材 料 與 製 造

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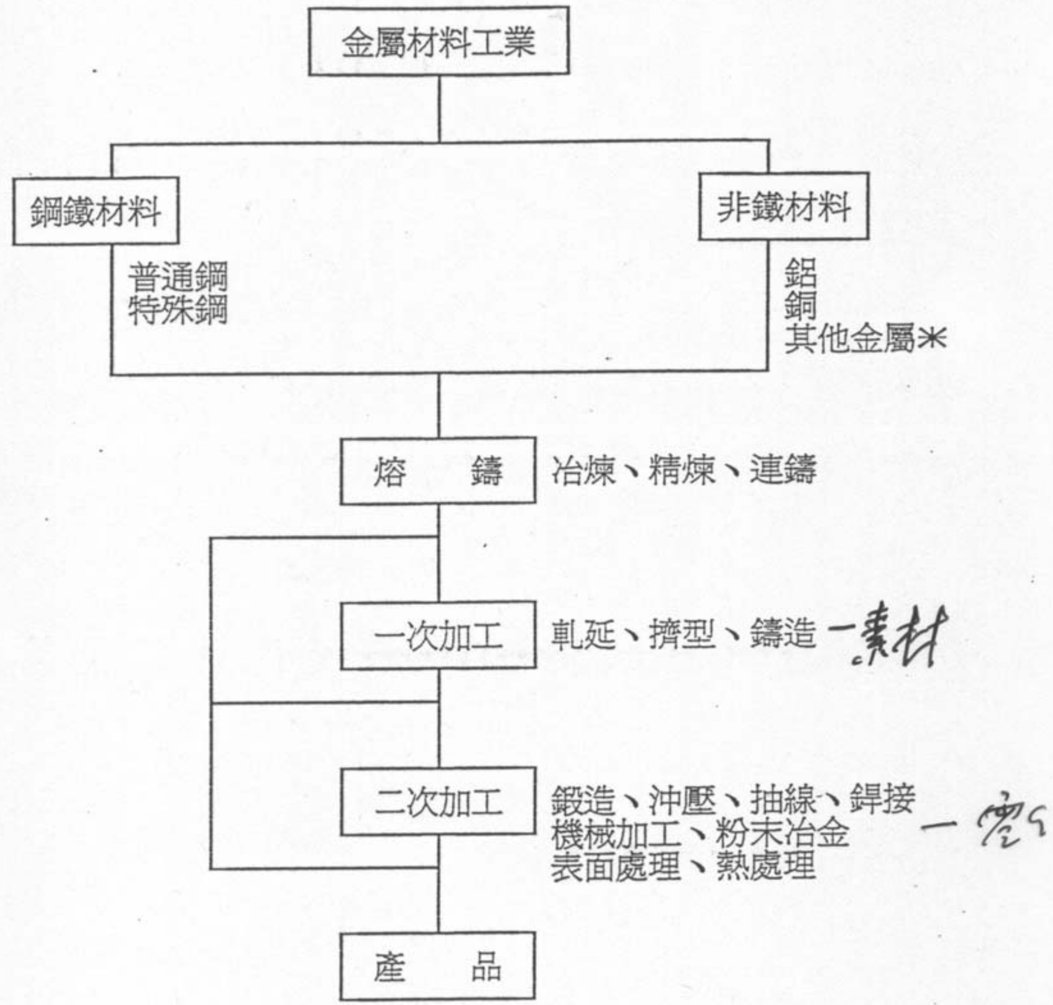
中華民國九十三年九月

二、金屬材料製造系統 ~NKFUST--傅兆章

(一)



※其他非鐵金屬材料包括鋅、鉛、錫、鎂、鎳、鈷、鈦及其合金，也包括金、銀、及鉑等等貴重金屬材料。

圖1-1 金屬材料工業之產業結構圖

(二)鐵及鋼的製造系統

原料：

(1)鐵礦石：磁鐵礦赤鐵礦褐鐵礦65% Fe

(2)焦碳→加熱至1150℃在Quench。因未還原鐵礦，

有副產品。

(3)石灰石→去雜質及造碴，形成slag

$$Fe_2O_3+3CO \rightarrow 2Fe+3CO_2$$

煉鐵→高爐1650℃→鐵水(含高碳)造pig iron(4% C+1.5% Si、1% Mn)

煉鋼→轉爐或平爐

B.O.F：將生鐵＋廢鋼或添合金元素

吹氧作$C+O_2 \rightarrow CO_2$，O_2減少『C』含量

速鑄→板材、棒材或型鋼

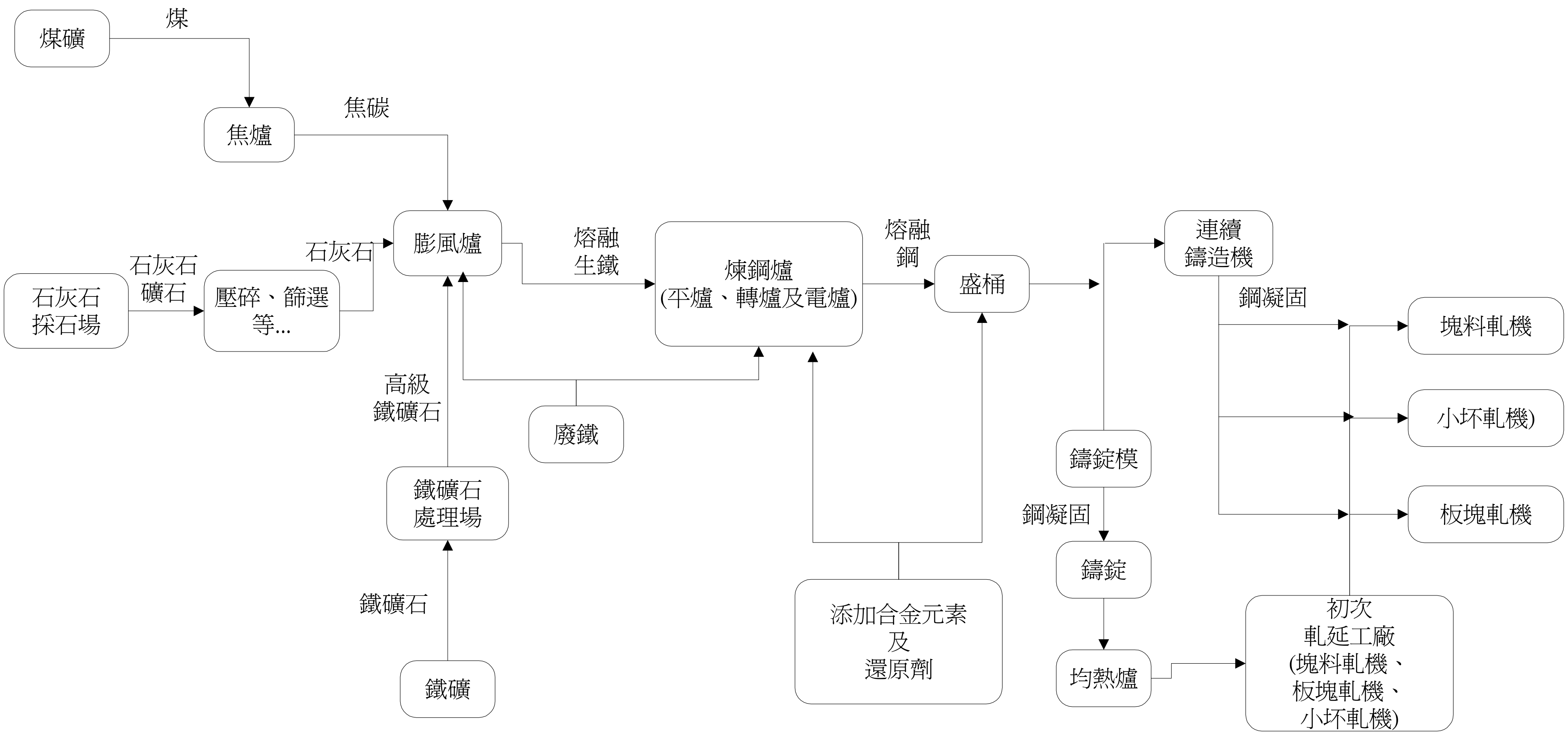


圖9.5 鋼鐵原料轉變成各種鋼鐵產品形式(不包含有塗層之產品)之主要步驟流程圖

[資料來源：**H.E. McGannon (ed.), "The Making Shaping, and Treating of Steel," 9th ed., United States Steel Corp., 1971, p.2.]**

