Aços Estruturais

AÇOS ESTRUTURAIS - NORMAS TÍPICAS

- Normas Brasileiras NBR: (S_Y/S_u, em MPa)
  - 7007: Perfis Laminados- MR(250/400), AR(290/415) AR(345/450), AR-COR(345/485)
  - 6648: Chapas Grossas (>6mm)- CG-24(235/380), CG-26(255/410)
  - 6649/50: Chapas Finas- CF-24(240/370), CF-26(260/400)
  - 5000: Chapas Grossas BLAR- G30(300/415), G35(345/450)
  - 5004: Chapas Finas BLAR- F32(310/410), F35(340/450)
- Normas Inglesas:
  - BS-4360: estruturas off-shore
  - BS-5400: estruturas metálicas
  - BS-5500: vasos de pressão
- ASME: seção IIa - aços C e aços-liga
  - (Na seção VIII, divisão1-projeto de vasos tradicionais, as tensões *admissíveis* variam de 70 a 170 MPa, para temperaturas < 345^{o}C)

AÇOS ESTRUTURAIS - NORMAS TÍPICAS

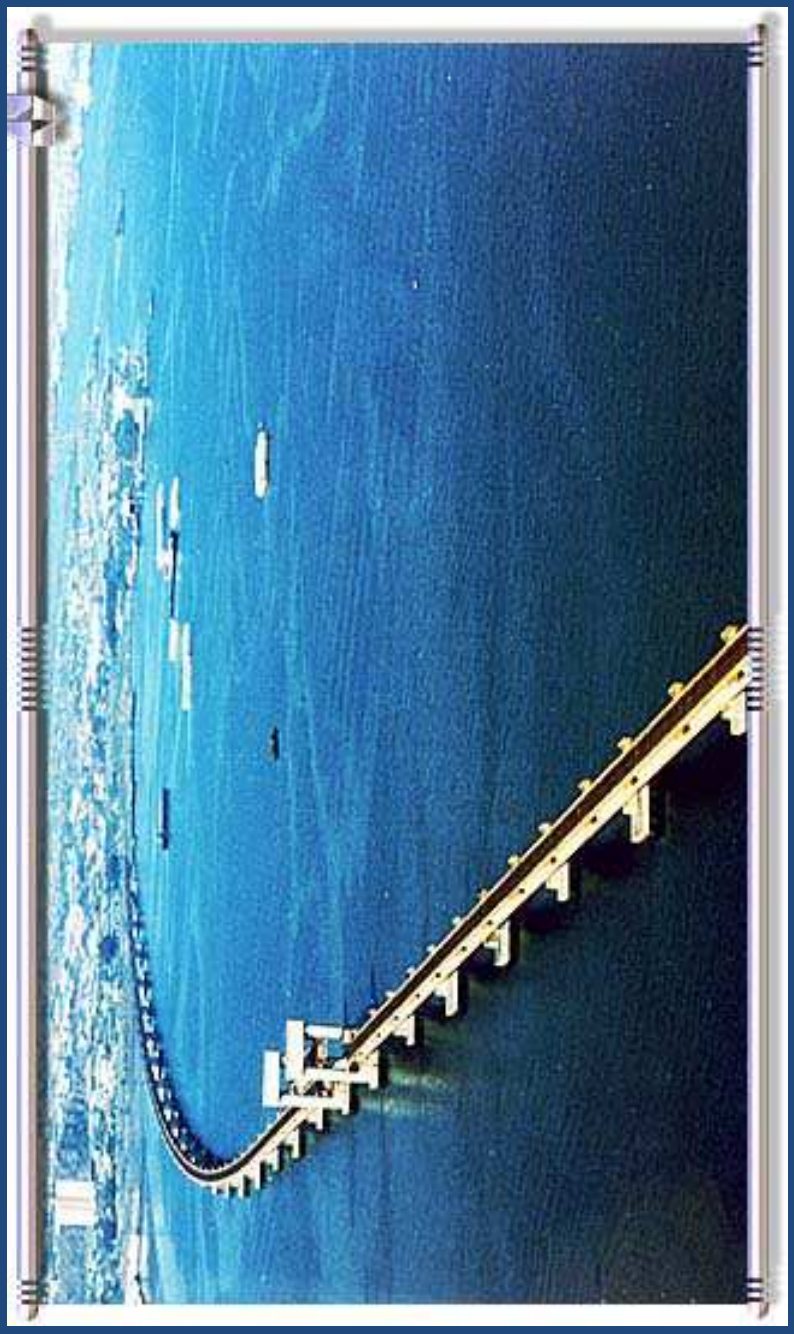
Normas ASTM:

