

DEFECTOS RETICULARES

PUNTUALES

Vacancias
At. Intersticiales
At. Sustitucionales
Frenkel
Crowdion

LINEALES

Dislocaciones

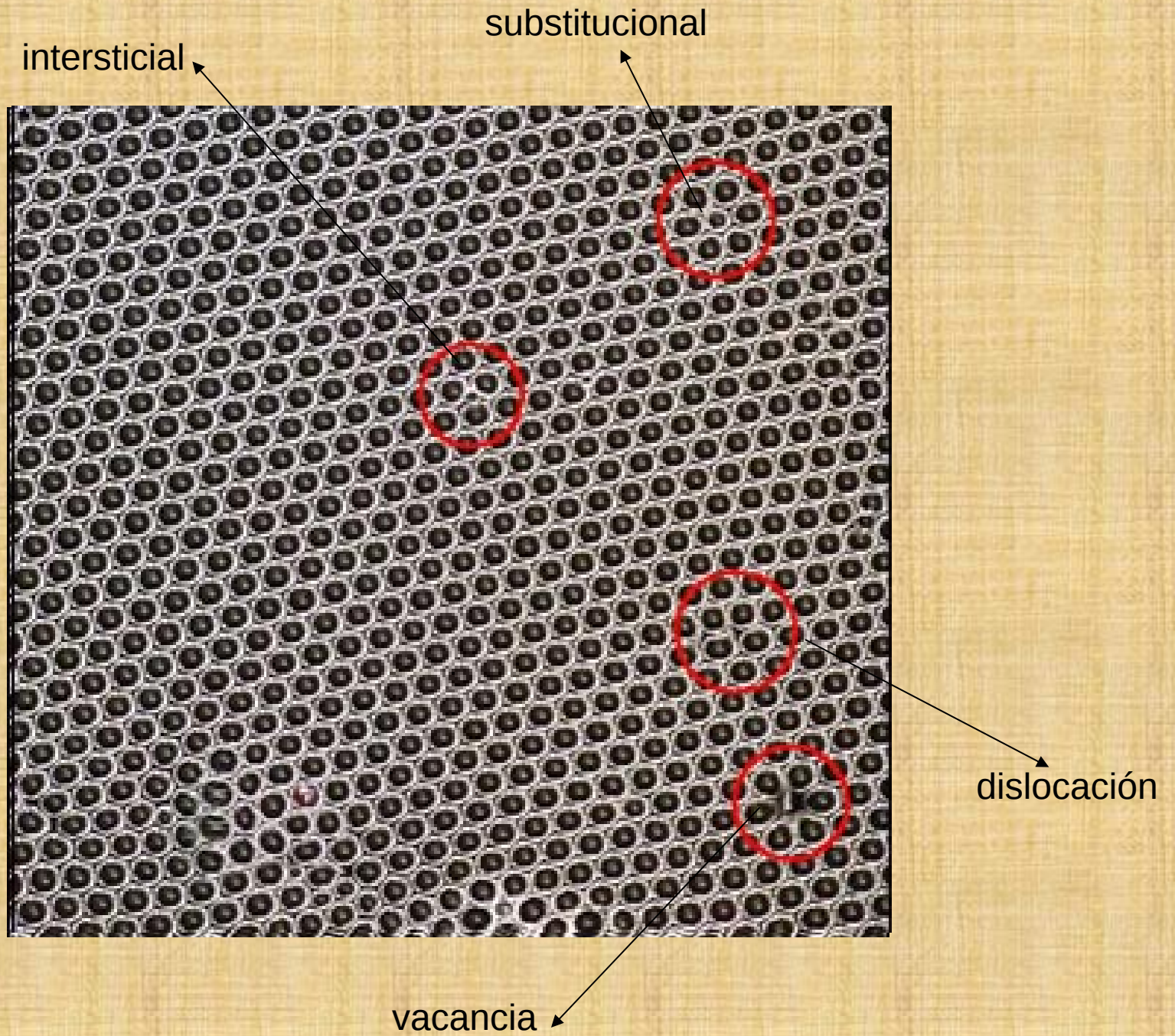
BIDIMENSIONALES

Bordes de grano
Maclas
Fallas de apilamiento