(三)鋼鐵的連鑄

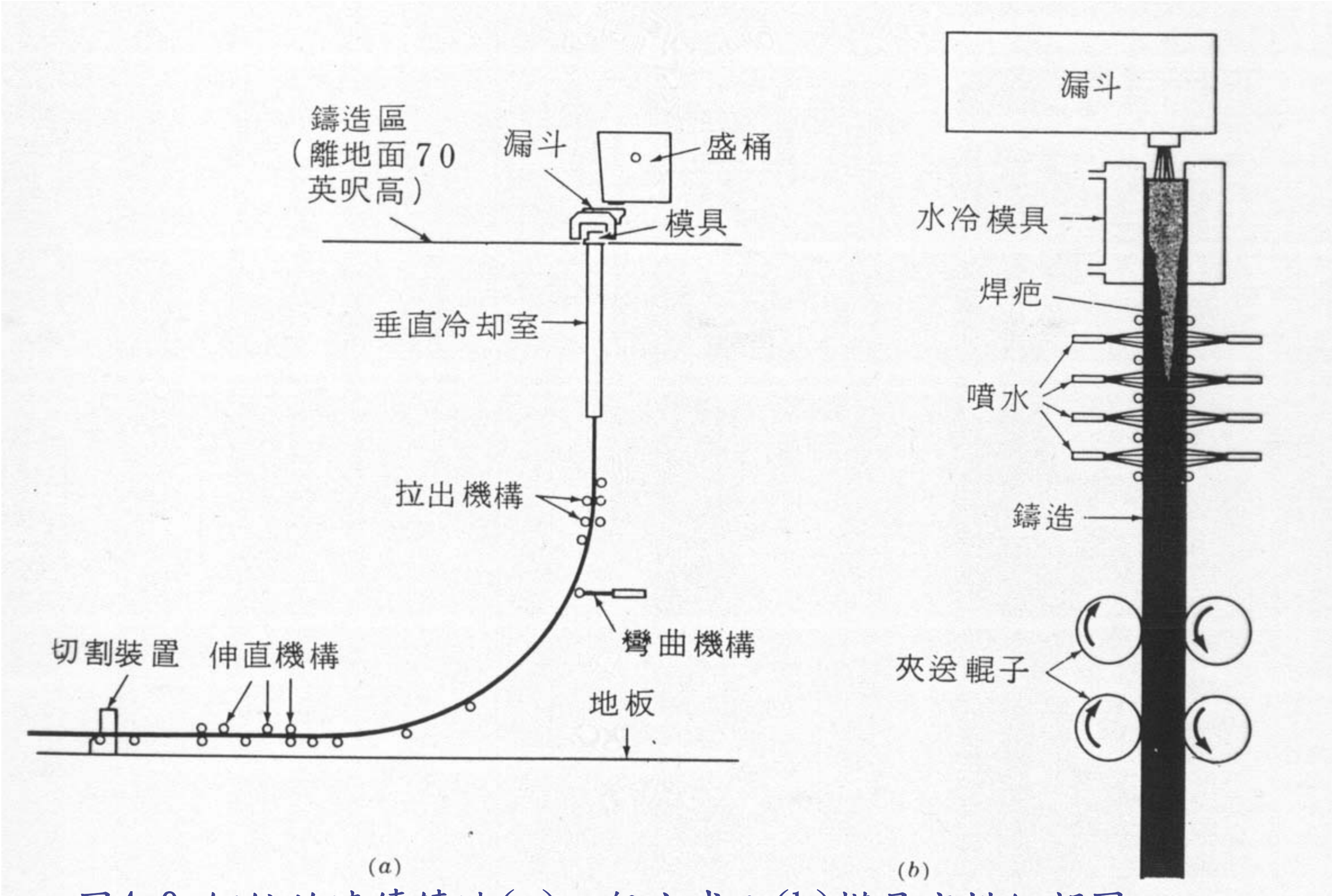
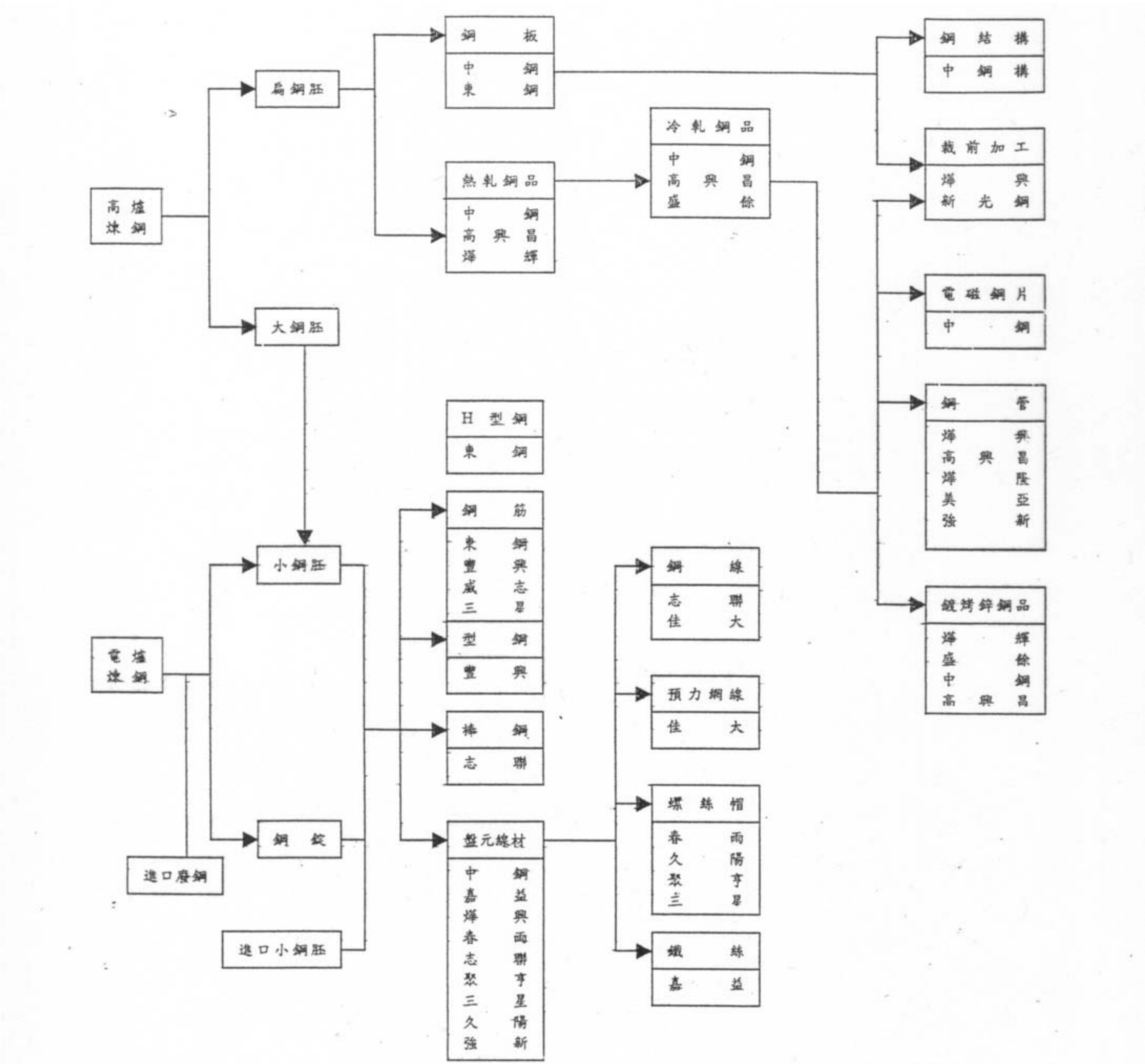