Norma	S_{Ymin}	Elem. Liga	Aplicação
A-36	250	C,Si,Mn	chapas grossas estruturais
A-106	210-280	C,Si	tubos sem costura
A-182	280-455	.5Mo a 9Cr1Mo	forjados p/ alta temperatura
A-242	290-345	Mn,Cu,Cr,Ni	perfis, chapas
A-355	210	.5Mo a 9Cr1Mo	tubos s/costura p/ alta temp.
A-387	210-315	até 5Cr.5Mo	tubos, vasos de pressão
A-414	175-315	C,Mn	placas p/ vasos de pressão
A-440	290-395	Mn,Cu,Si	perfis, placas, barras
A-572	290-450	Mn,Ni,V,N	perfis, placas, barras
A-606	240-345	C,Mn	folhas
A-607	290-485	Mn,Nb,V,Ni,Cu	folhas
A-618	345	Mn,Ni,V,Si	tubos
A-633	320-410	Mn,V,Cr,Cu,N	perfis p/ baixa temperatura
A-656	550	Mn,V,Al,N,Ti	chapas p/ veículos
A-812	455-560	C,Mn,V,Nb,Si	chapas p/ vasos de pressão

Aços Estruturais

Aços Estruturais

Aços Estruturais



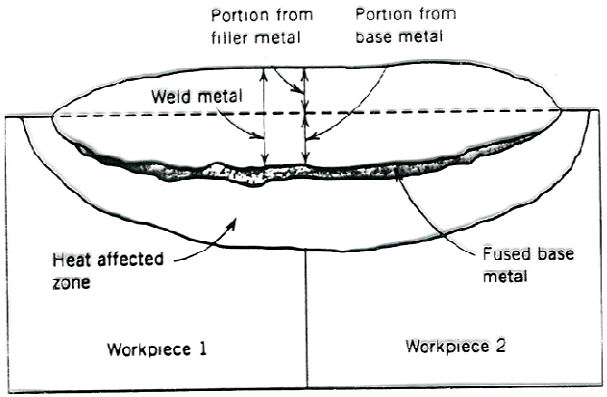
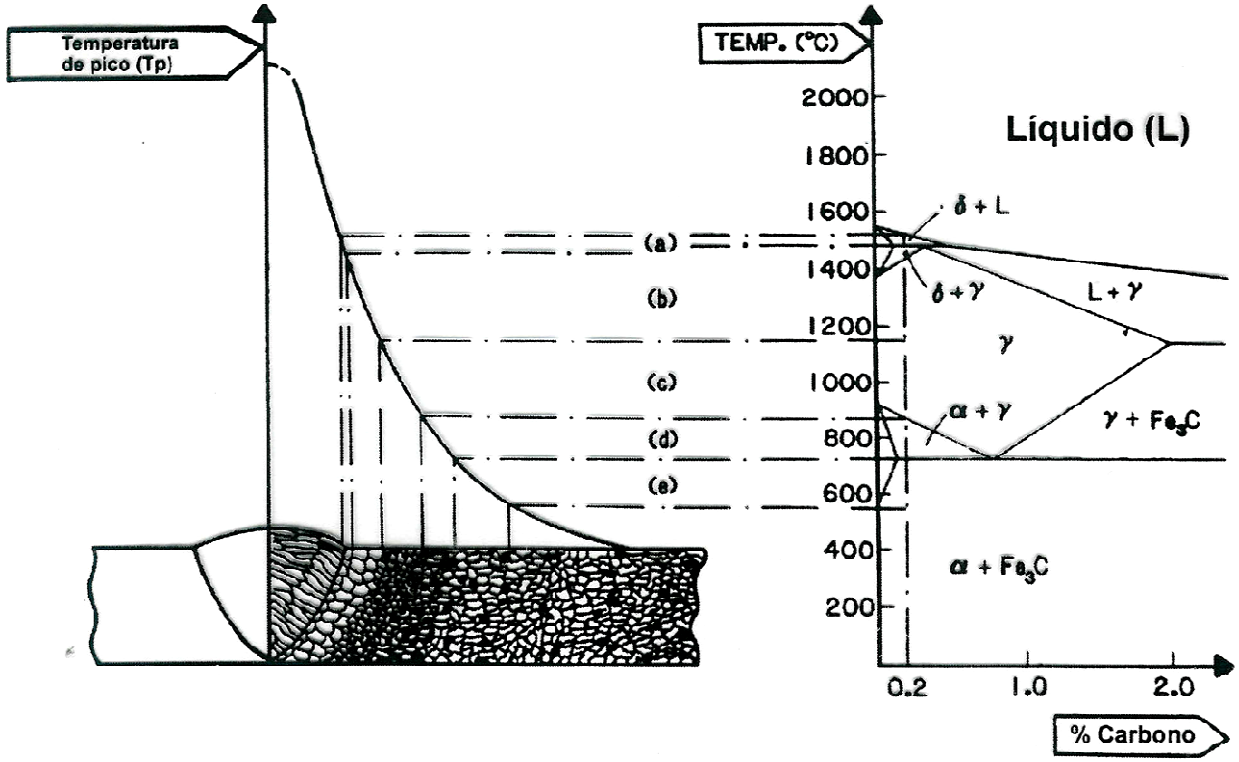
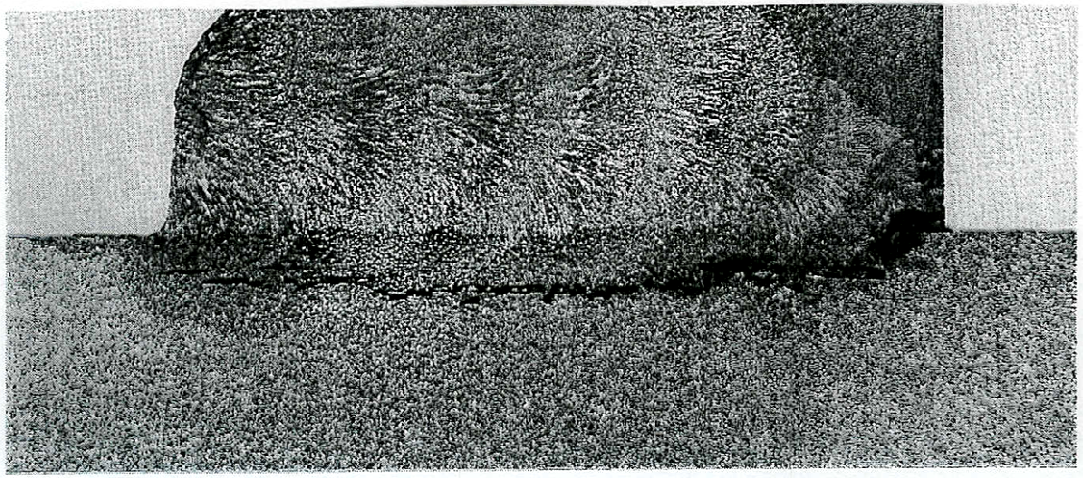
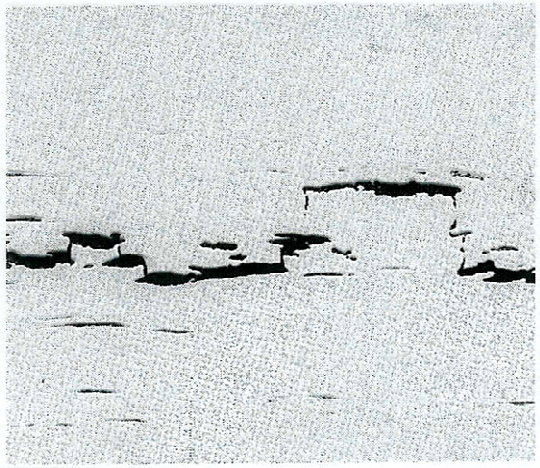


FIGURE 12.3 Schematic cross-sectional representation showing the zones in the vicinity of a typical fusion weld. (From *Iron Castings Handbook*, C. F. Walton and T. J. Opar, Editors, 1981.)