TRIDIMENSIONALES

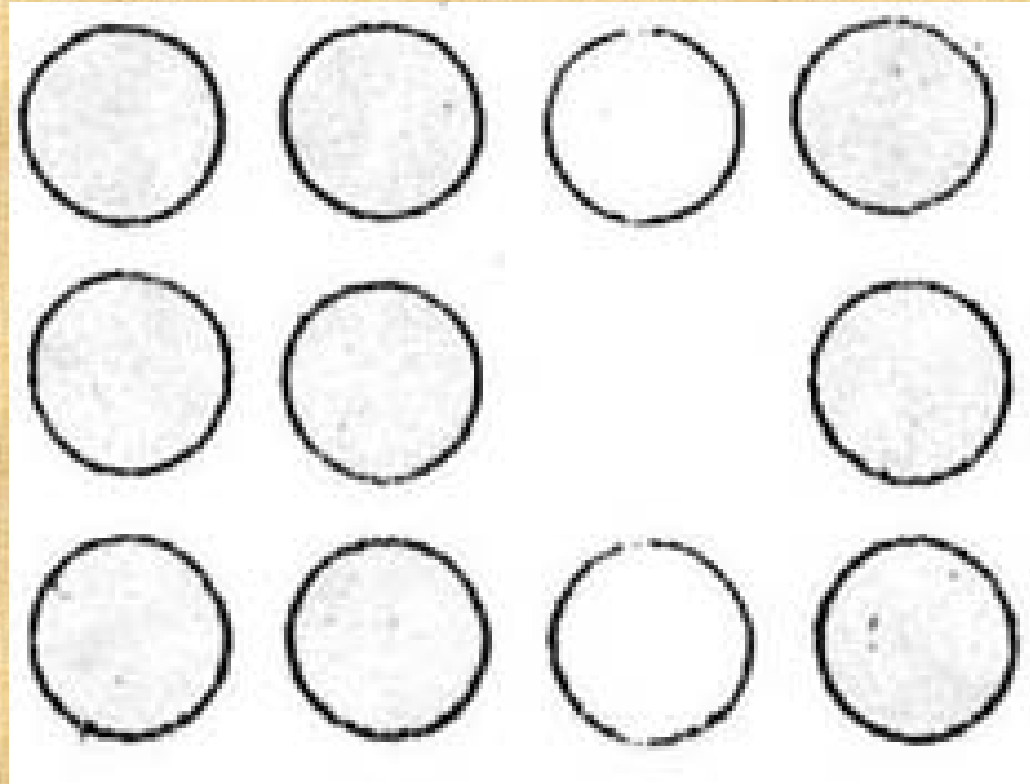
Precipitados
Spikes
Zonas de Seeger

**Parece
perfecta,
pero...**



VACANCIAS

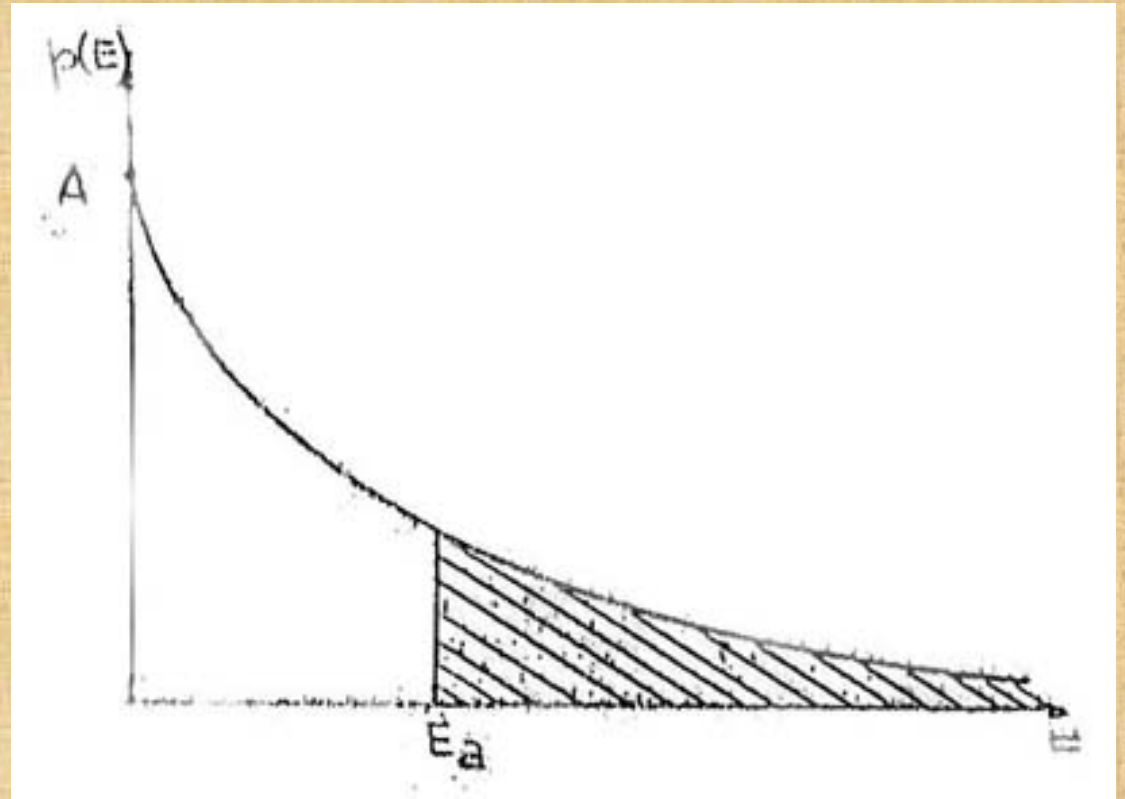
$$N_v = N \cdot e^{-\frac{\Delta Q}{R \cdot T}}$$



