MSE250 - Homework 7 Graphs and Textbook Questions (8th ed.)

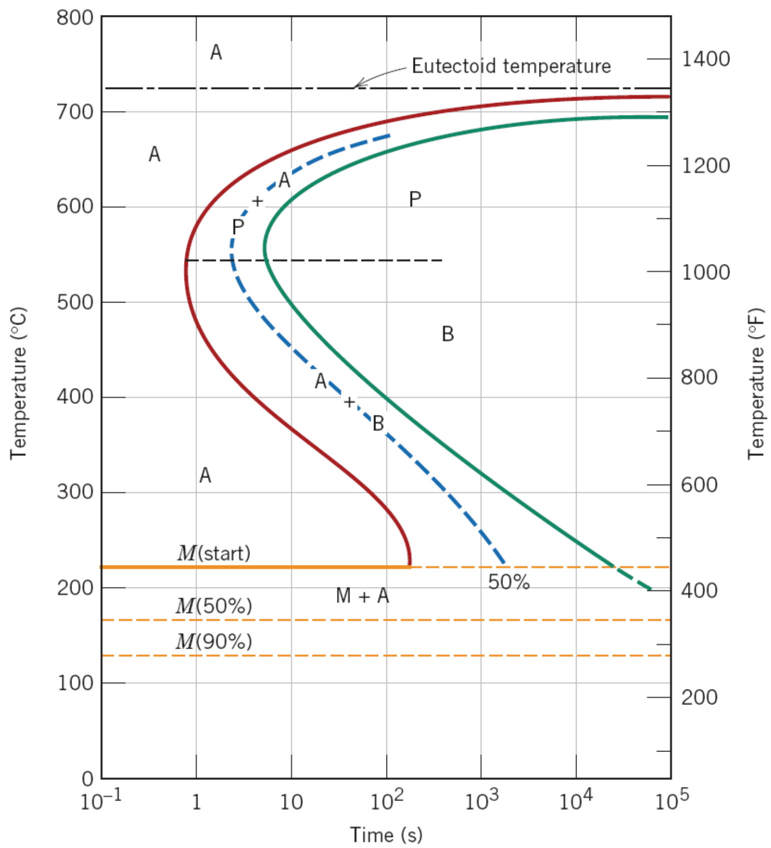


Figure 10.22 The complete isothermal transformation diagram for an iron–carbon alloy of eutectoid composition: A, austenite; B, bainite; M, martensite; P, pearlite.

