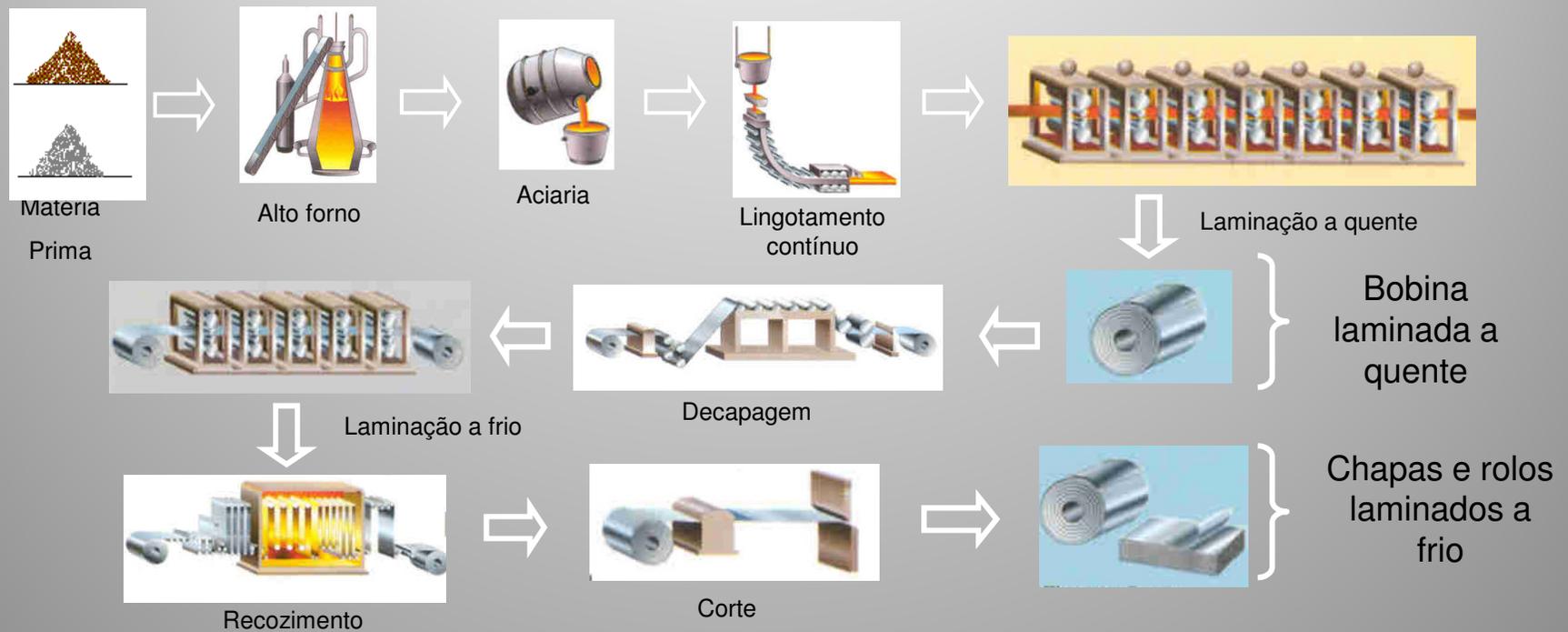
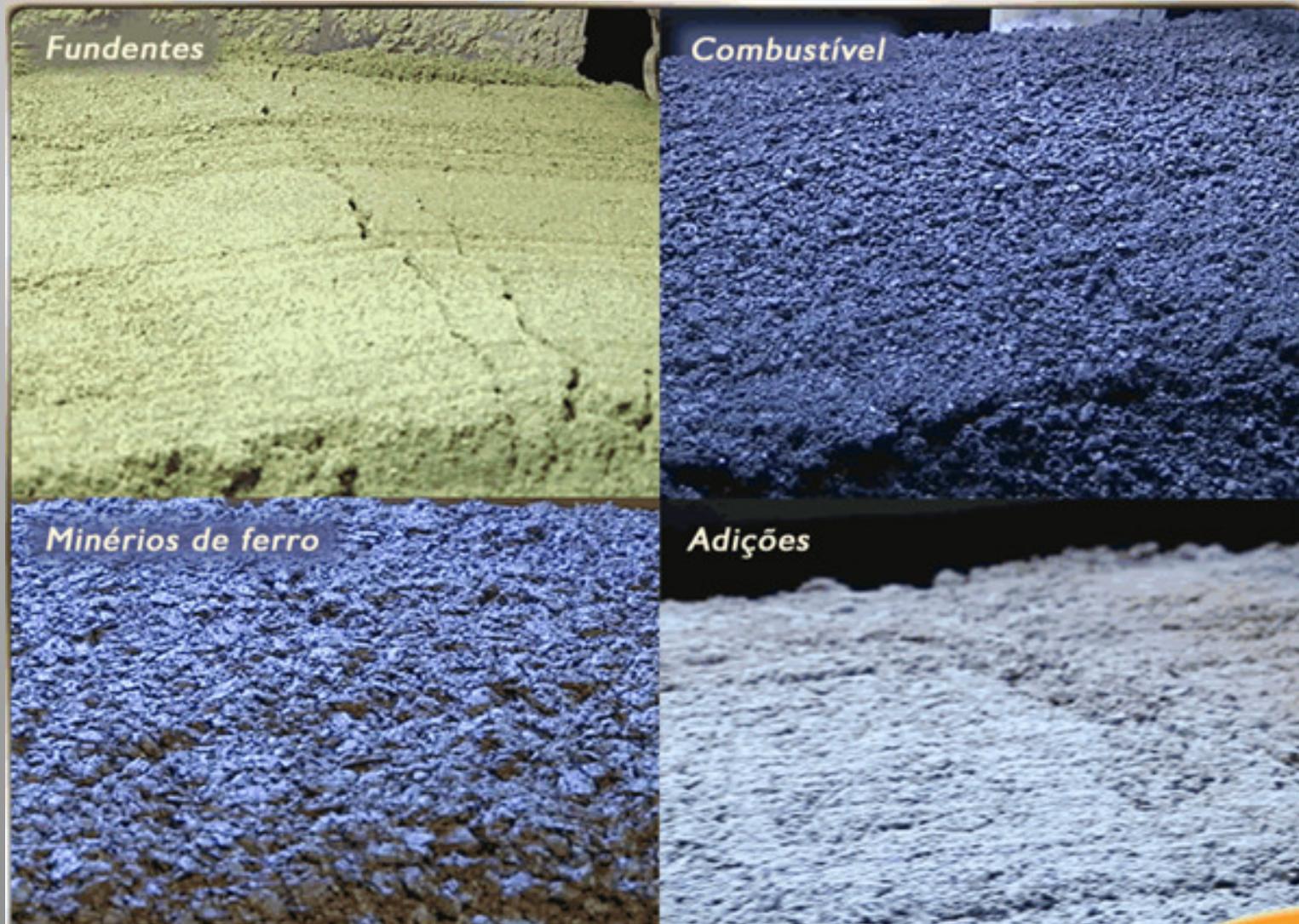