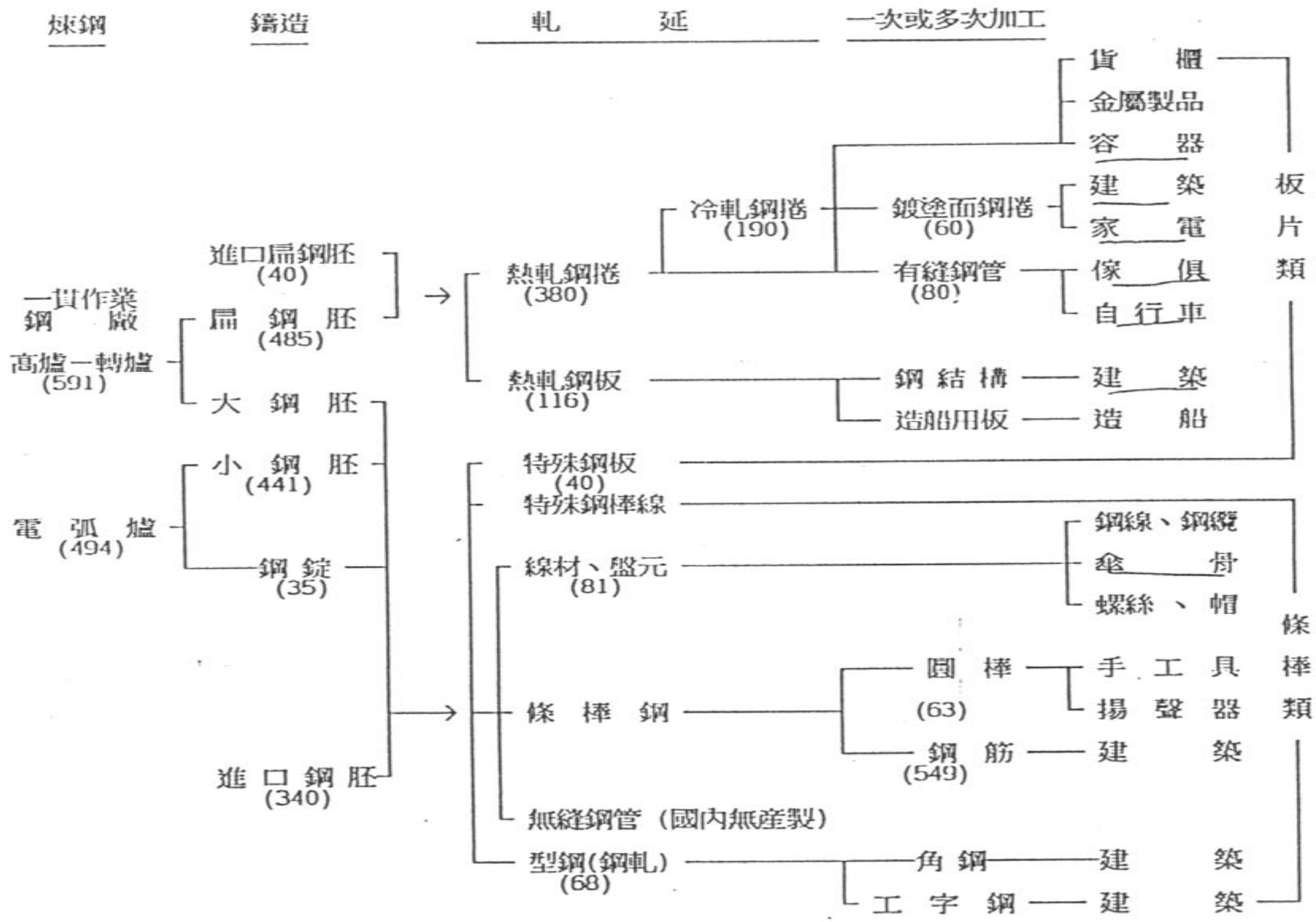
圖4.9 鋼錠的連續鑄造(a)一般方式；(b)模具安排細部圖。

[資料來源：**H.E. McGannon (ed.), "The Making Shaping, and Treating of Steel," 9th ed., United States Steel Corp., 1971, pp.707~708.**

(四)碳鋼產業關聯圖~NKFUST--傅兆章



(五)我國鋼鐵產業 ~NKFUST--傅兆章

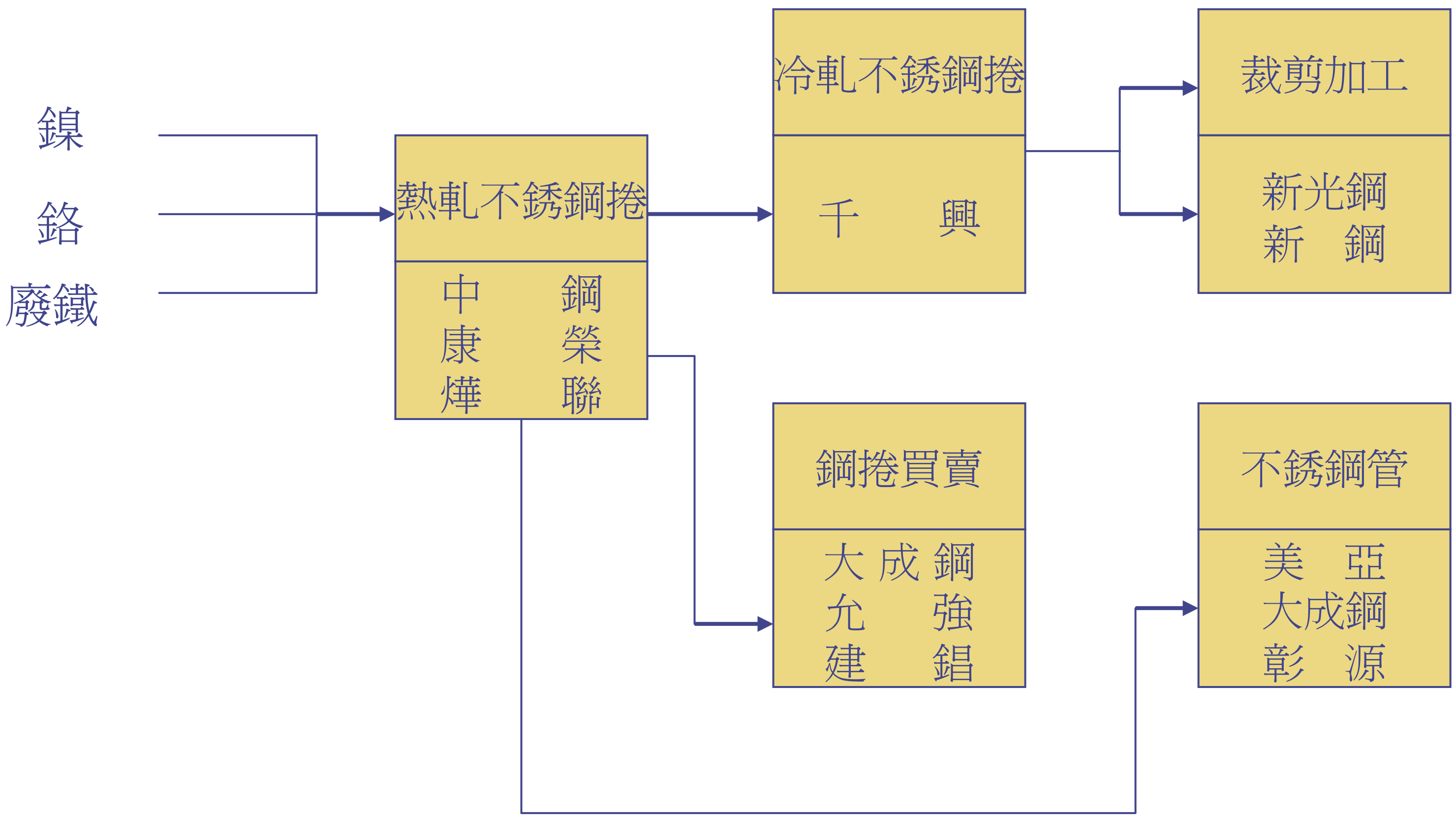


註:1.括號內數字為民國八十年國內產量(萬公噸)
2.我國一貫作業鋼廠僅中鋼公司 1家; 電弧爐煉鋼廠約43家; 單軋鋼廠約 221家

資料來源:中國鋼鐵公司與鋼鐵公會提供

圖3-1 我國鋼鐵產業結構圖

(七)不鏽鋼產業關連圖


鎳
鉻
廢鐵
熱軋不銹鋼捲
中 鋼
康 榮
燁 聯
冷軋不銹鋼捲
千 興
裁剪加工
新光鋼
新 鋼
鋼捲買賣
大 成 鋼
允 強
建 錩
不銹鋼管
美 亞
大成鋼
彰 源

(八)特殊合金鋼產業關連圖

相關連之應用行業 ｜ 關鍵性零件或組件實例

- 特殊合金鋼
  - 機械工業
    - 特殊機械 — ・齒輪箱
    - 產業機械 — ・傳動主軸
    - 重機 — ・線性滑軌
    - 工具機 — ・滾珠螺桿
  - 鋼鐵工業
    - 金屬加工業(鍛抽鑄) — ・模具、刀具、治具、沖頭
    - 線棒板片材製造業 — ・軋輥、滚輪
  - 交通運輸工業
    - 電聯車／高速鐵路 — ・轉向架、車軸
    - 自行車工業 — ・變速齒輪
    - 船舶製造業 — ・化學船儲槽
    - 汽機車工業 — ・齒輪、連桿、凸輪軸
    - 航空工業 — ・風扇外殼
  - 電機工業
    - 發動機 — ・心軸、傳動軸
    - 變流器 — ・軸承
    - 變壓器 — ・鐵心
  - 化學工業
    - 石化工業 — ・泵
    - 無機化學品工業 — ・攪拌器
    - 塑膠加工 — ・大柱、料桿
  - 能源工業
    - 發電設備 — ・主軸、・發電機／渦輪機葉片
    - 污染防治設備 — ・不鏽鋼桶槽、攪拌器
  - 國防工業

(九)特殊鋼的分類 ~NKFUST--傅兆章

- 特殊鋼
  - 特殊用途鋼
    - 機械構造用碳素鋼
    - 構造用合金鋼
      - Cr系
      - Ni-Cr系
      - Cr-Mo系
      - Ni-Cr-Mo系
      - Mn系
      - Mn-Cr系
  - 特殊用途鋼
    - 不鏽鋼
      - 奧斯田體系
      - 麻田散體系
      - 肥粒體系
    - 耐熱鋼
      - Cr系
      - Ni-Cr系
    - 彈簧鋼
      - 碳素系
      - Si-Mn系
      - S-Cr系
    - 快削鋼
      - S系
      - Pb系
    - 軸承鋼
    - 鋼琴線材
    - 高張力鋼
    - 高錳鋼
    - 電氣矽鋼片
      - 低碳低矽鋼片
      - 非方向性矽鋼片
      - 方向性矽鋼片
  - 工 具 鋼
    - 碳素工具鋼
    - 合金工具鋼
      - 切削
      - 耐衝擊
      - 耐磨
      - 熱加工
    - 高速鋼
    - 中空鋼