Ecuación de
Boltzmann:

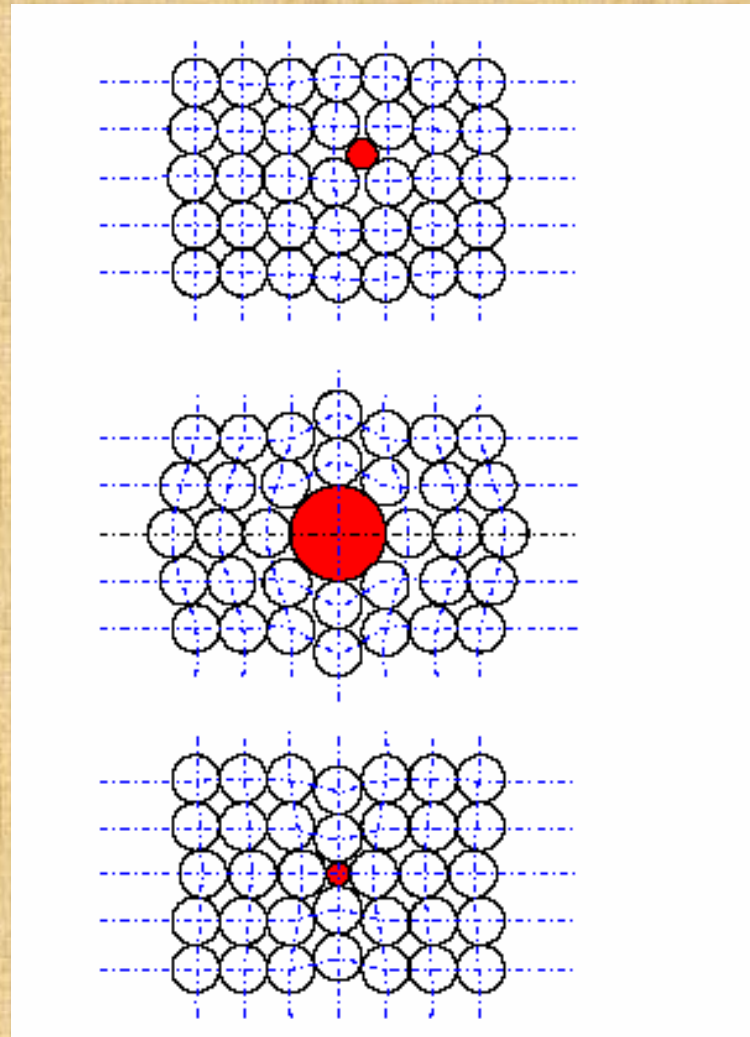
$$p(E) = A \cdot e^{-\frac{E}{k \cdot T}}$$