Fluxo de Processo - Usina

Usina siderúrgica



Matéria Prima



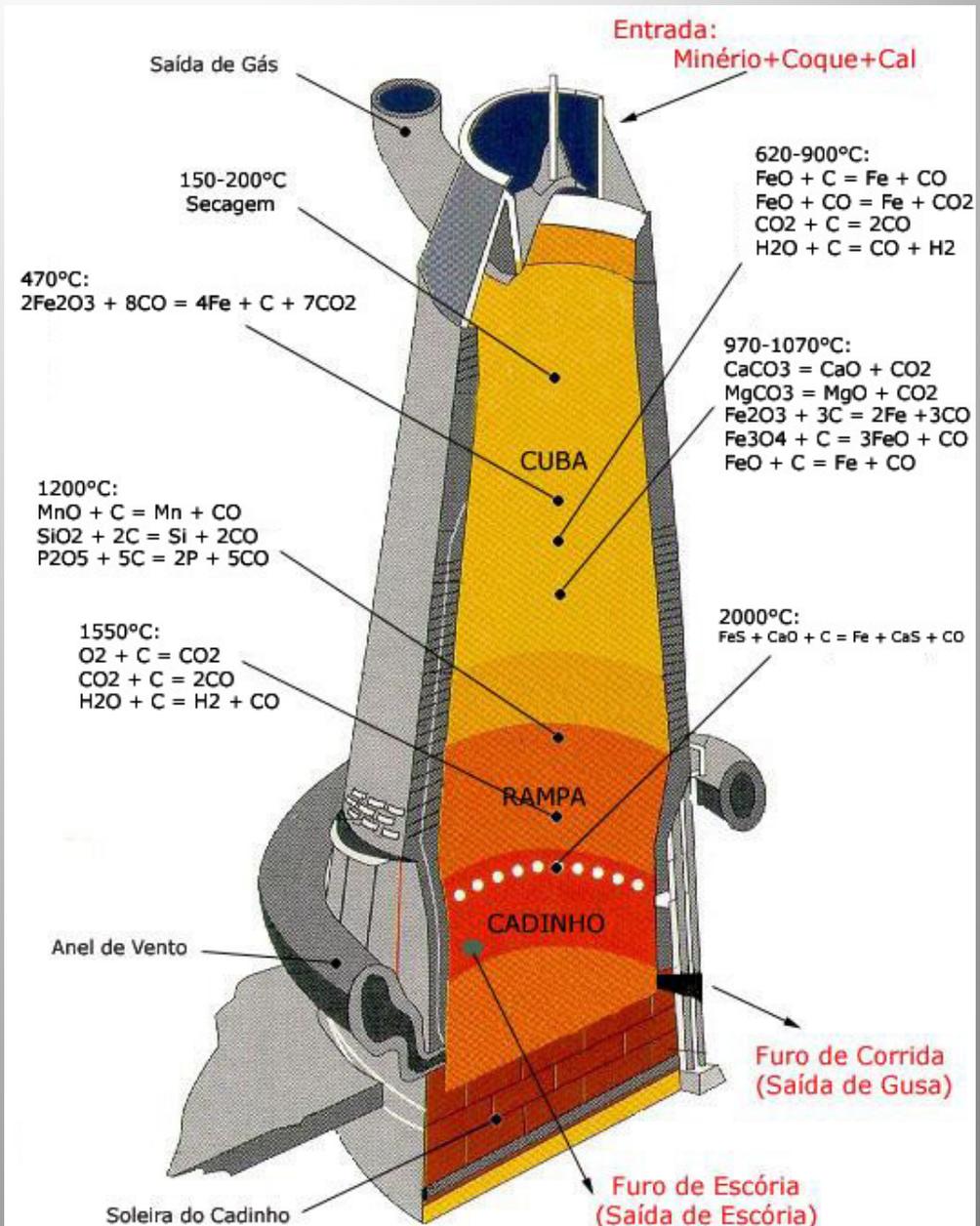
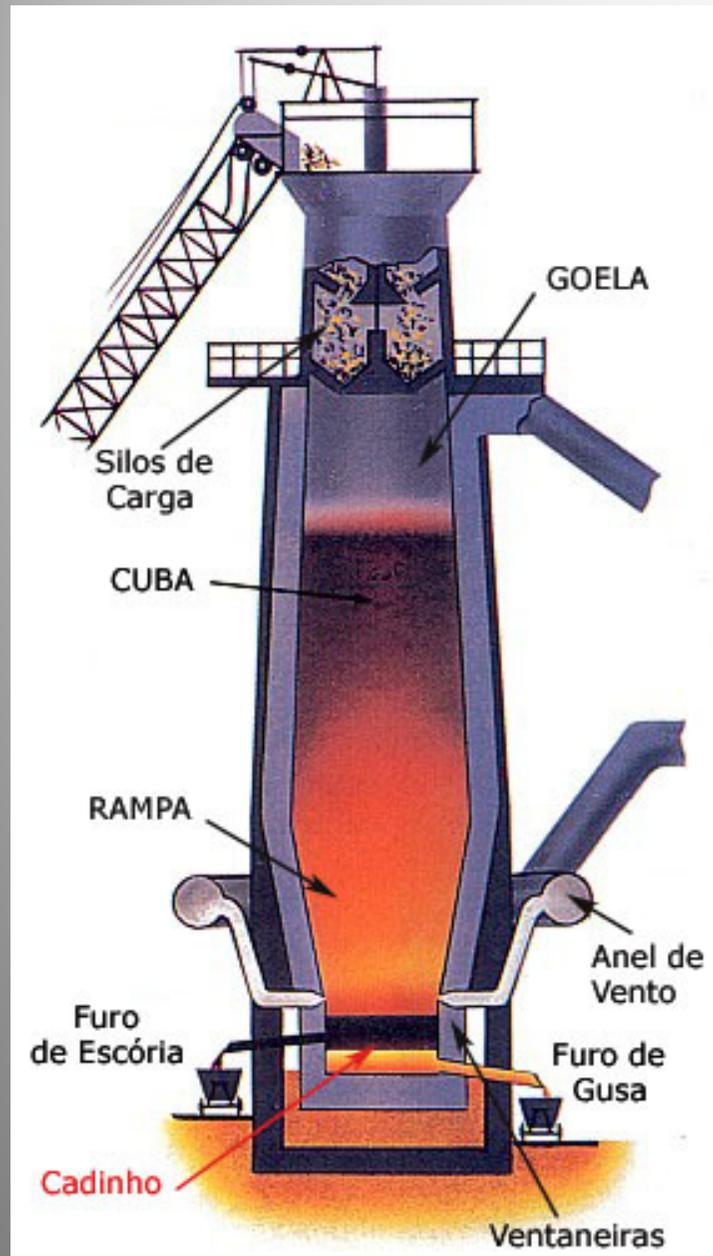
Matéria Prima