(十)Fe-Fe_3C平衡圖 ~NKFUST--傅兆章

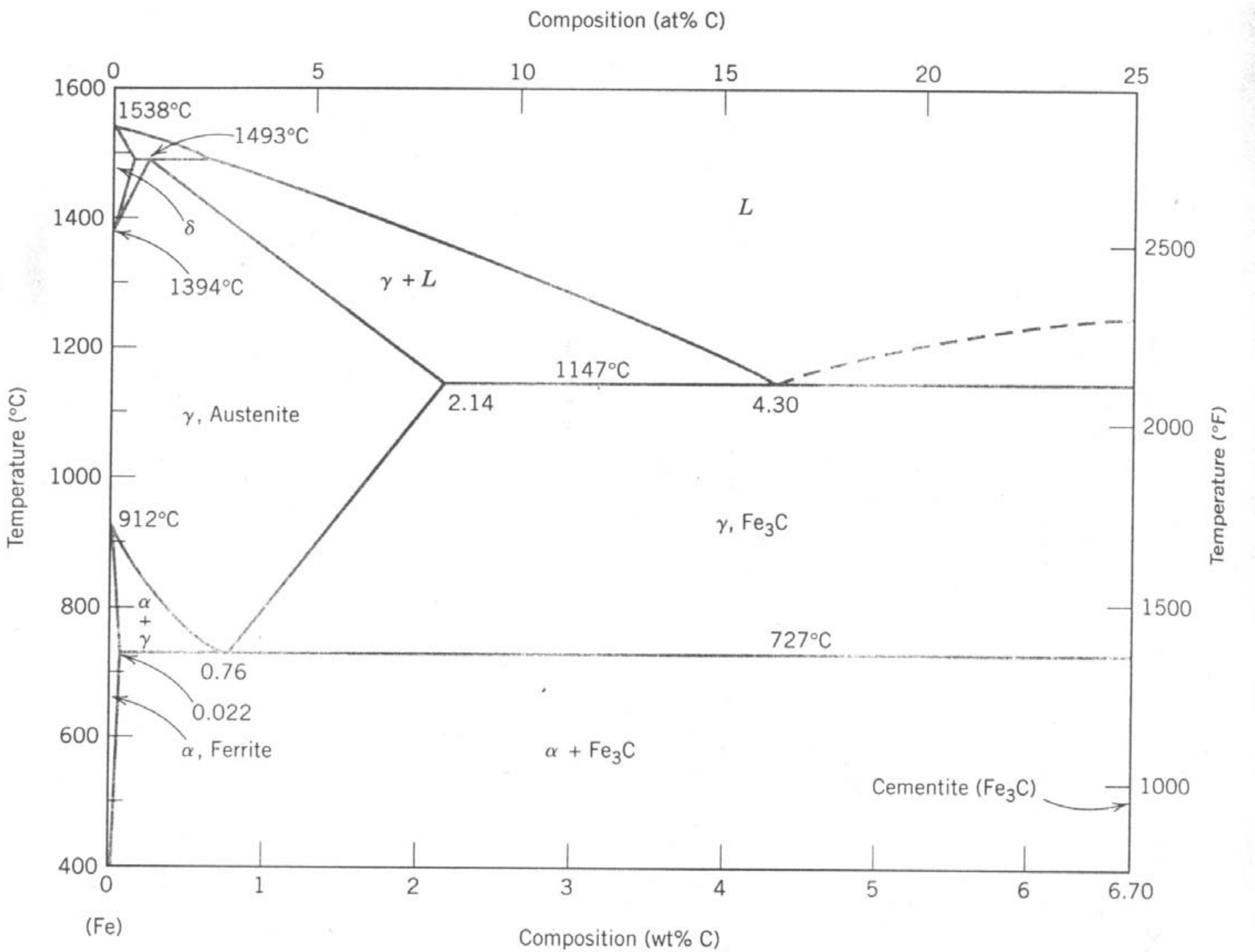


Figure 9.22 The iron-iron carbide phase diagram.(Adapted from Binary Alloy Phase Diagrams, 2nd edition, Vol. 1, T. B. Massalski, Editor-in-Chief, 1990. Reprinted by permission of ASM International, Materials Park, OH 44073-0002.)

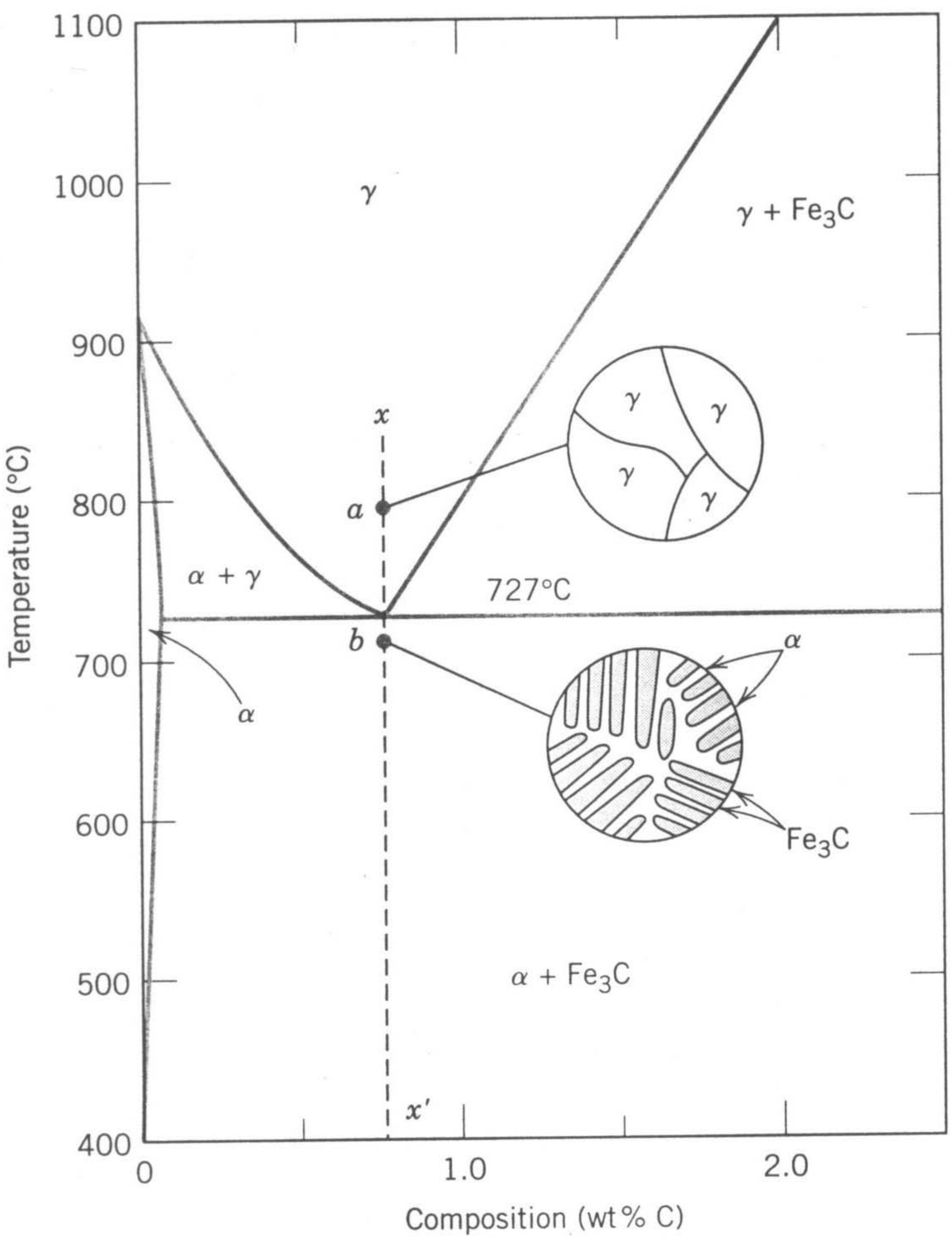


Figure 9.24 Schematic representations of the microstructures for an iron-carbon alloy of eutectoid composition(0.76wt% C) above and below the eutectoid temperature