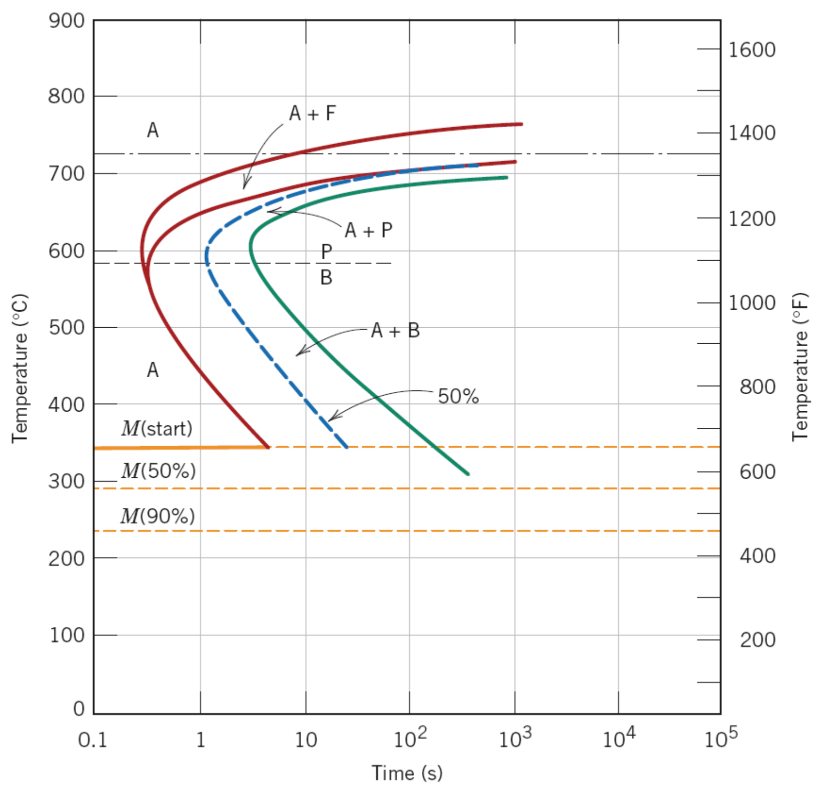


Figure 10.39 Isothermal transformation diagram for a 0.45 wt% C iron–carbon alloy: A, austenite; B, bainite; F, proeutectoid ferrite; M, martensite; P, pearlite. (Adapted from *Atlas of Time-Temperature Diagrams for Irons and Steels*, G. F. Vander Voort, Editor, 1991. Reprinted by permission of ASM International, Materials Park, OH.)

10.24 Figure 10.40 shows the continuous cooling transformation diagram for a 1.13 wt% C iron–carbon alloy. Make a copy of this figure and then sketch and label continuous cooling curves to yield the following microstructures:

(a) Fine pearlite and proeutectoid cementite

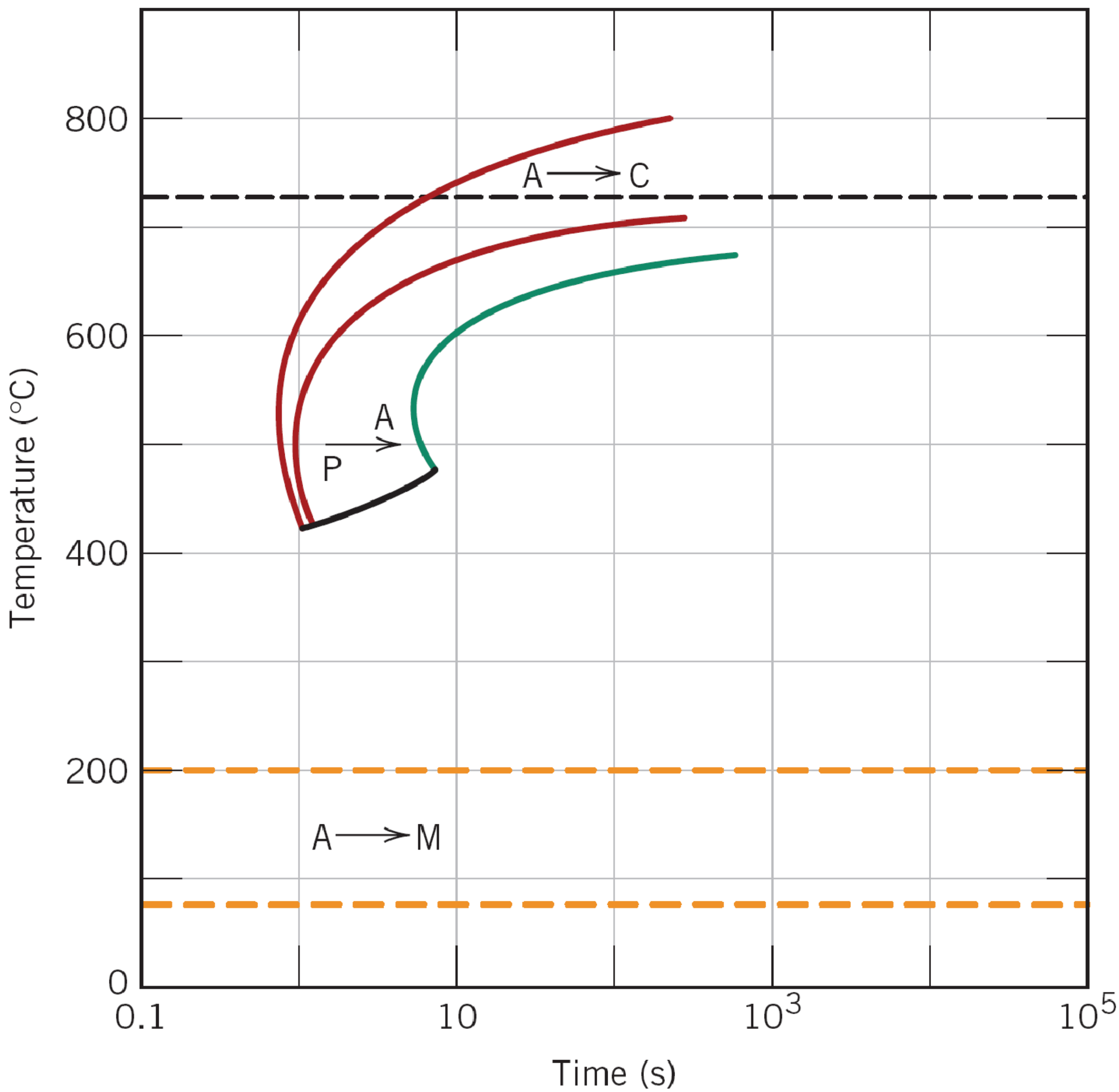
(b) Martensite

(c) Martensite and proeutectoid cementite

(d) Coarse pearlite and proeutectoid cementite

(e) Martensite, fine pearlite, and proeutectoid cementite

Figure 10.40 Continuous cooling transformation diagram for a 1.13 wt% C iron–carbon alloy.



Mechanical Behavior of Iron–Carbon Alloys
Tempered Martensite

10.30 Briefly explain why fine pearlite is harder and stronger than coarse pearlite, which in turn is harder and stronger than spheroidite.