Alto Forno



Partes do alto-forno



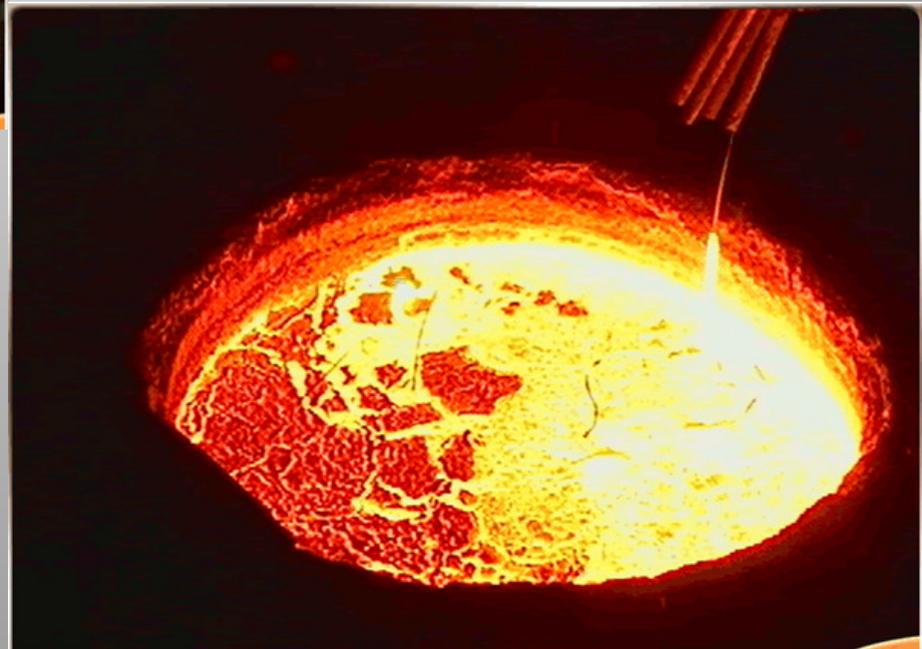
Aciaria



Ferro Gusa = 4%C
+
Sucata

Redução da %C

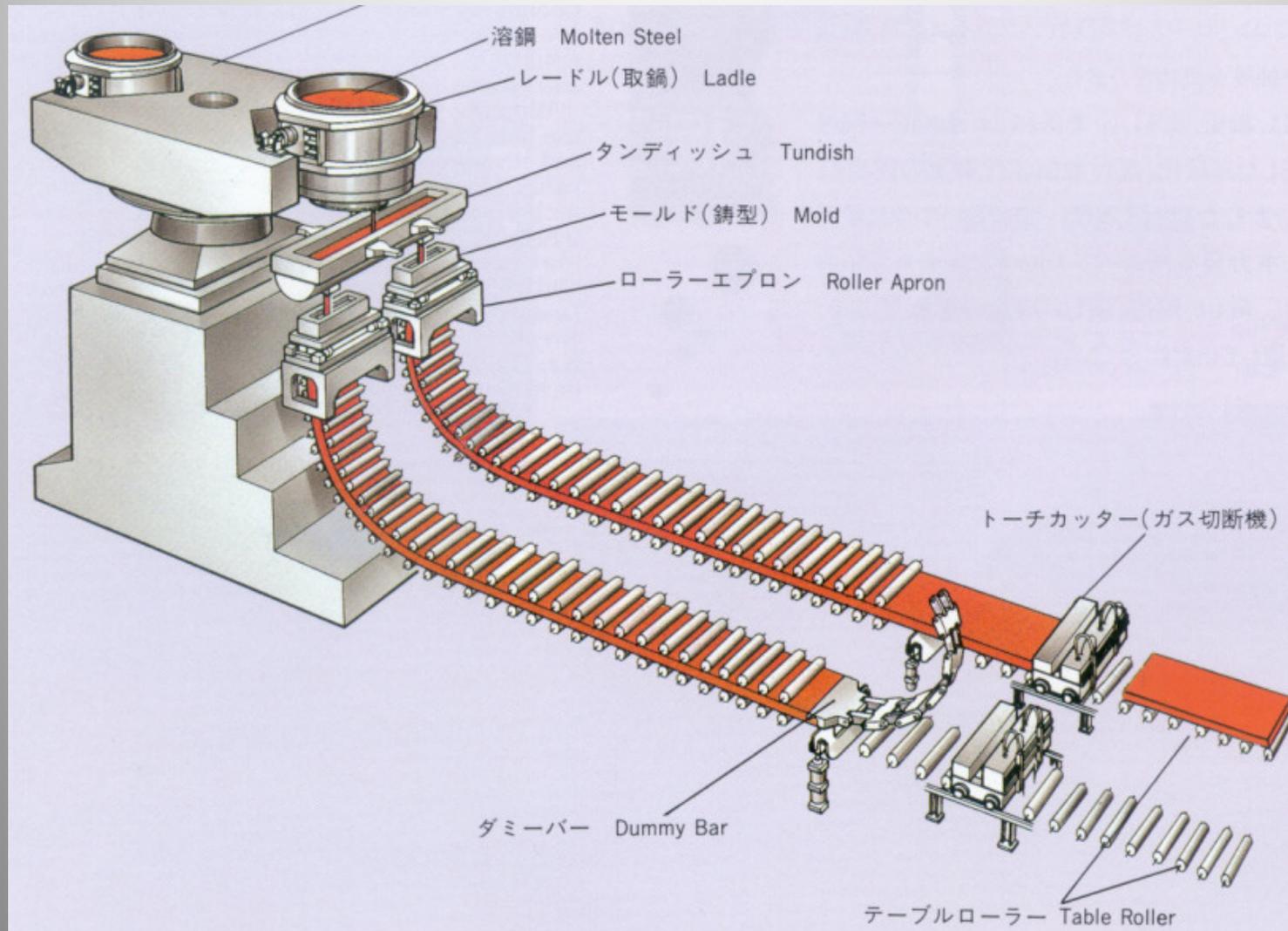