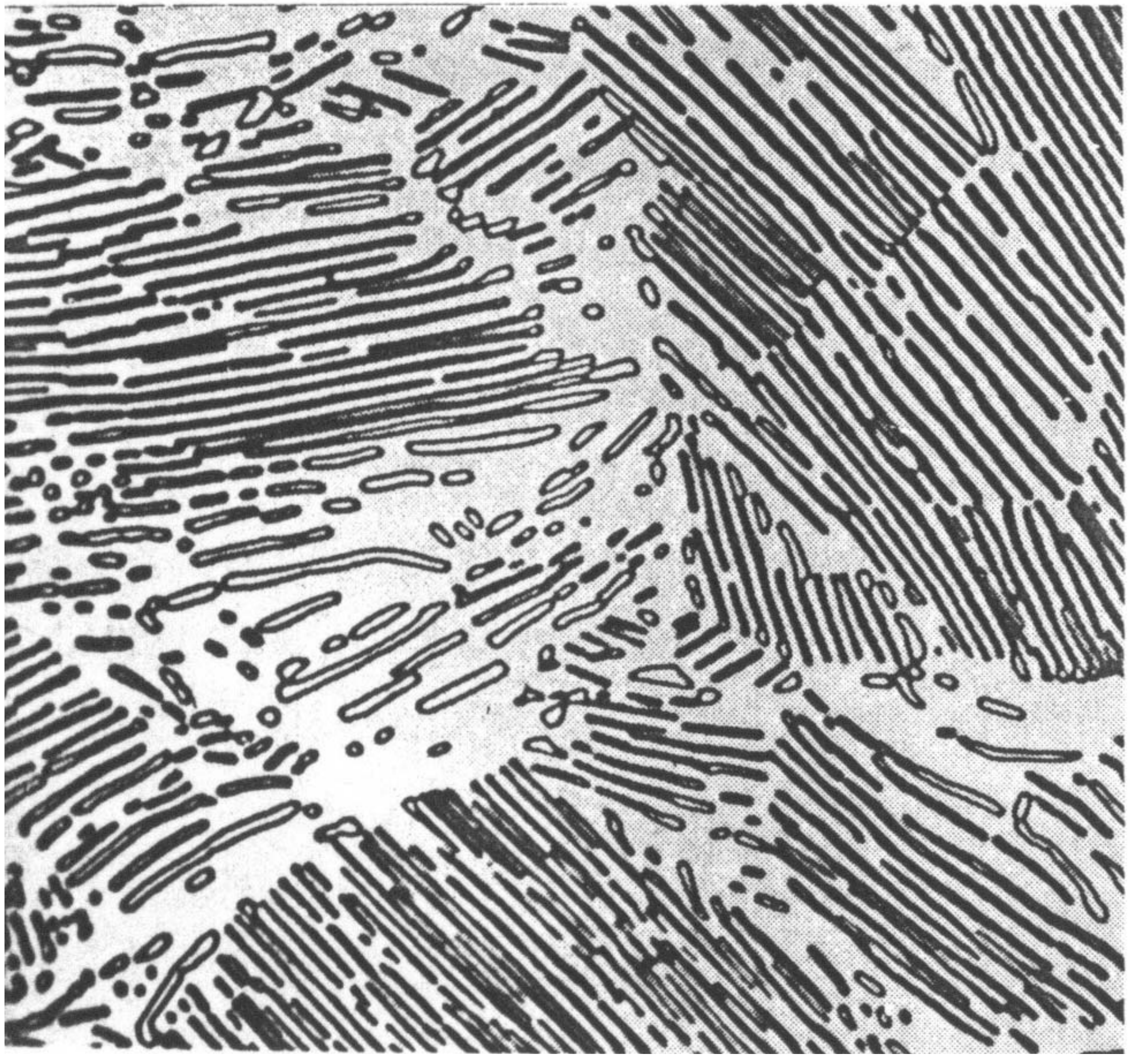


Figure 9.25 Photomicrograph of a eutectoid steel showing the pearlite microstructure consisting of alternating layers of α ferrite(the light phase) and Fe_3C (thin layers most of which appear dark). 500×. (Reproduced with permission from Metals Handbook, Vol. 9, 9th edition, Metallography and Microstructures, American Society for Metals, Materials Park, OH, 1985)

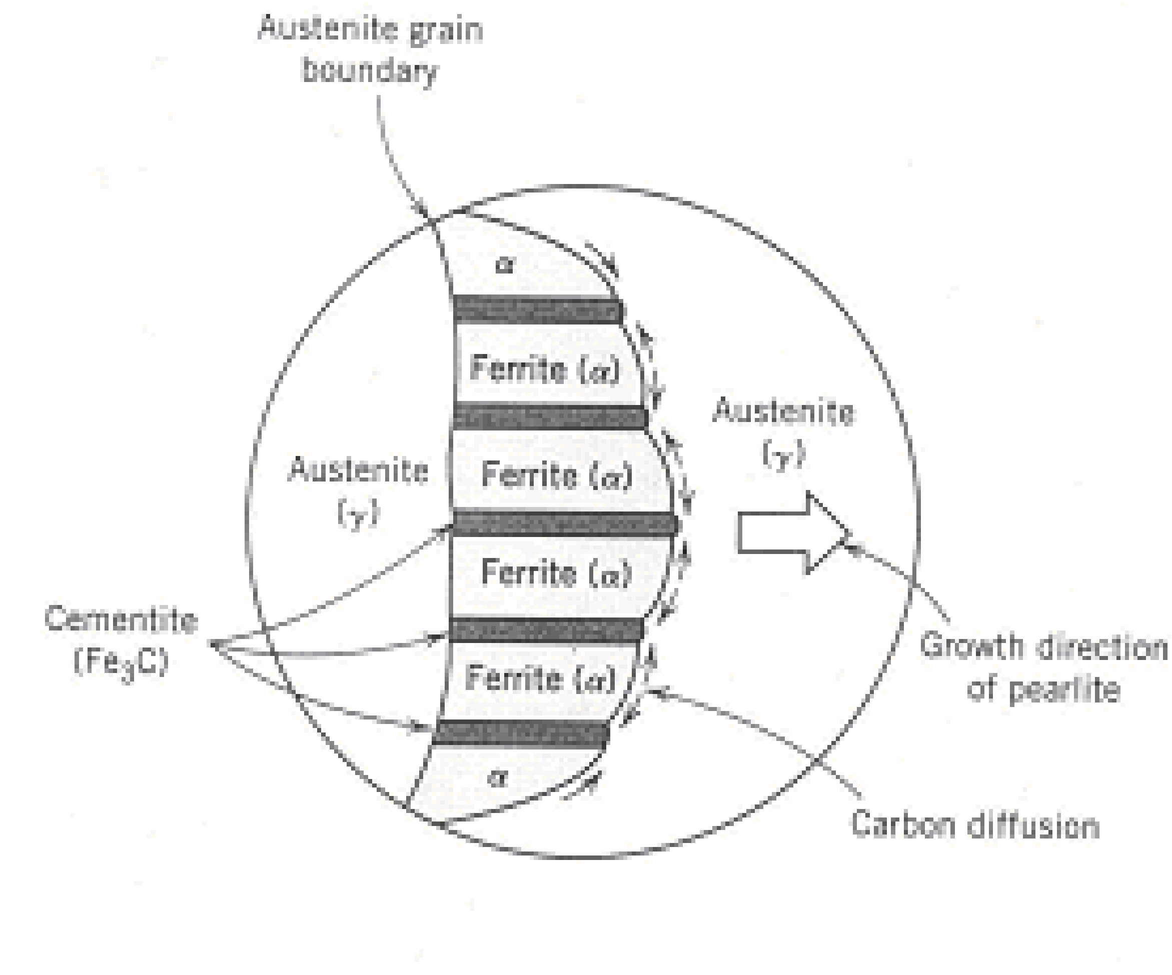


Figure9.26 Schematic representation of the formation of pearlite from austenite; direction of carbon diffusion indicated by arrows

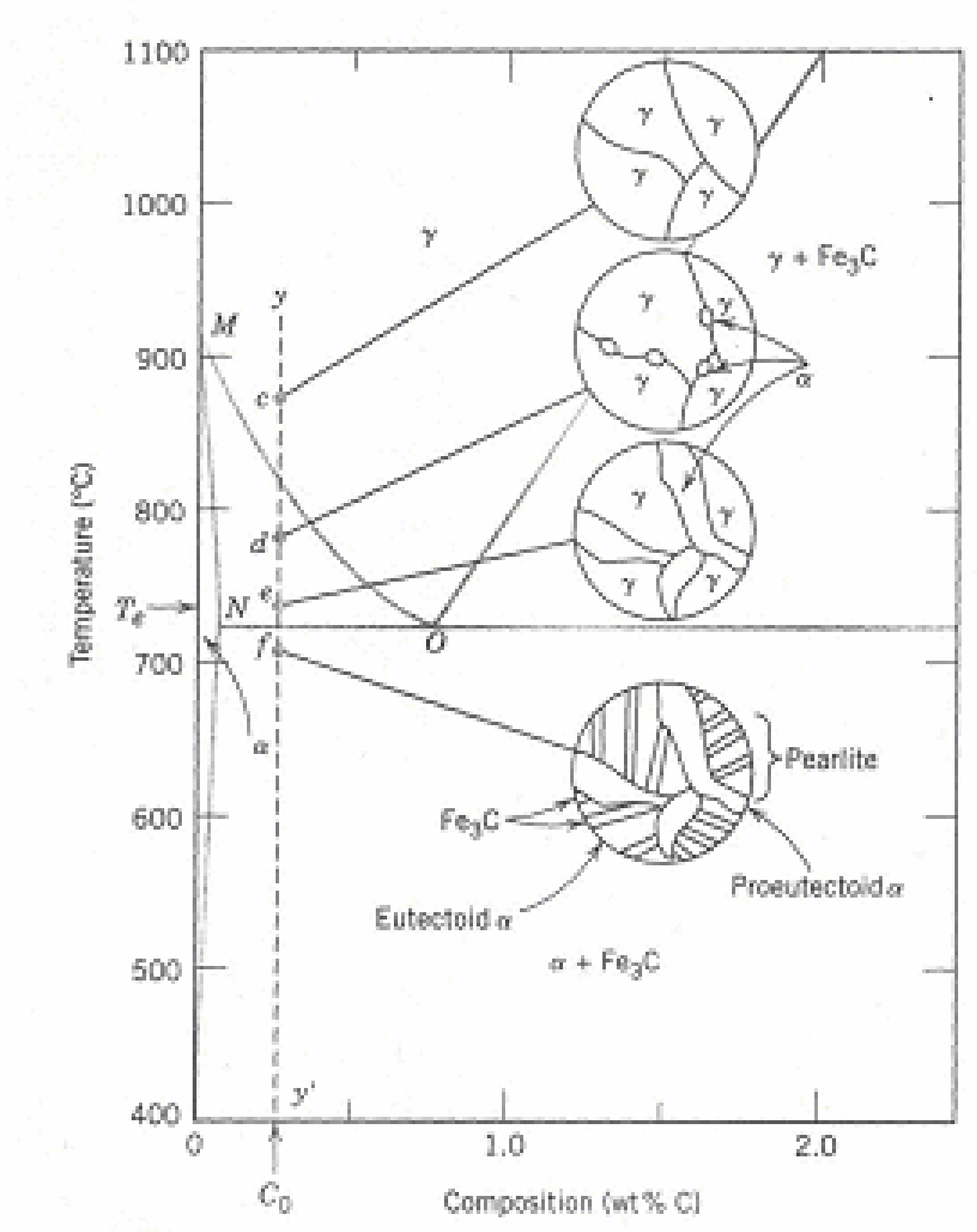


Figure 9.27 Schematic representation of the microstructures for an iron-carbon alloy of hypoeutectoid composition Co(containing less than 0.76wt% C) as it is cooled from within the austenite phase region to below the eutectoid temperature