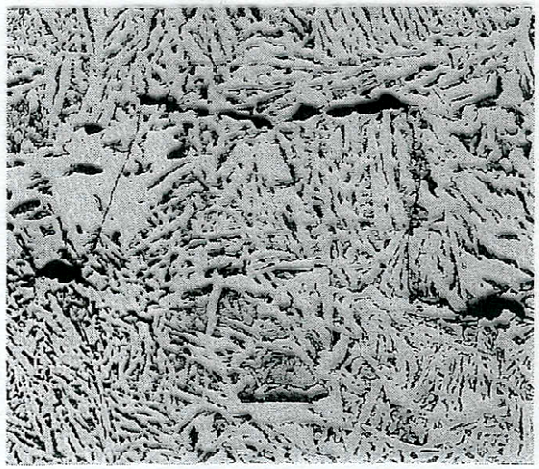




(a)



(b)



(c)

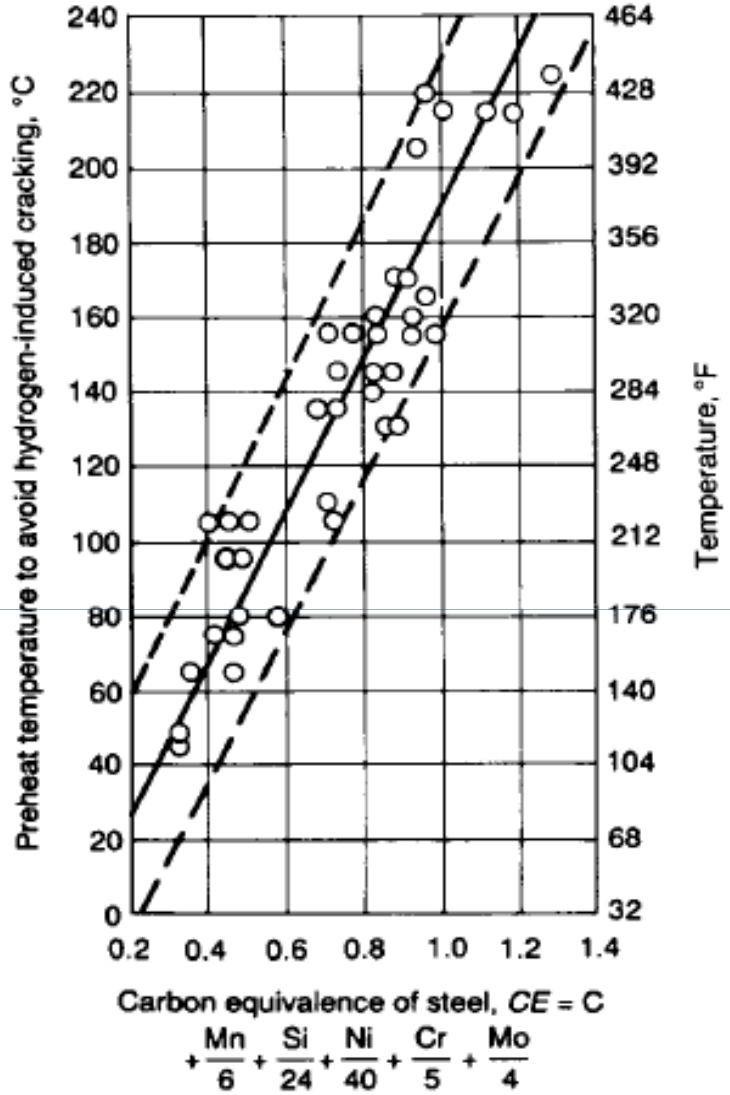


Figure 17.24 Effect of carbon equivalent on preheat requirement to prevent hydrogen cracking. Reprinted from Lesnewich (34).