Acerto Composição Química



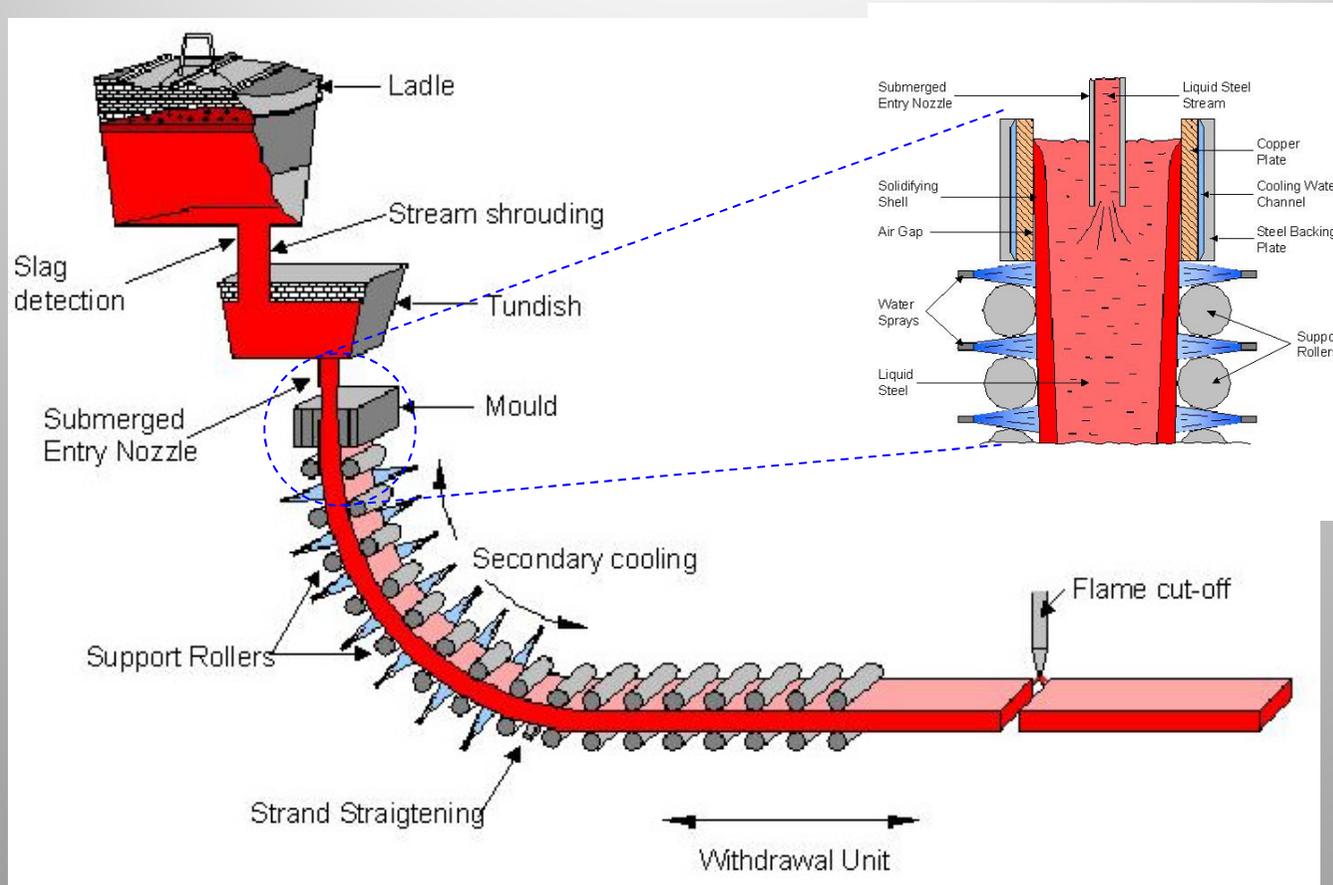
Lingotamento Contínuo



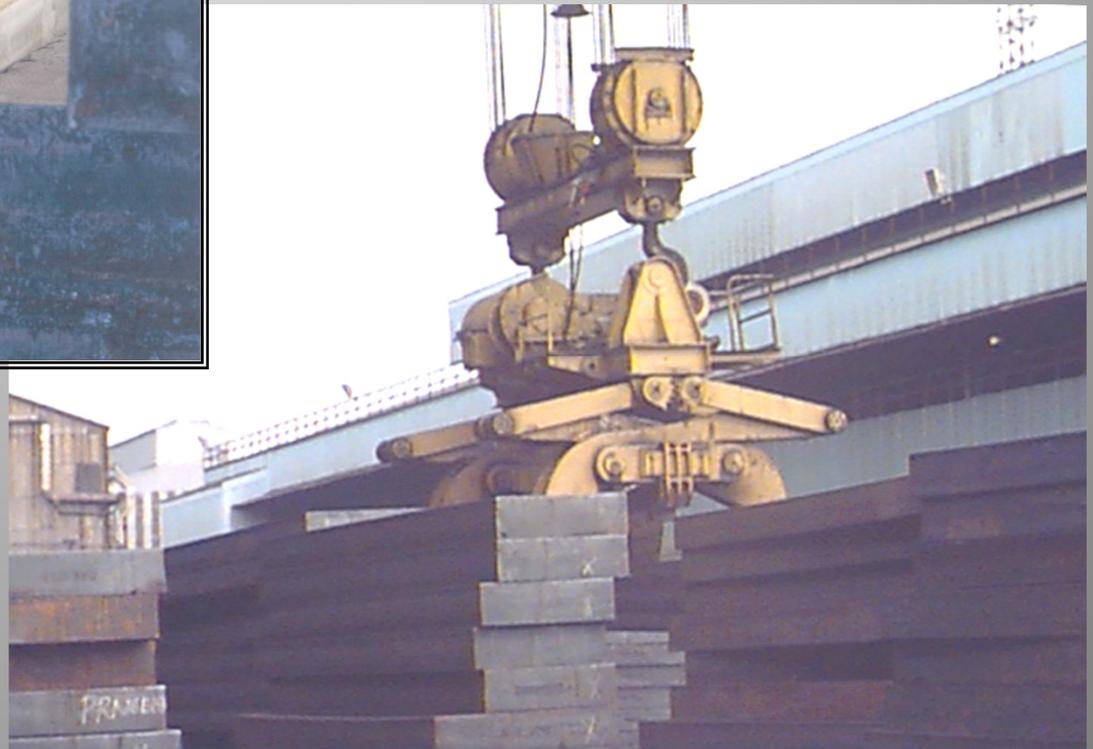
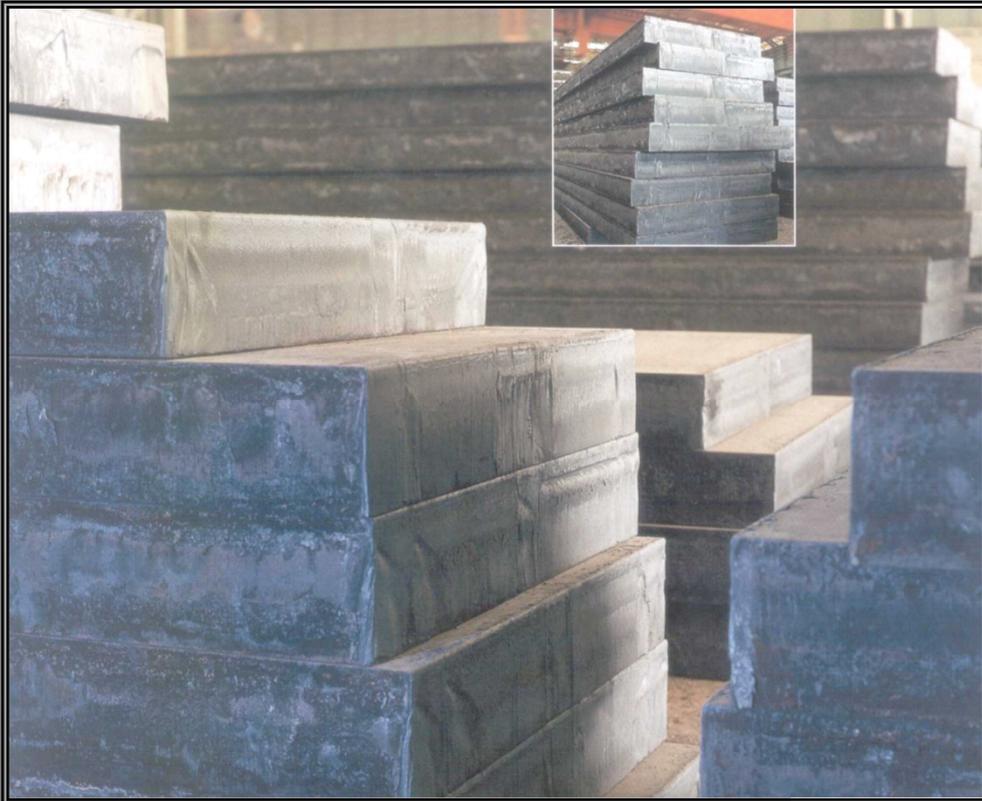
Lingotamento Continuo