probabilidad de
que un átomo
tenga una
energía E



E_a = Energía de activación

Átomos intersticiales y sustitucionales



ATOMO INTERSTICIAL

C, N, O, H, B

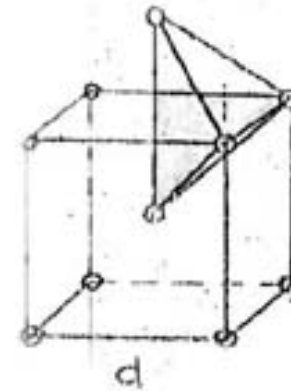
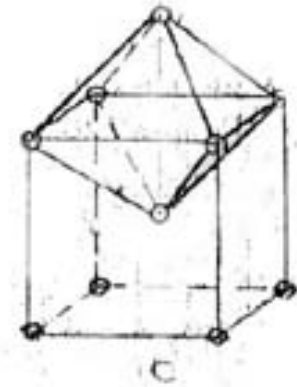
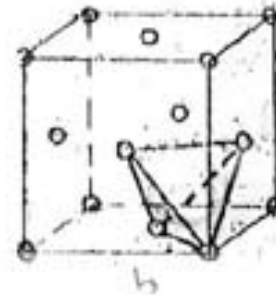
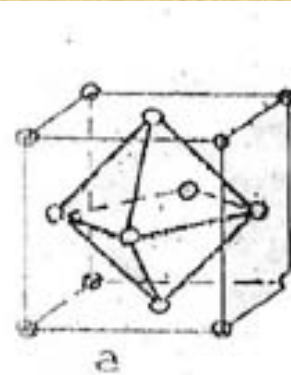
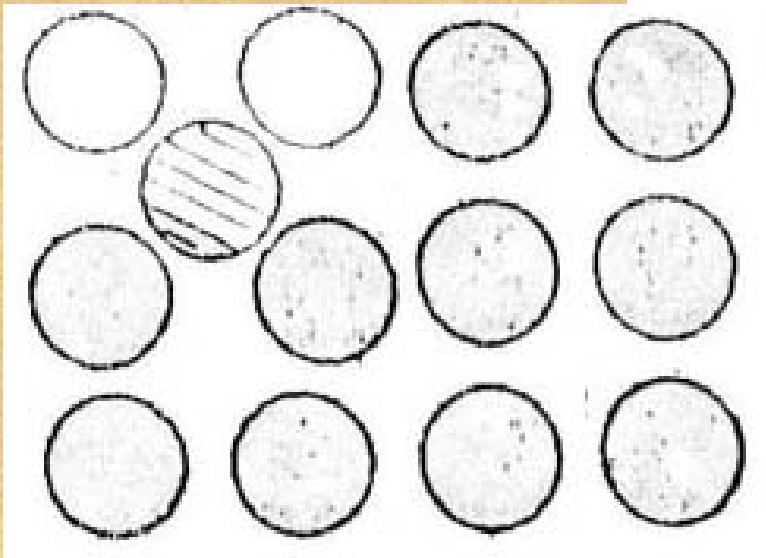
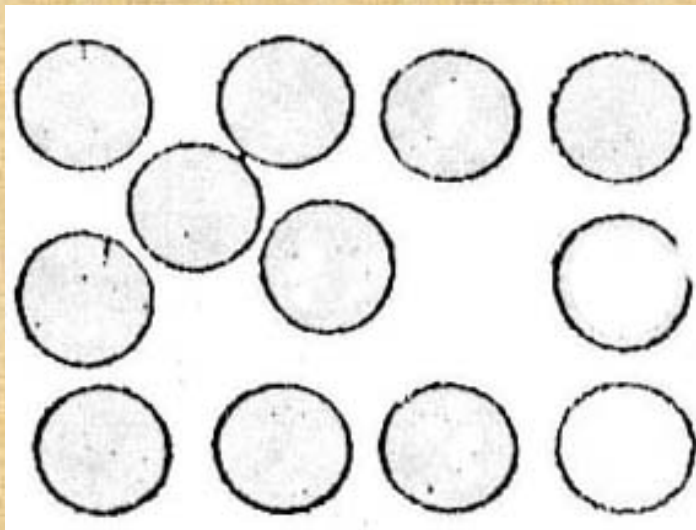