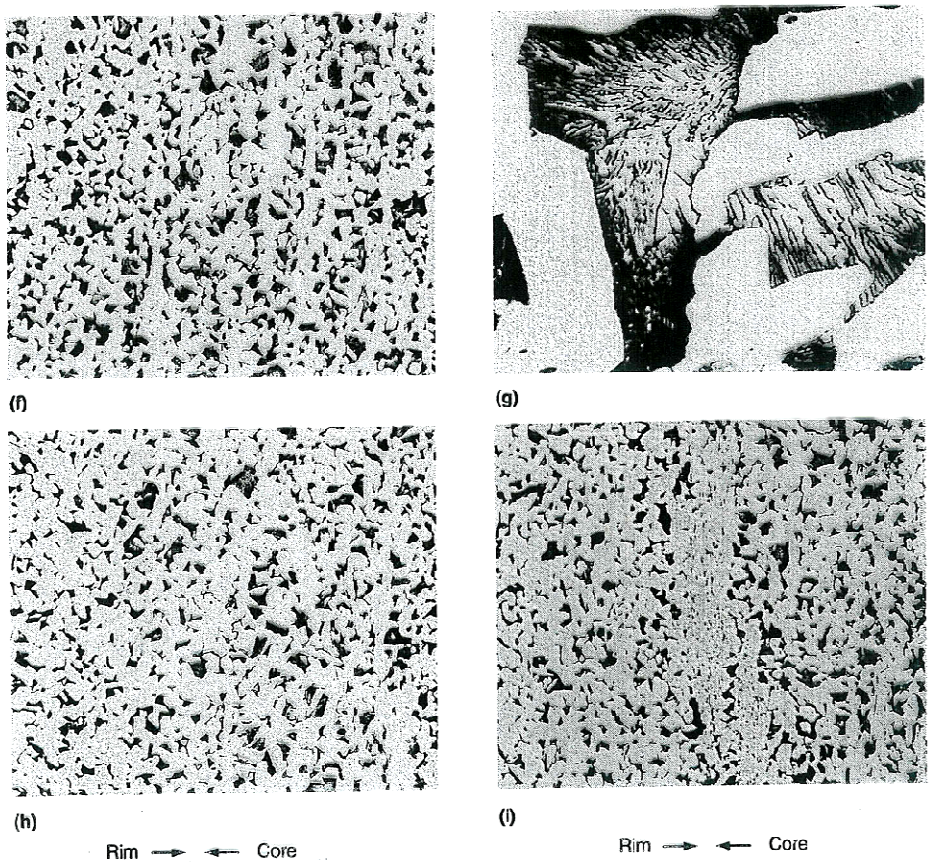


Fig. 5.1 (continued) Rimming grade 0.2% C mild steel. **(a)** Hot-rolled bar. Ammonium persulfate. 2×. **(b)** Hot-rolled bar. Oberhoffer. 2×. **(c)** Hot-rolled bar. Sulfur print (reproduction). 2×. **(d)** 0.20C-0.004Si-0.45Mn-0.033S-0.016P (wt%). Rim region. 120 HV. 10 vol% pearlite. Picral. 100×. **(e)** 0.20C-0.004Si-0.45Mn-0.033S-0.016P (wt%). Rim region. 120 HV. 10 vol% pearlite. Picral. 1000×. **(f)** 0.26C-0.004Si-0.45Mn-0.051S-0.013P (wt%). Core region. 140 HV. 18 vol% pearlite. Picral. 100×. **(g)** 0.26C-0.004Si-0.45Mn-0.051S-0.013P (wt%). Core region. 140 HV. 18 vol% pearlite. Picral. 1000×. **(h)** 0.26C-0.004Si-0.45Mn-0.051S-0.013P (wt%). Rim-core junction. Picral. 100×. **(i)** 0.26C-0.004Si-0.45Mn-0.051S-0.013P (wt%). Rim-core junction. Picral. 100×. **(h)** and **(i)** are different regions of the rim-core junction of one bar.