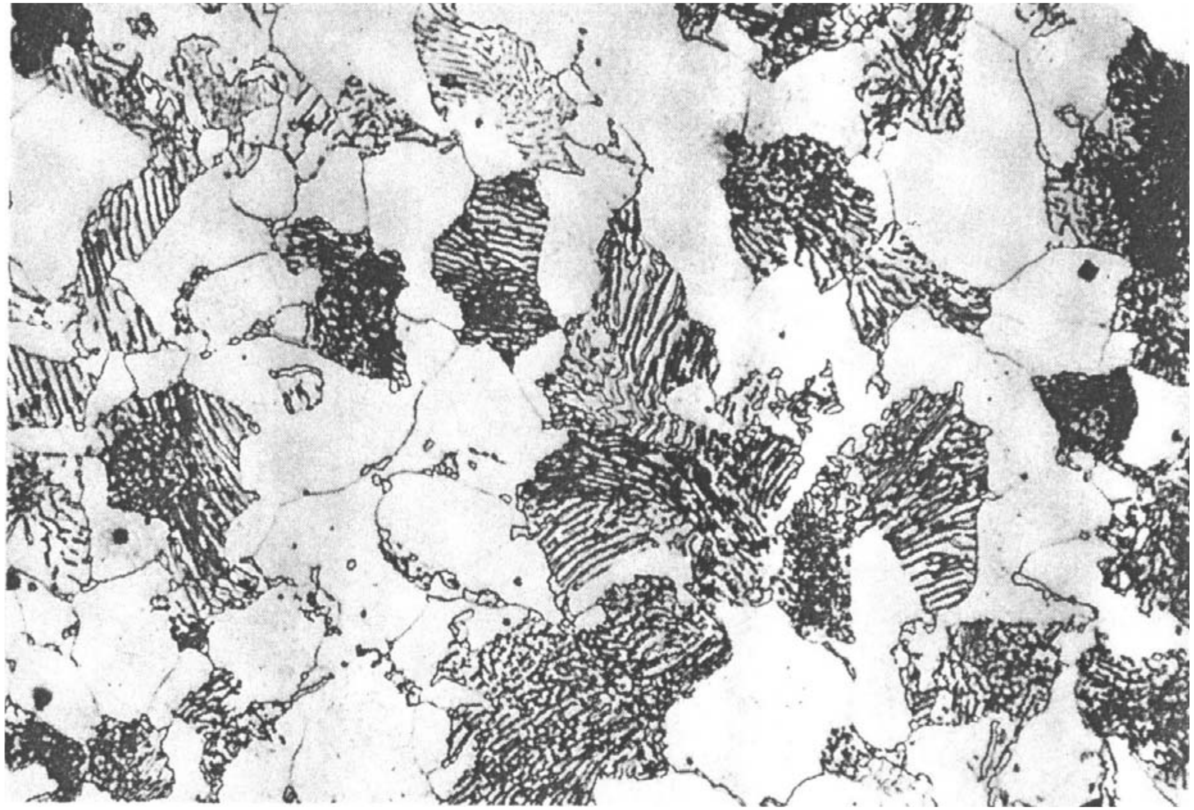


Figure 9.28 Photomicrograph of a 0.38wt% C steel having a microstructure consisting of pearlite and proeutectoid ferrite. 635×(Photomicrograph courtesy of Republic Steel Corporation)

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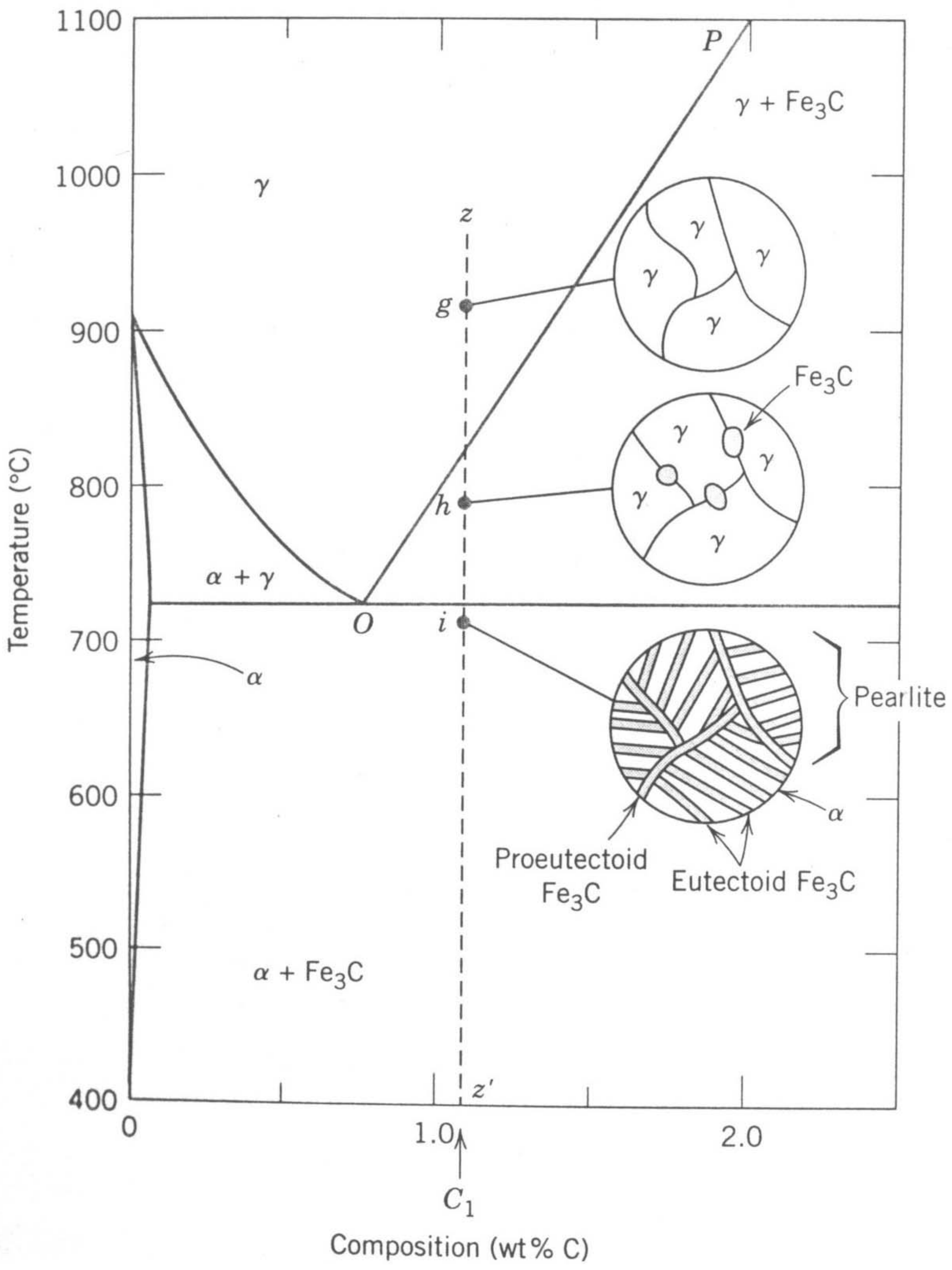

Figure 9.30 Schematic representations of the microstructures for an iron-carbon alloy of hypereutectoid composition C_1(containing between 0.76 and 2.14wt% C), as it is cooled from within the austenite phase region to below the eutectoid temperature

Figure 9.31 Photomicrograph of a 1.4wt% C steel having a microstructure consisting of a white proeutectoid cementite network surrounding the pearlite colonies. 1000×. (Copyright 1971 by United States Steel Corporation.)

