iron and steel so special. Having a transformation from the fcc austenite phase to the bcc ferrite and / or martensite phase, together with the formation of the **Fe_3C** cementite phase, is just another way to say (carbon) "steel".
Whenever a new phase forms "from scratch", it needs to go through the process of nucleation. How and where new phases nucleate is something we can influence - in contrast to the equilibrium ("nirvana") structure.
As it turns out, nucleation is a complex process. Looking at it in some detail needs considerable space, so I will devote several modules to this topic. What you will find in the links is:

1. **Global and local equilibrium for point defects.**
   How *supersaturated* point defects like vacancies start to "precipitate" under simple and ideal circumstances. It's an exercise for finding out how it is *not* done and why we need to dig deeper.
2. **Homogeneous nucleation.**
   The easy way to start a new phase. Unfortunately it is almost impossible and rarely happens.
3. **Heterogeneous nucleation.**
   It's dirty business and thus what really happens, just like in real life.
4. **Size and density of precipitates.**
   Now that it got started we need to look at what we get, and how that depends on the thermal history.
5. **Precipitation and structures.**
   It's about growing up and how that depends on how you were born and raised.