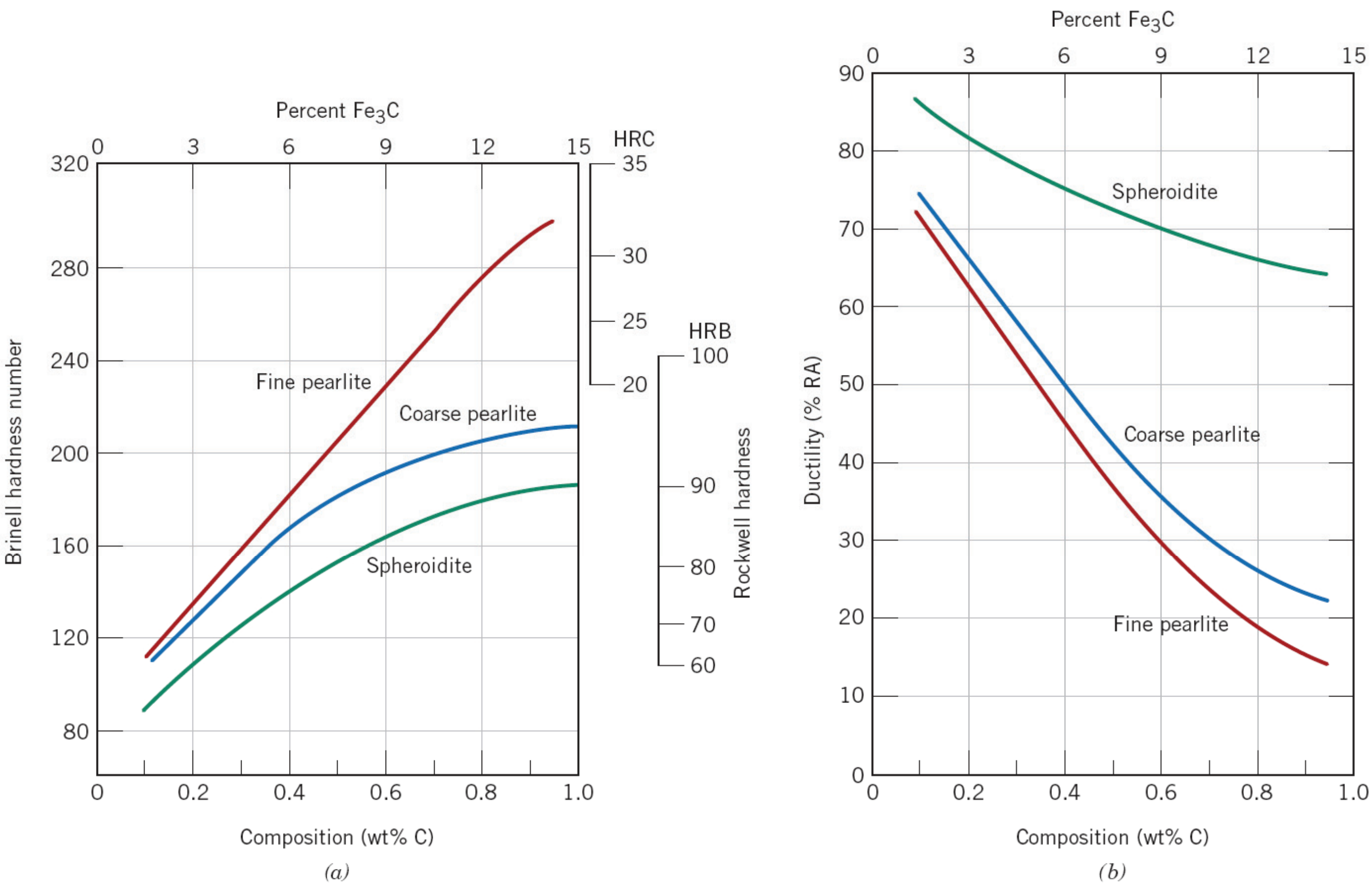


Figure 10.30 (*a*) Brinell and Rockwell hardness as a function of carbon concentration for plain carbon steels having fine and coarse pearlite as well as spheroidite microstructures. (*b*) Ductility (%RA) as a function of carbon concentration for plain carbon steels having fine and coarse pearlite as well as spheroidite microstructures. (Data taken from *Metals Handbook: Heat Treating,* Vol. 4, 9th edition, V. Masseria, Managing Editor, American Society for Metals, 1981, pp. 9 and 17.)

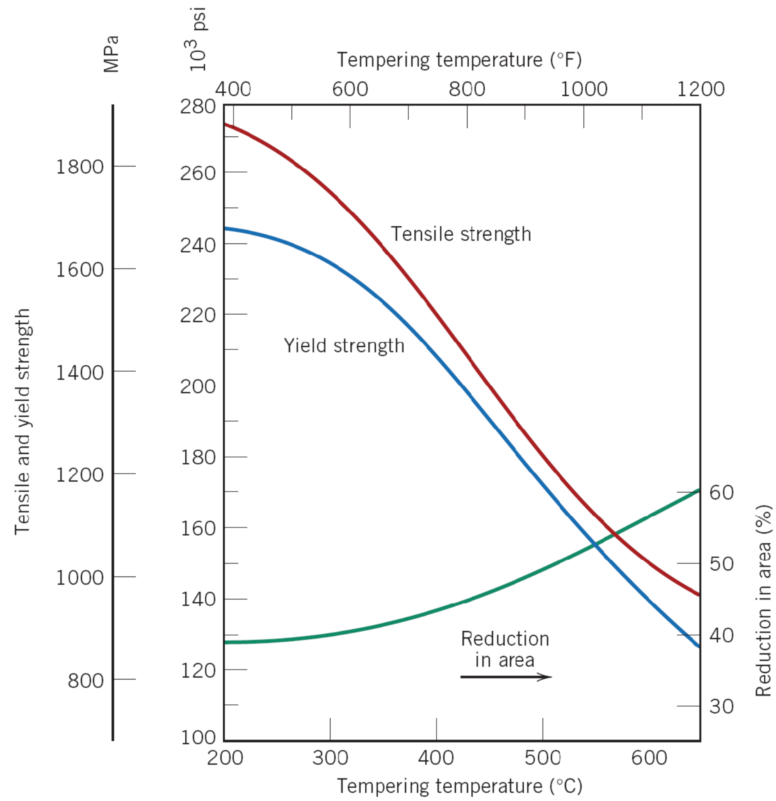


Figure 10.34 Tensile and yield strengths and ductility (%RA) (at room temperature) versus tempering temperature for an oil-quenched alloy steel (type 4340). (Adapted from figure furnished courtesy Republic Steel Corporation.)

Precipitation Hardening

11.D14 Copper-rich copper–beryllium alloys are precipitation hardenable. After consulting the portion of the phase diagram shown in Figure 11.30, do the following:

(a) Specify the range of compositions over which these alloys may be precipitation hardened.

(b) Briefly describe the heat-treatment procedures (in terms of temperatures) that would be used to precipitation harden an alloy having a composition of your choosing, yet lying within the range given for part (a).