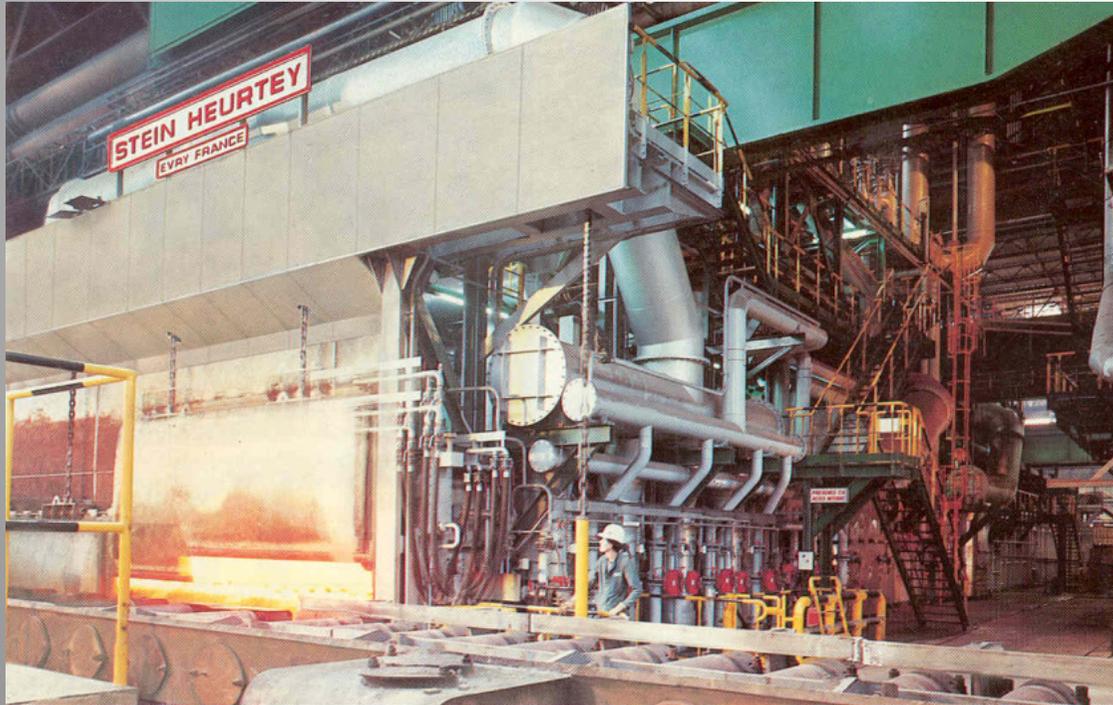
Lingotamento Continuo



Placas



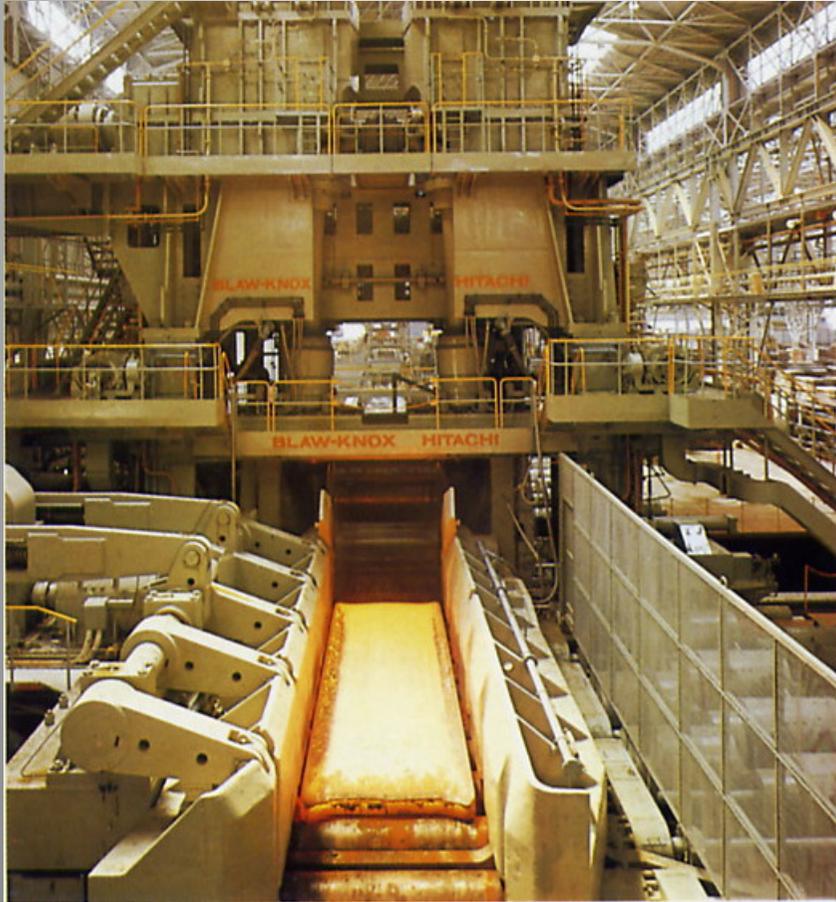
Forno reaquecimento de placas



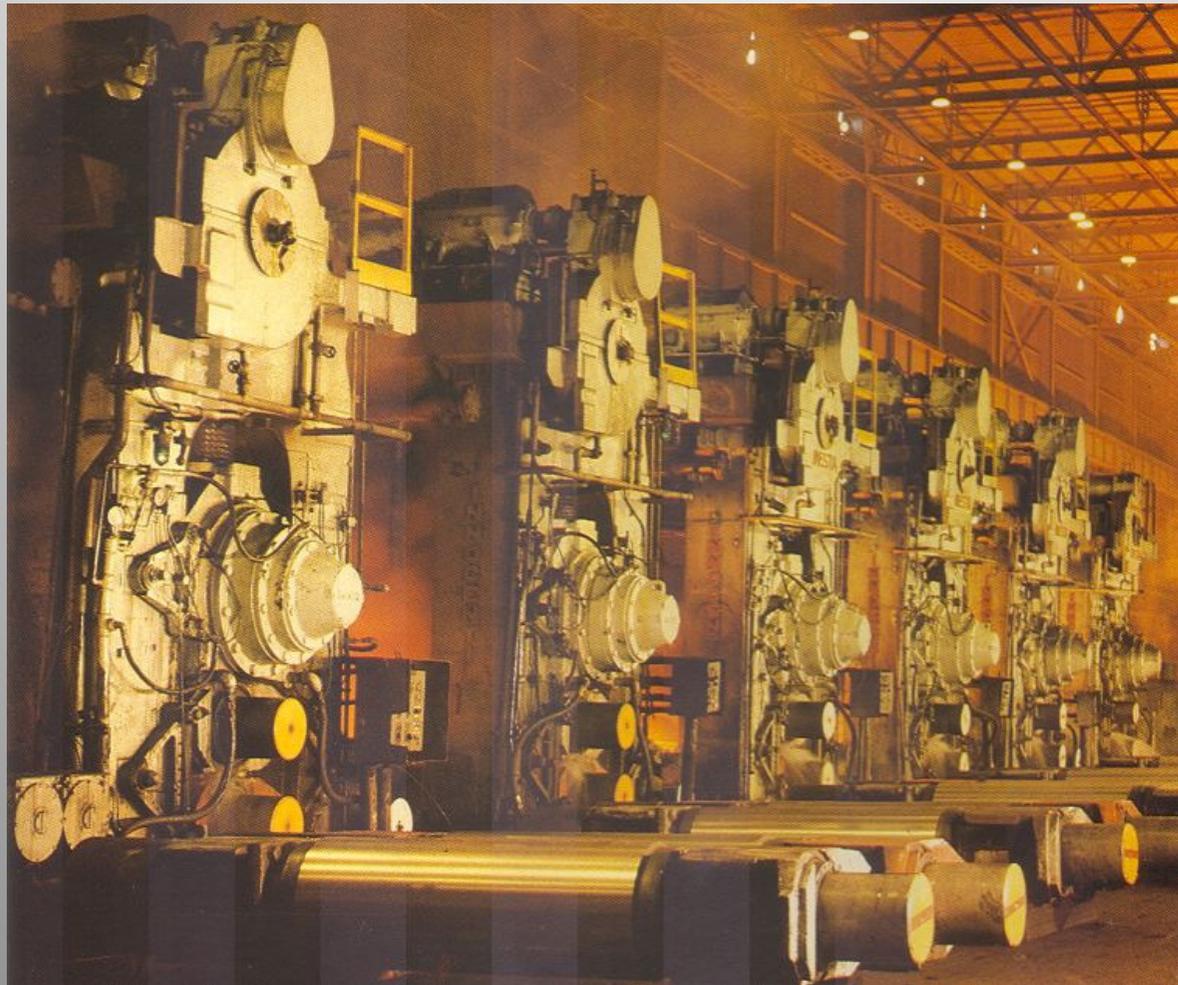
Forno reaquecimento de placas



Laminação a Quente



Trem contínuo de laminação a quente



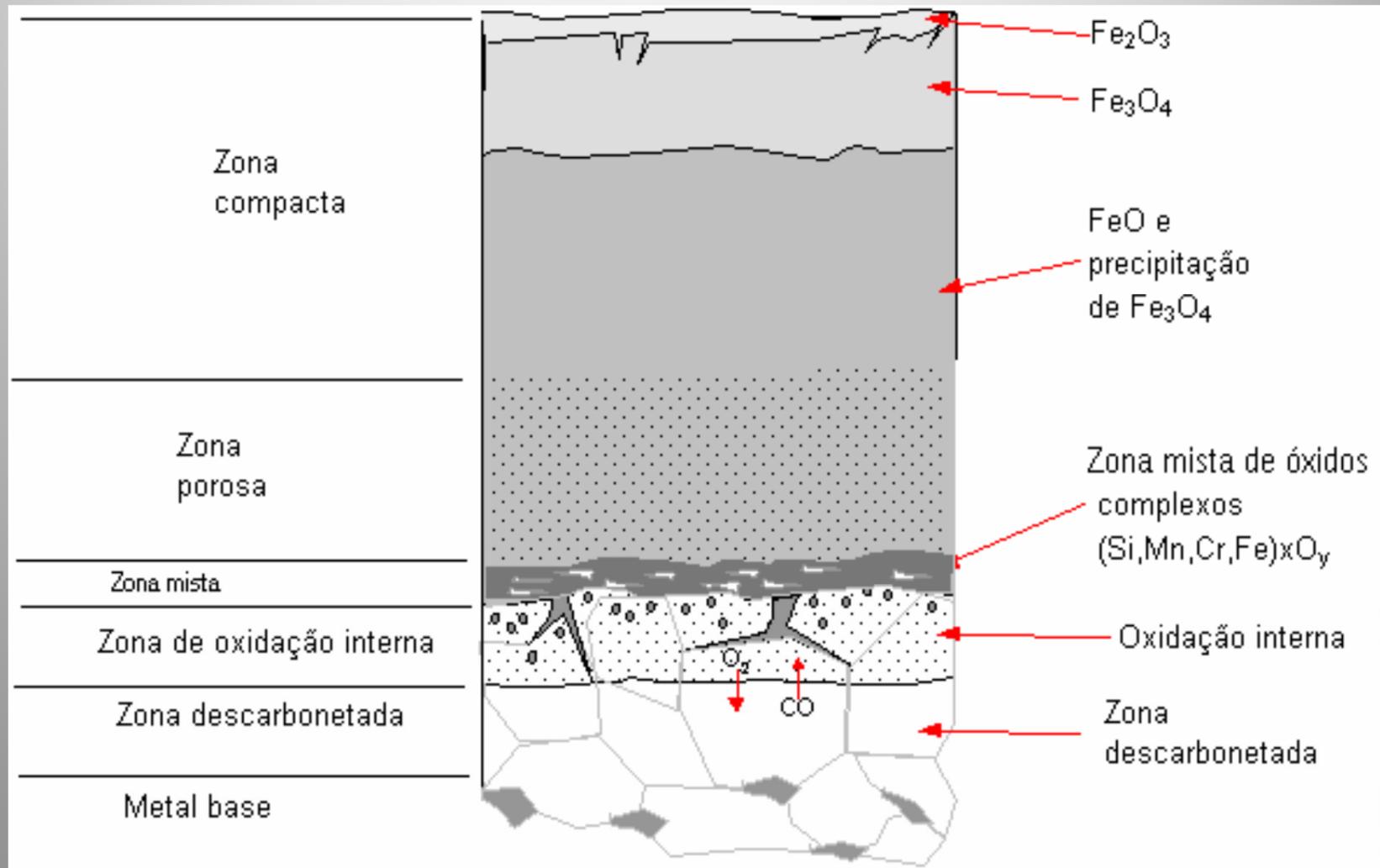
BQ – Bobina Laminada a Quente



Decapagem



Decapagem



Decapagem

- 1º tanque (ácido) - tem como função aquecer e iniciar o ataque na chapa.