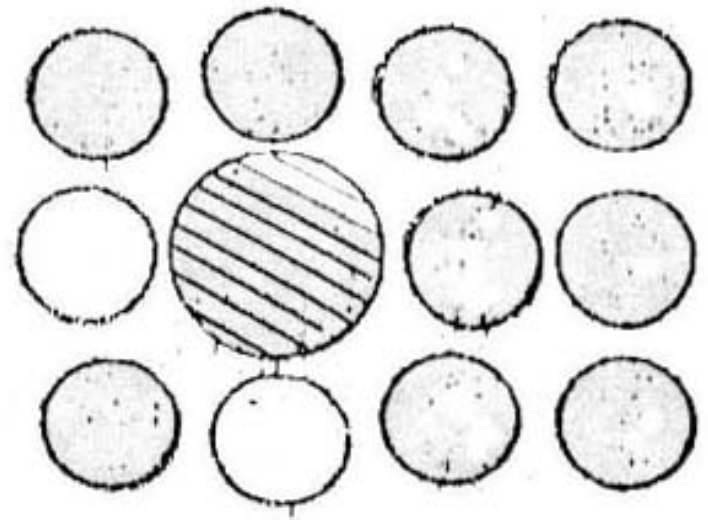
Fig 37 a) CC hueco octaédrico
b) CC tetraédrico
c) CC octaédrico
d) CC tetraédrico