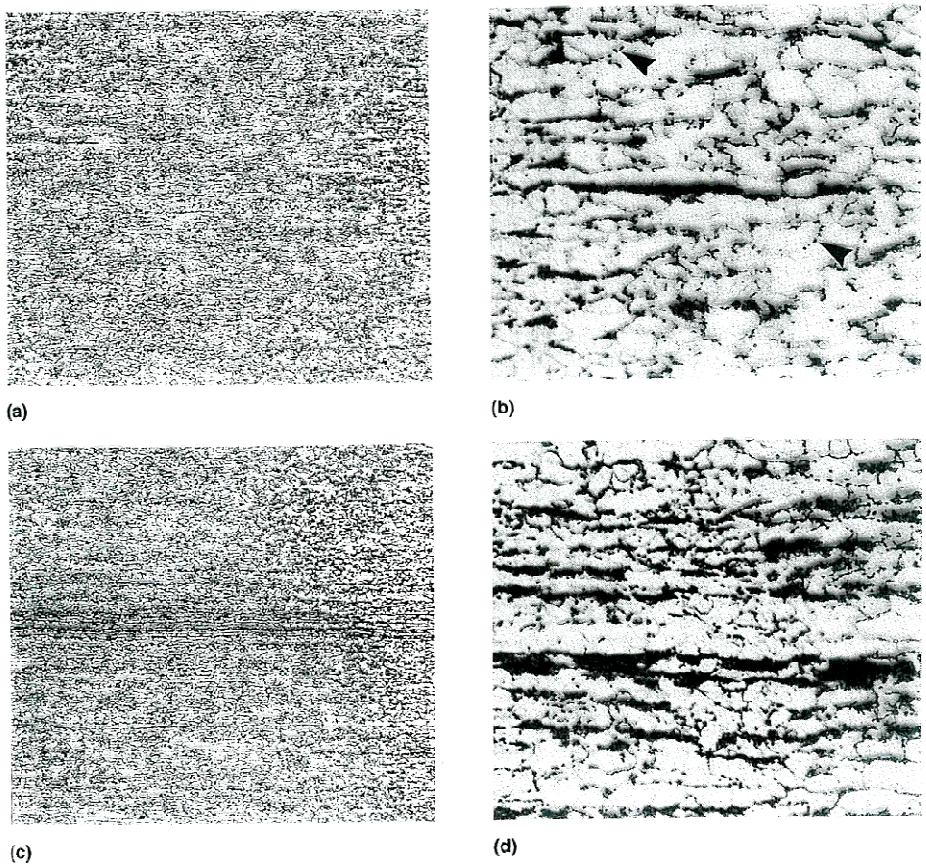
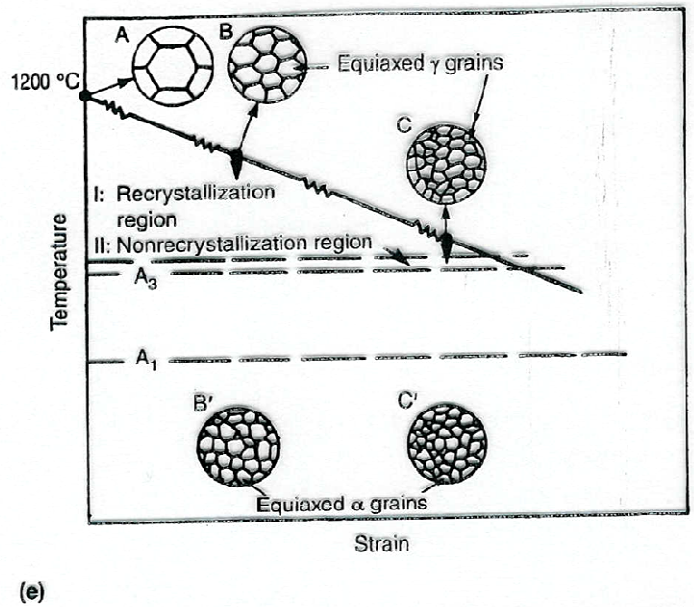
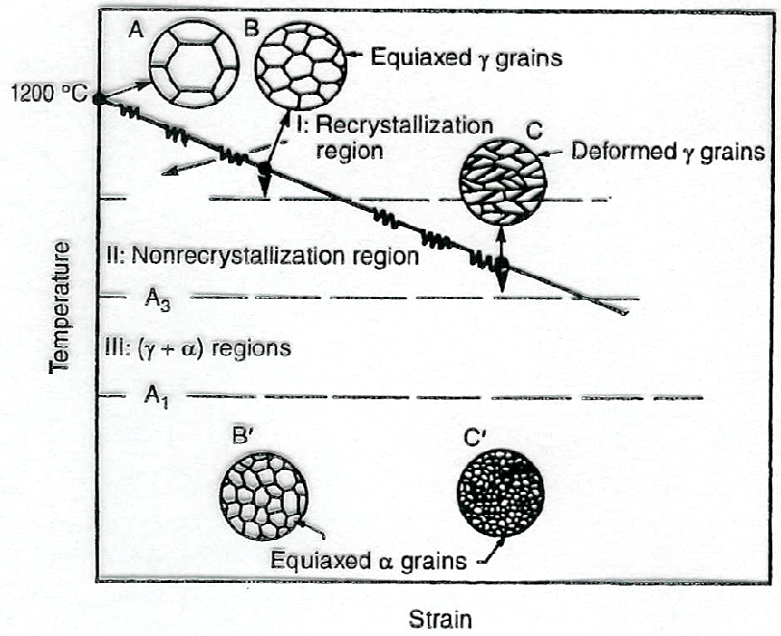