- 2º tanque (ácido) - nessa etapa é removida grande parte da camada de óxido.
- 3º tanque (ácido) - restante da camada de óxido é removida e a chapa estará totalmente decapada,
- 4º e o 5º tanque (água) - limpeza da chapa.

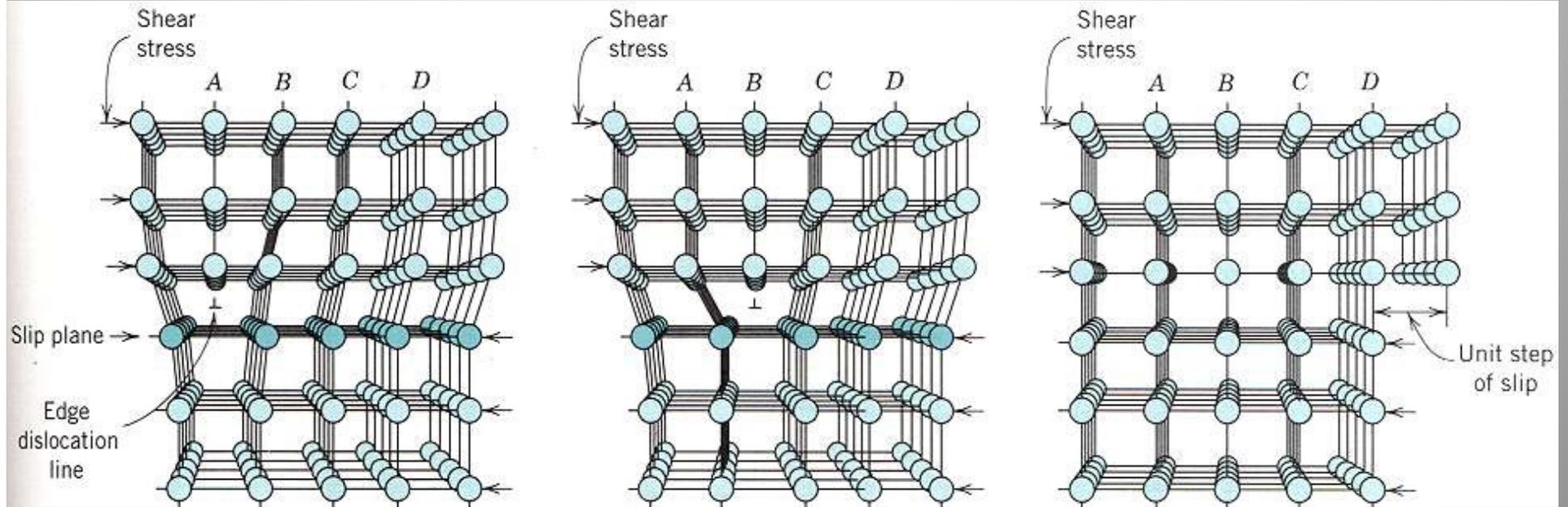
BF – Bobina Laminada a Frio



Mecanismos de deformação

- Deformação elástica
- Deformação plástica

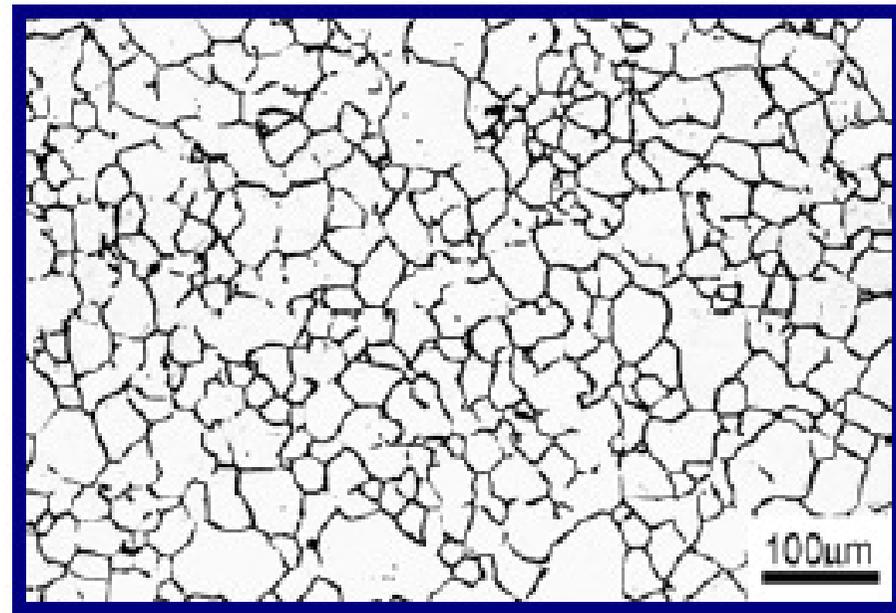
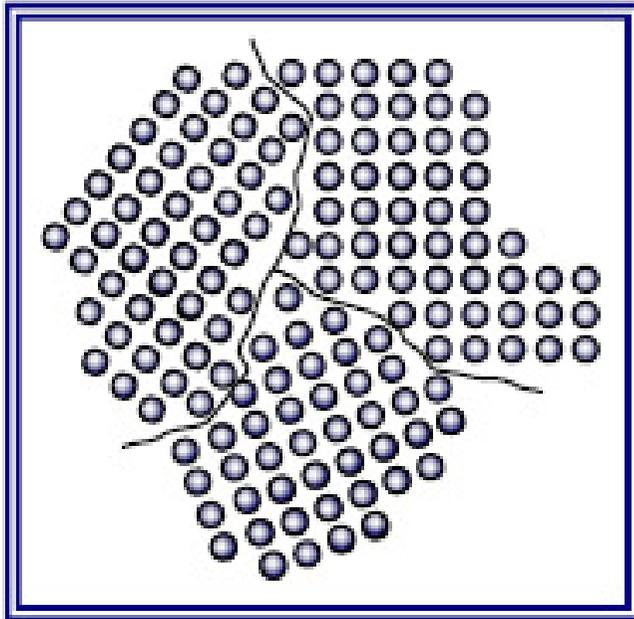
Discordâncias