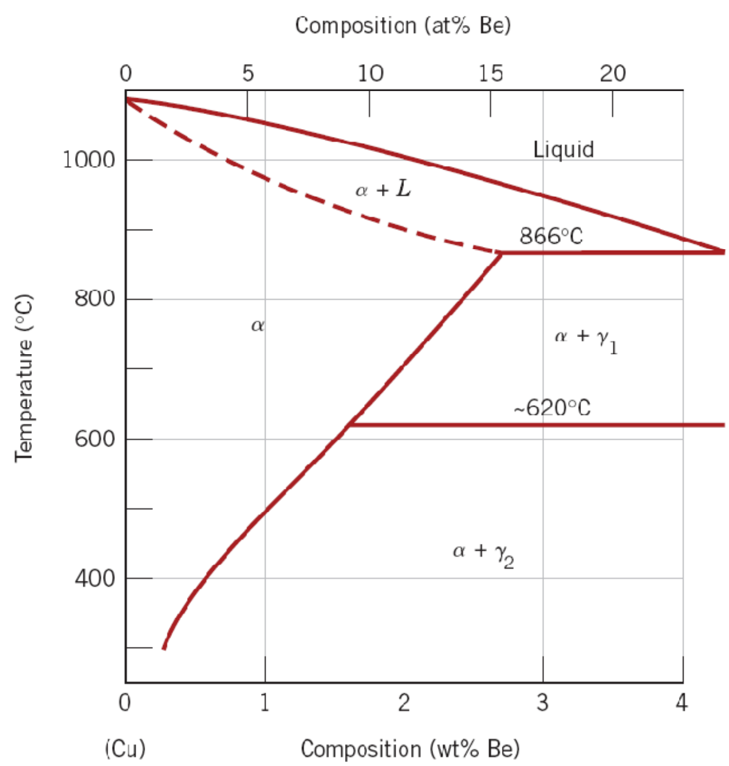


Figure 11.30 The copper-rich side of the copper–beryllium phase diagram. [Adapted from *Binary Alloy Phase Diagrams,* 2nd edition, Vol. 2, T. B. Massalski (Editor-in-Chief), 1990. Reprinted by permission of ASM International, Materials Park, OH.]

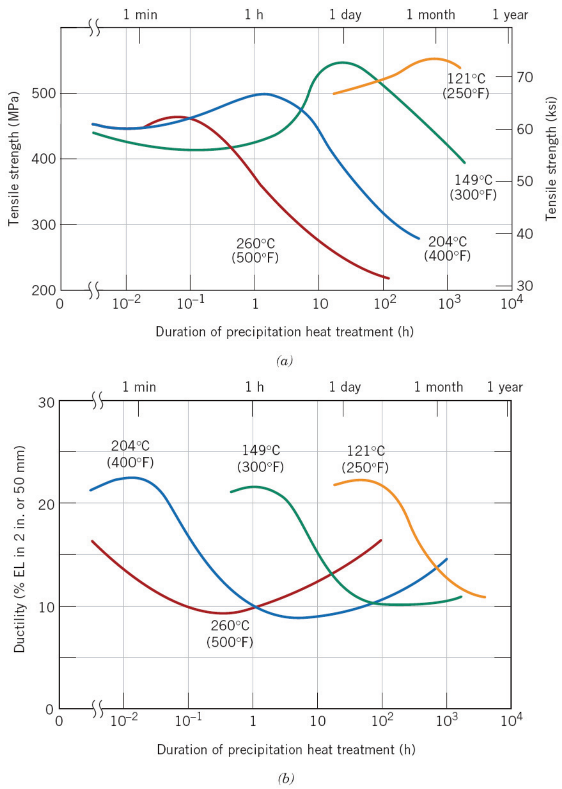


Figure 11.27 The precipitation hardening characteristics of a 2014 aluminum alloy (0.9 wt% Si, 4.4 wt% Cu, 0.8 wt% Mn, 0.5 wt% Mg) at four different aging temperatures: (*a*) tensile strength, and (*b*) ductility (%EL). [Adapted from *Metals Handbook: Properties and Selection: Nonferrous Alloys and Pure Metals*, Vol. 2, 9th edition, H. Baker (Managing Editor), American Society for Metals, 1979, p. 41.]