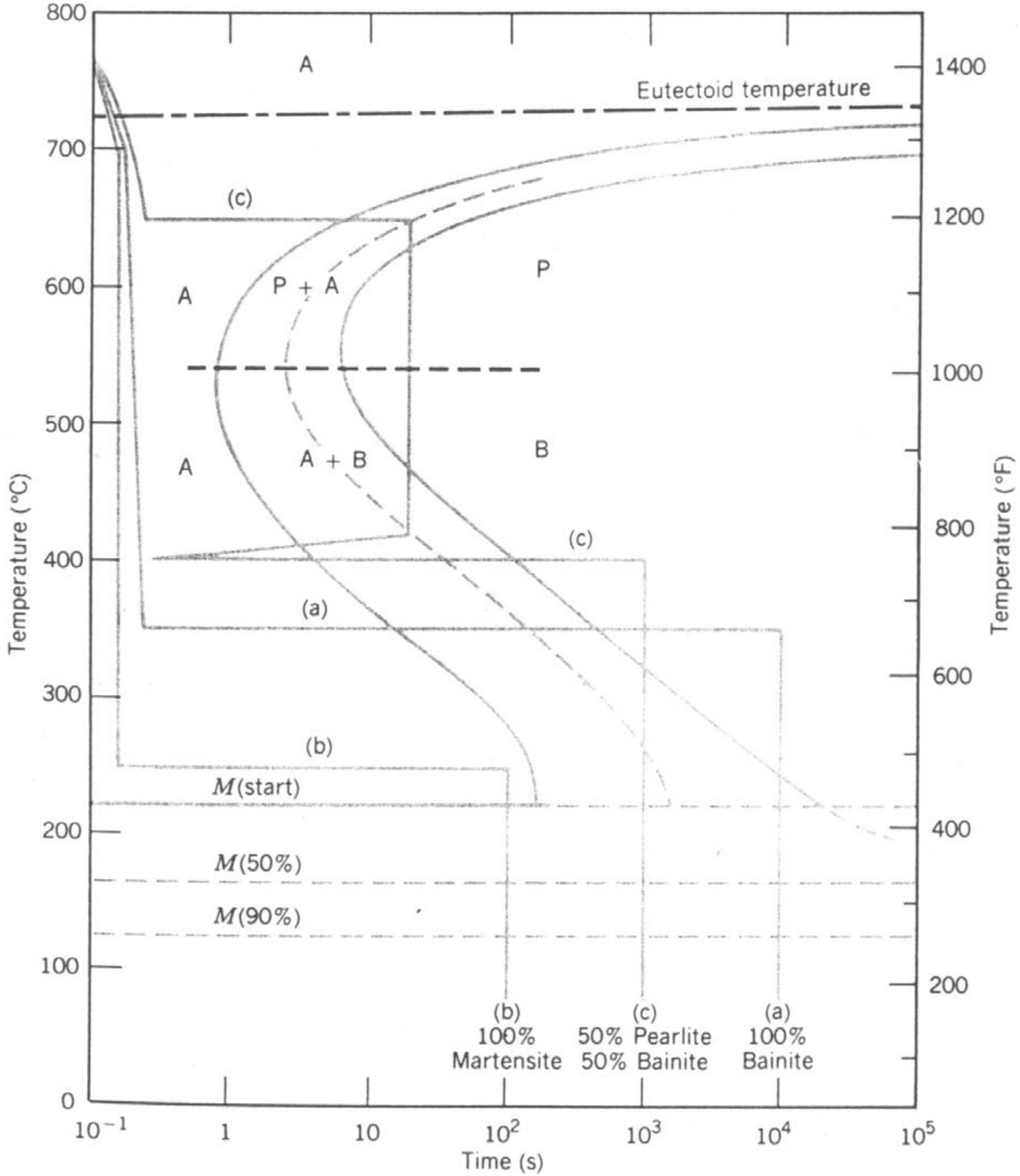

Figure 10.15 Isothermal transformation diagram for an iron-carbon alloy of eutectoid composition and the isothermal heat treatments(a), (b), and (c) in Example Problem10.1.

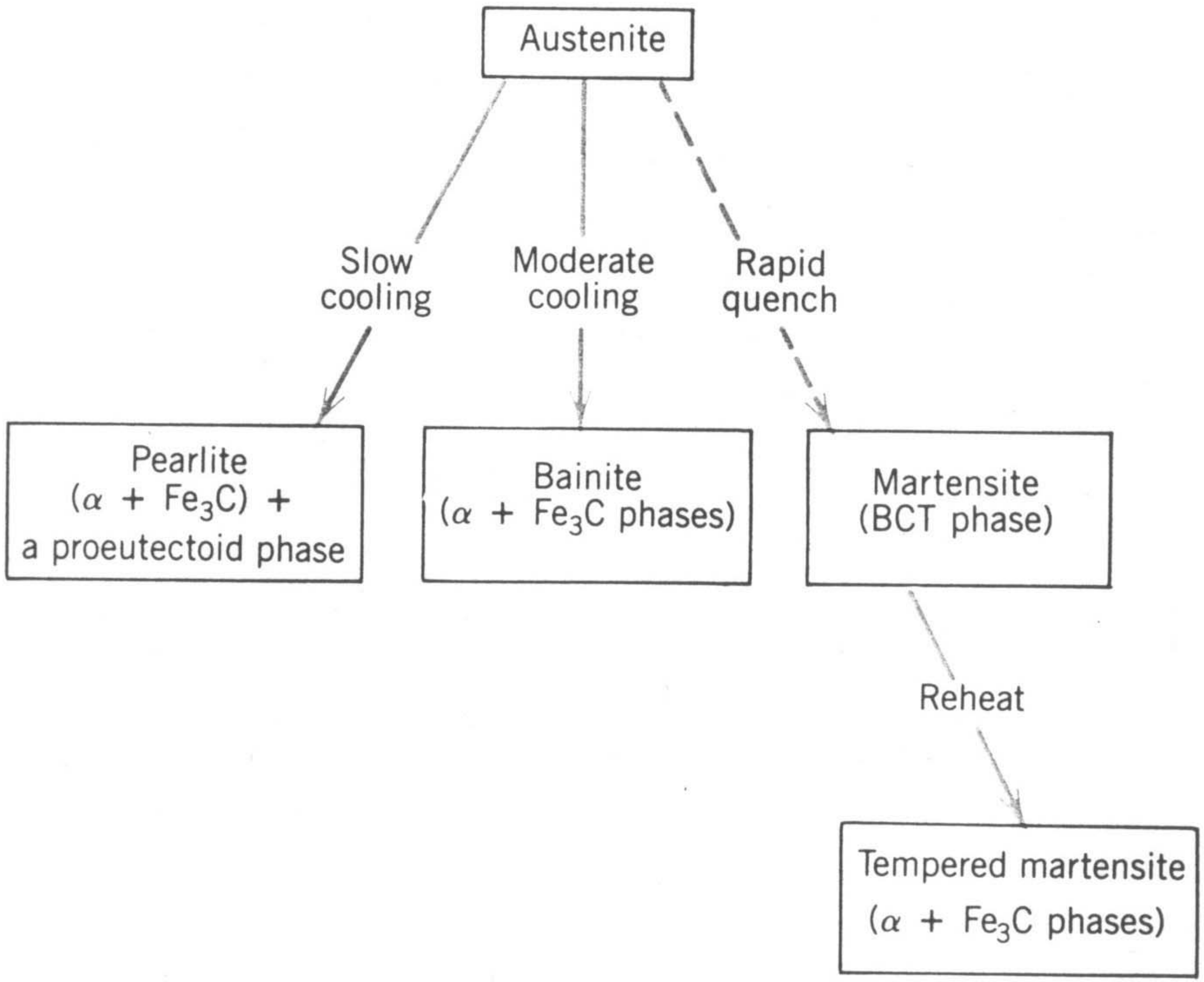

Figure 10.26 Possible transformations involving the decomposition of austenite. Solid arrows, transformations involving diffusion; dashed arrow, diffusionless transformation.