Fig. 5.12 Higher-strength grade of HSLA hot-rolled steel strip. High carbon, high manganese, microalloys: niobium and vanadium. 0.085C-0.19Si-1.42Mn-0.003Mo-0.045Nb-0.003Ti-0.038V-0.001S-0.015P (wt%). 220 HV. **(a)** Quarter-thickness region. Nital. 100×. **(b)** Quarter-thickness region. Nital. 1000×. **(c)** Central region. Nital. 100×. **(d)** Central region. Nital. 1000×. **(e)** Scanning electron micrograph of quarter-thickness region. Nital. 5000×.



(e)

Fig. 5.4 Fracture-tough semikilled and fully killed carbon-manganese plate. **(a)** 0.15% C semikilled (0.17C-0.09Si-1.02Mn, wt%). As-rolled: center of 12.5 mm thick plate. 110 HV. 15 vol% pearlite. Picral. 100×. **(b)** 0.15% C semikilled (0.17C-0.09Si-1.02Mn, wt%). As-rolled: center of 12.5 mm thick plate. 110 HV. 15 vol% pearlite. Picral. 1000×. **(c)** 0.1% C fully killed (0.10C-0.25Si-1.08Mn, wt%). As-rolled: center of 12.5 mm thick plate. 150 HV. 8 vol% pearlite. Picral. 100×. **(d)** 0.1% C fully killed (0.10C-0.25Si-1.08Mn, wt%). As-rolled: center of 12.5 mm thick plate. 150 HV. 8 vol% pearlite. Picral. 1000×. **(e)** Changes in microstructure with deformation during hot rolling of a plain carbon-manganese steel. Adapted from Ref 4.



(i)

Fig. 5.8 (continued) **(e)** 0.16C-0.04Si-1.43Mn-0.04Nb (wt%). As-rolled 12 mm plate; finish rolled at an intermediate temperature. 190 HV. Picral. 100×. **(f)** 0.16C-0.04Si-1.43Mn-0.04Nb (wt%). As-rolled 12 mm plate; finish rolled at an intermediate temperature. 190 HV. Picral. 1000×. **(g)** 0.24C-0.06Si-1.52Mn-0.04Nb (wt%). As-rolled 12 mm plate; finish rolled at a comparatively high temperature. 195 HV. Picral. 100×. **(h)** 0.24C-0.06Si-1.52Mn-0.04Nb (wt%). As-rolled 12 mm plate; finish rolled at a comparatively high temperature. 195 HV. Picral. 1000×. **(c)** to **(f)** P, pearlite; B, probable bainite. **(i)** Three stages of the hot-rolling process in niobium-containing carbon-manganese steels and the changes in microstructure in each stage. Adapted from Ref 4.