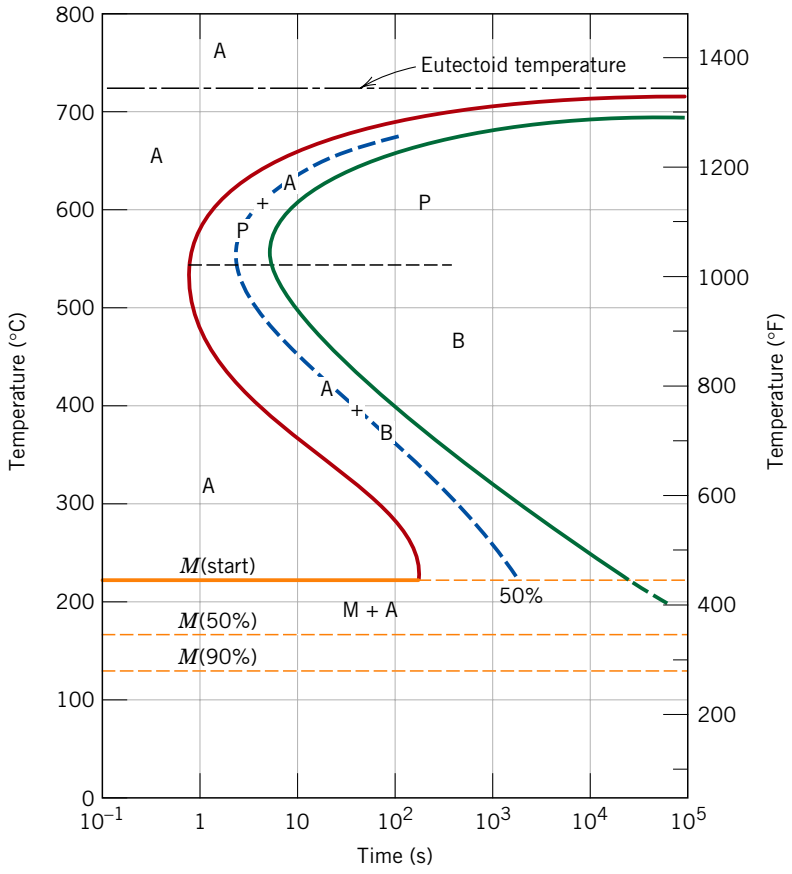
Tutorial 6

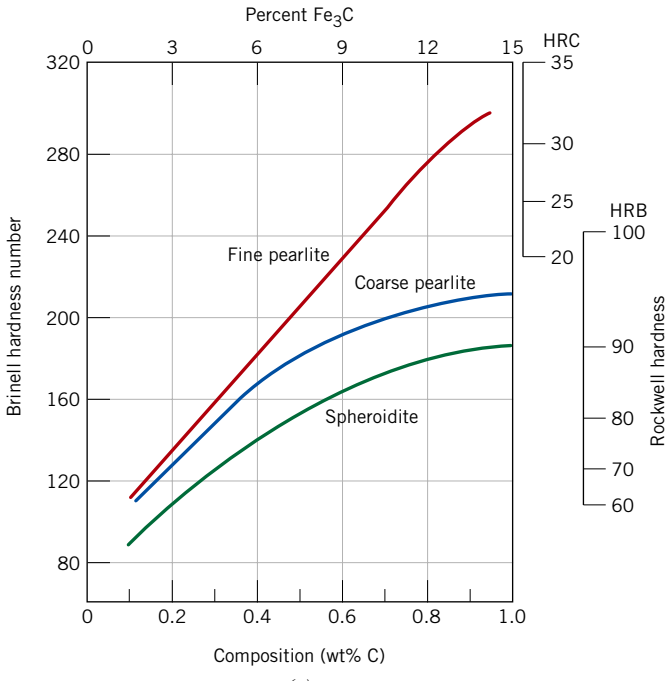
Questions 1-3 are from the textbook Callister, 8th ed. Chapters 10: 10.18, 10.D3 and 10.D4

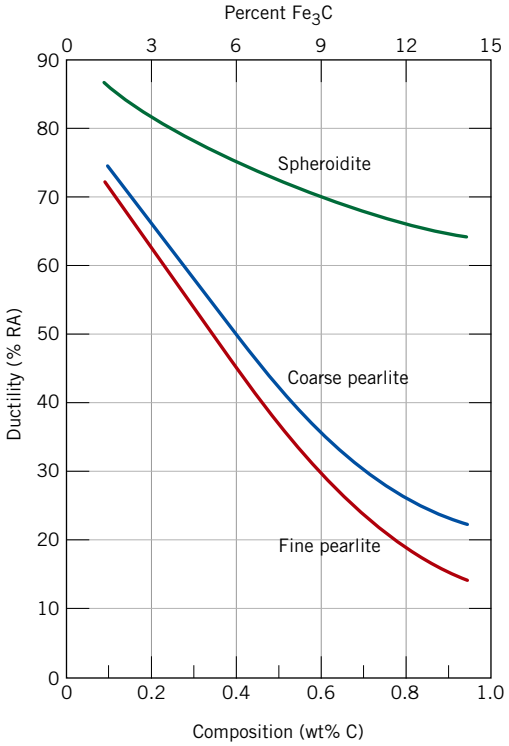
1. Using the isothermal transformation diagram for an iron–carbon alloy of eutectoid composition, specify the nature of the final microstructure (in terms of micro-constituents present and approximate percentages of each) of a small specimen that has been subjected to the following time– temperature treatments. In each case assume that the specimen begins at 760°C and that it has been held at this temperature long enough to have achieved a complete and homogeneous austenitic structure.

   a) Cool rapidly to 700°C, hold for 10^4 s, then quench to room temperature.
   b) Reheat the specimen in part (a) to 700°C for 20 h.
   c) Rapidly cool to 600°C, hold for 4 s, rapidly cool to 450°C, hold for 10 s, then quench to room temperature.
   d) Cool rapidly to 400°C, hold for 2 s, then quench to room temperature.
   e) Cool rapidly to 400°C, hold for 20 s, then quench to room temperature.
   f) Cool rapidly to 400°C, hold for 200 s, then quench to room temperature.



2. It is desired to produce an iron–carbon alloy that has a minimum hardness of 175 HB and a minimum ductility of 52%RA. Is such an alloy possible? If so, what will be its composition and microstructure (coarse and fine pearlites and spheroidite are alternatives)? If this is not possible, explain why.





3.

a) For a 1080 steel that has been water quenched, estimate the tempering time at 425°C to achieve a hardness of 50 HRC.

b) What will be the tempering time at 315°C necessary to attain the same hardness?