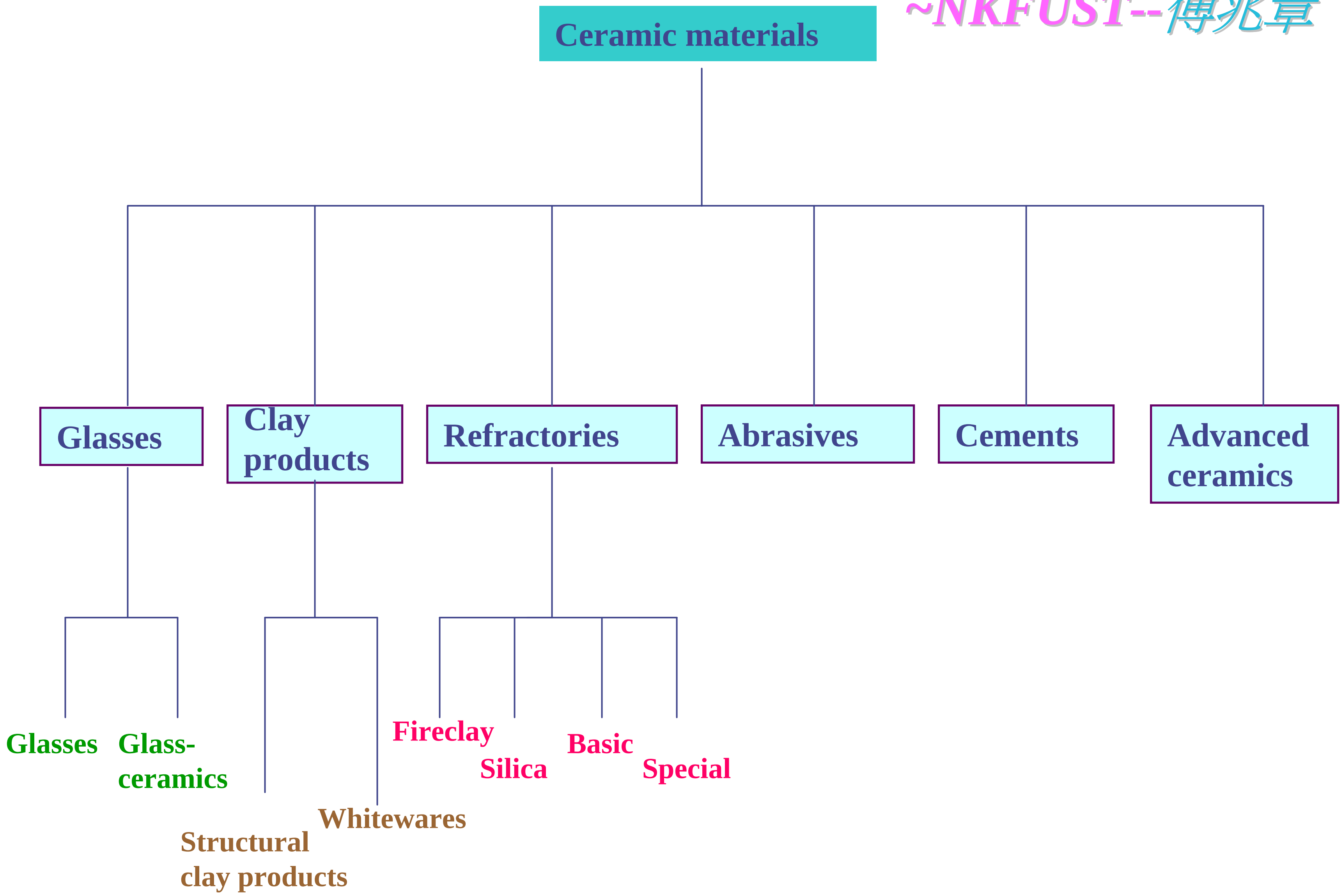

Figure 14.1 Classification of ceramic materials on the basis of application

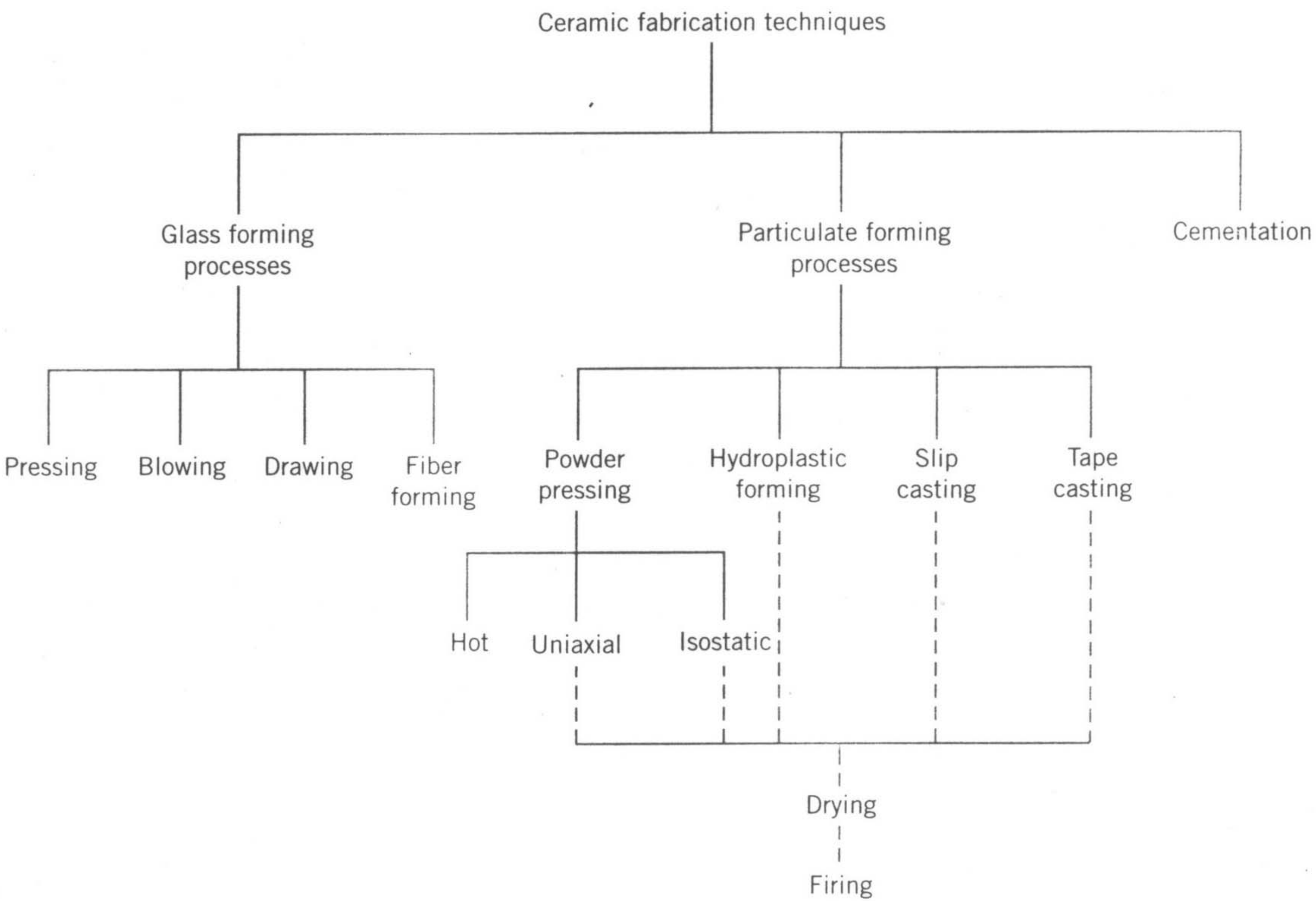

Figure 14.2 A classification scheme for the ceramic-forming techniques discussed in this chapter

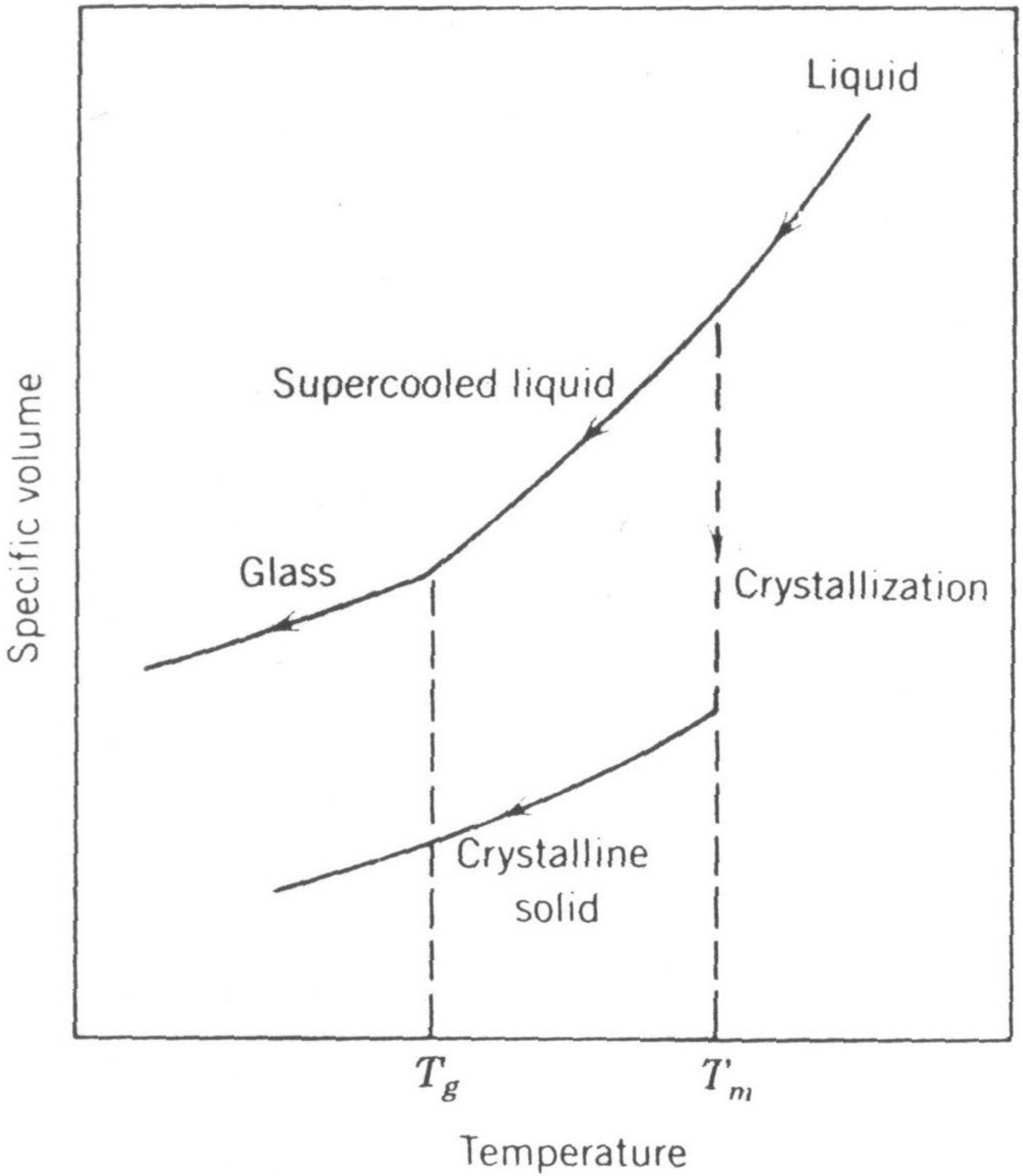

Figure 14.3 Contrast of specific volume-versus-temperature behavior of crystalline and noncrystalline materials. Crystalline materials solidify at the melting temperature T_m. Characteristic of the noncrystalline state is the glass transition temperature T_g