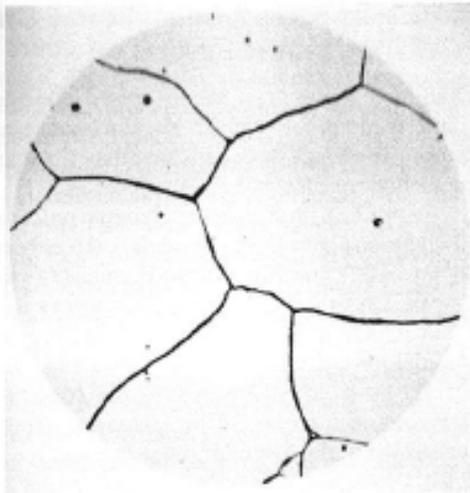
Mecanismos de endurecimento

- ***Contorno de grão***
- ***Solução Sólida***
- ***Deformação a frio (encruamento)***

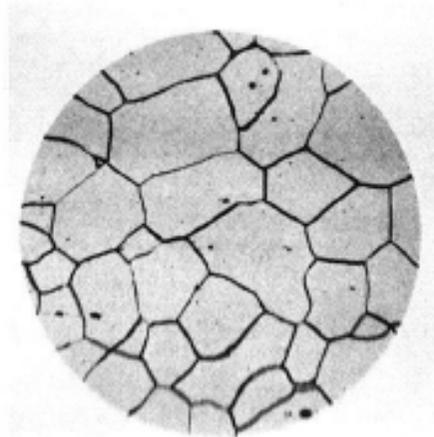
Contorno de Grão



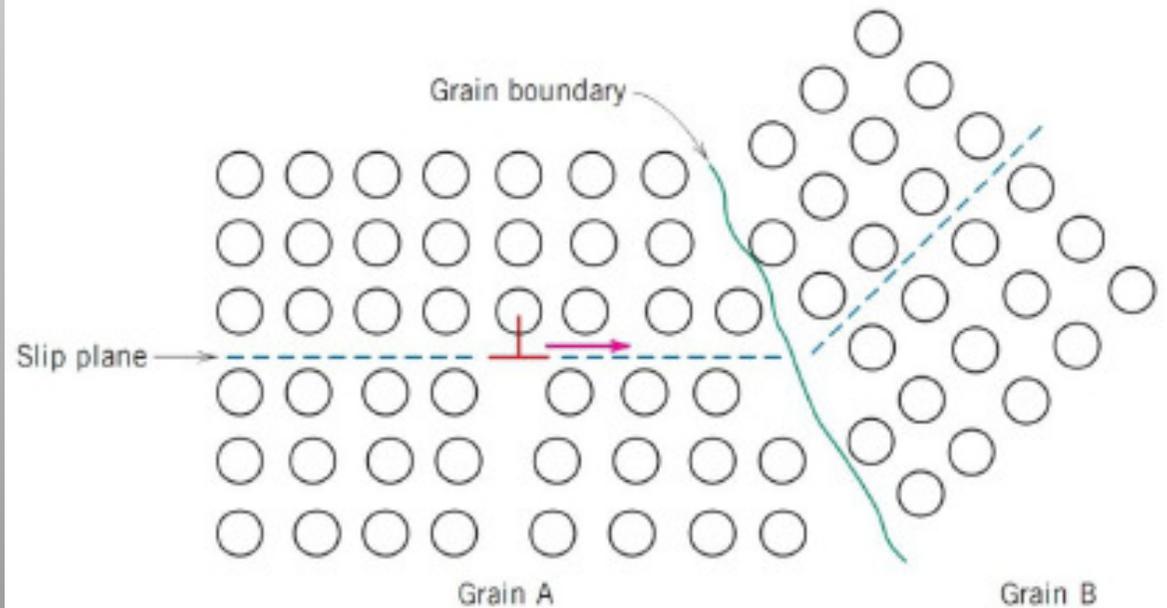
Contorno de Grão



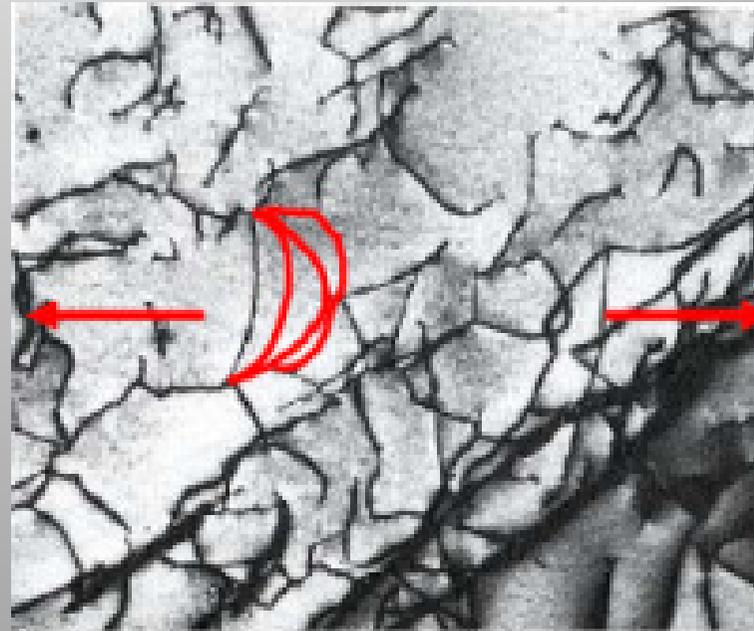
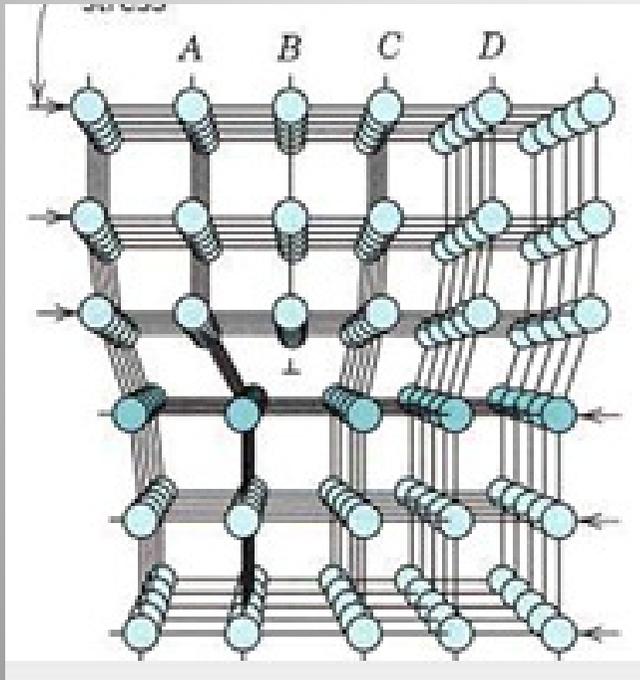
(a) Grain Size, $G = 1$



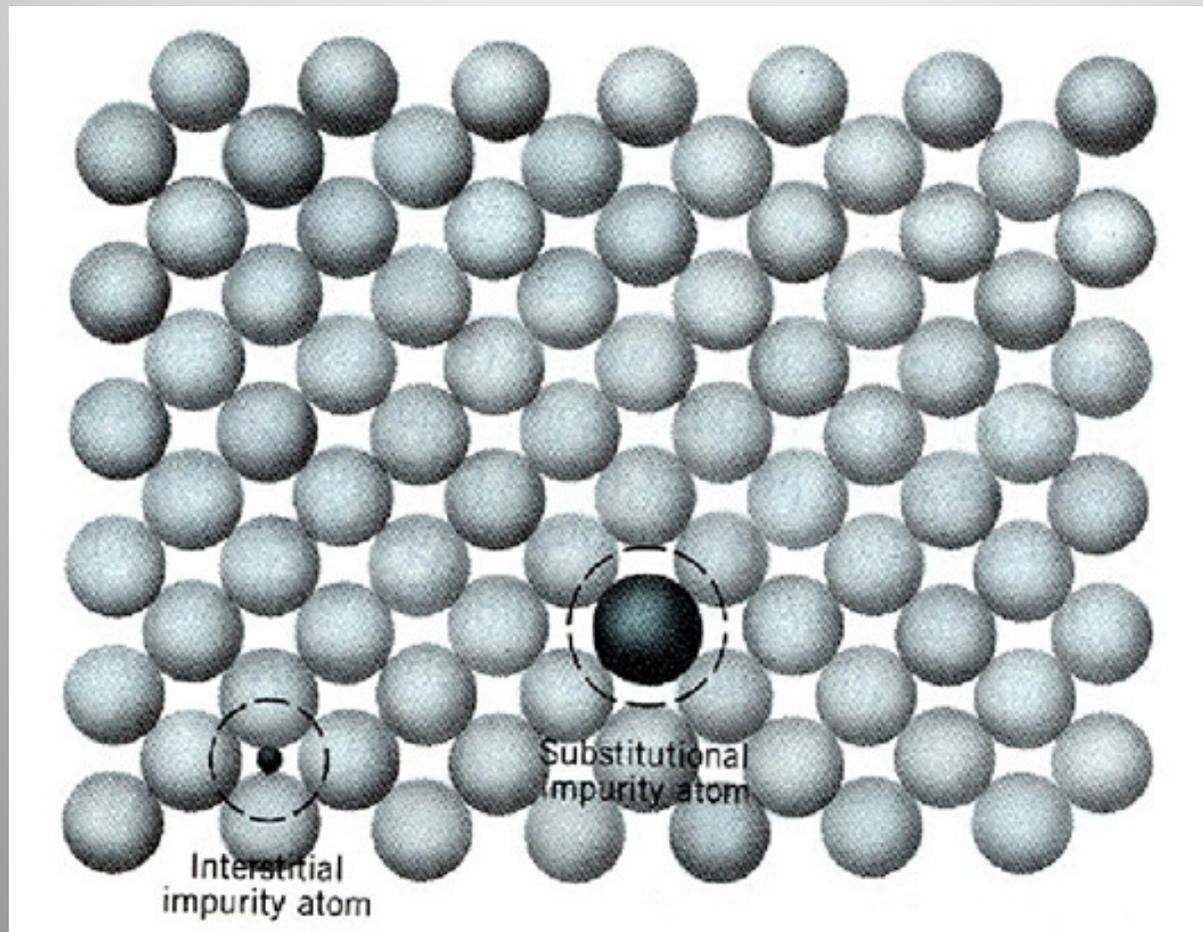
(b) Grain Size, $G = 4$



Deformação a frio



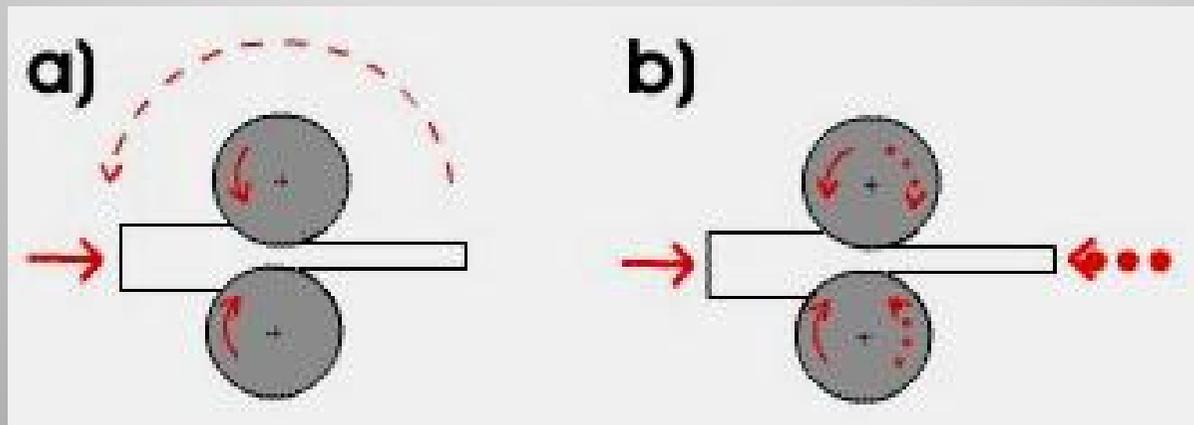
Efeito do carbono



Classificação dos Aços

- *Aço baixo teor de carbono ($\% C \leq 0,30\%$)*
- *Aço médio teor de carbono ($0,30 < \% C < 0,50$)*
- *Aço alto teor de carbono ($\% C \geq 0,50$)*

Laminação - Objetivo



Espessura inicial > Espessura final

Laminação a frio

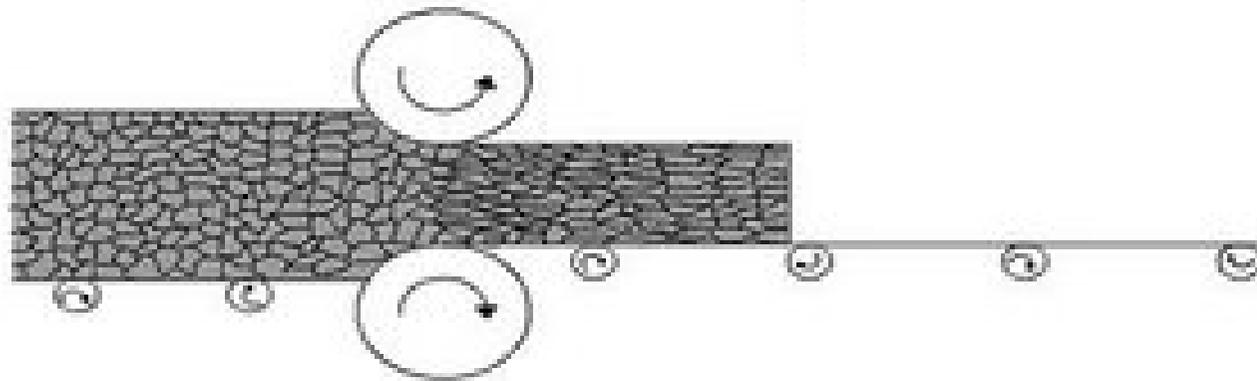
- ***Boa qualidade superficial;***
- ***Boa tolerância de espessura;***
- ***Aumenta dureza, limite de escoamento e limite de resistência;***
- ***Diminui alongamento, ductilidade;***

Tipos laminadores



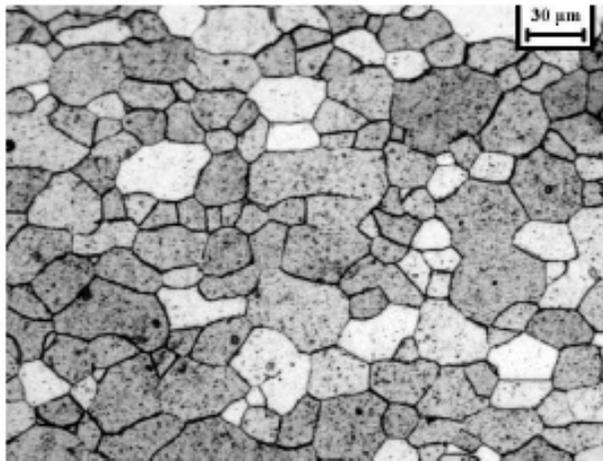
Encruamento

Processo de Laminação a Frio



Encruamento

ENCRUAMENTO



Material original

⇒
Laminação
à frio



Material encruado

Encruamento