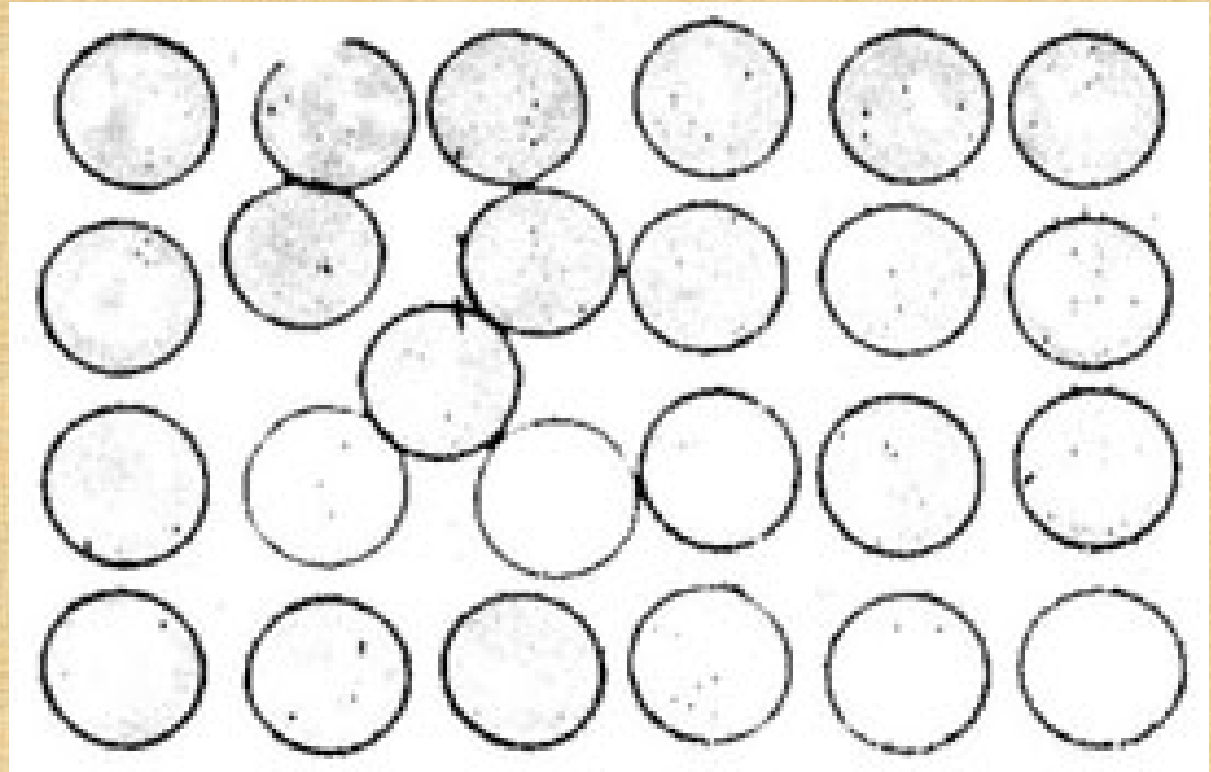
FRENKEL



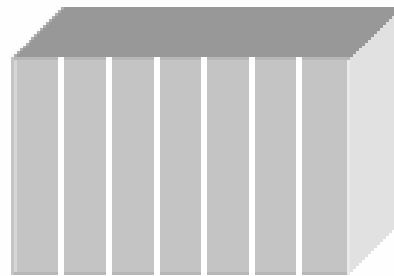
ATOMO
SUSTITUCIONAL



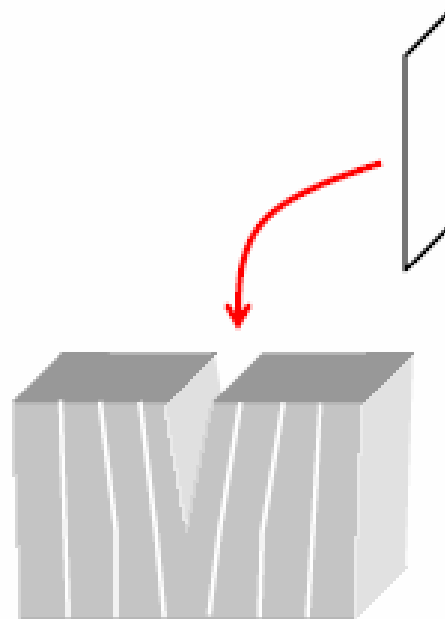
CROWDION



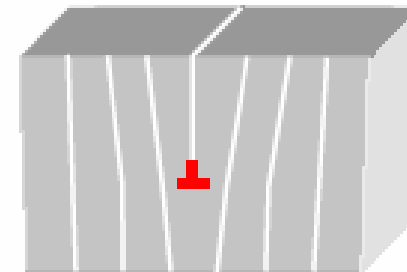
DEFECTOS LINEALES: DISLOCACIONES



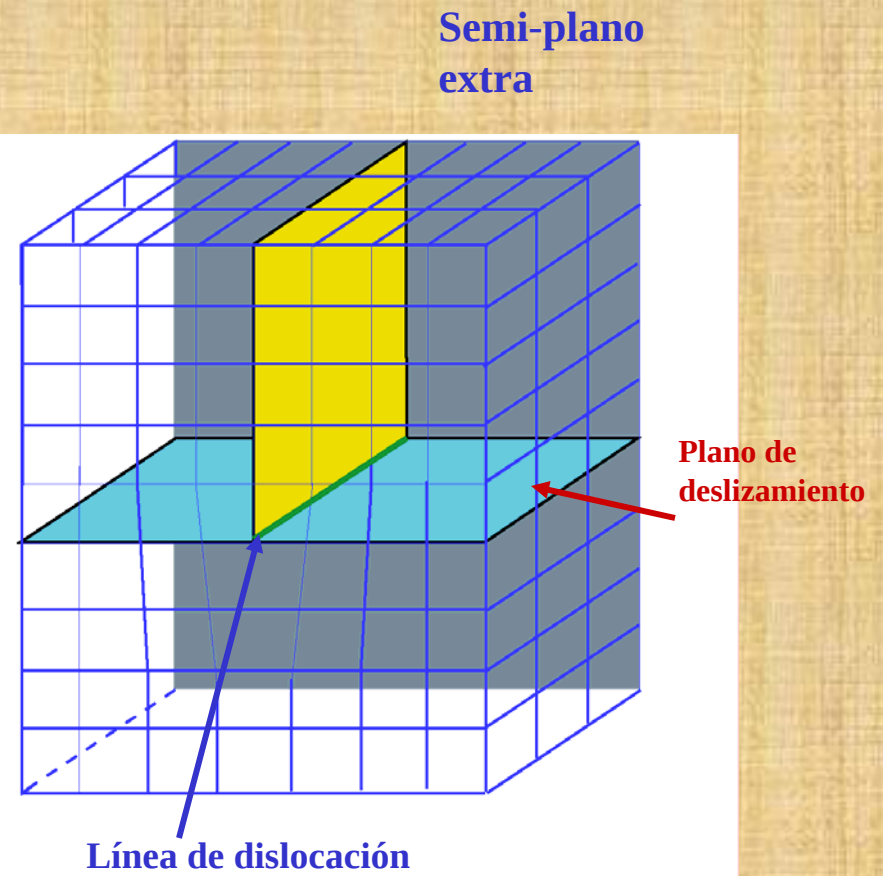
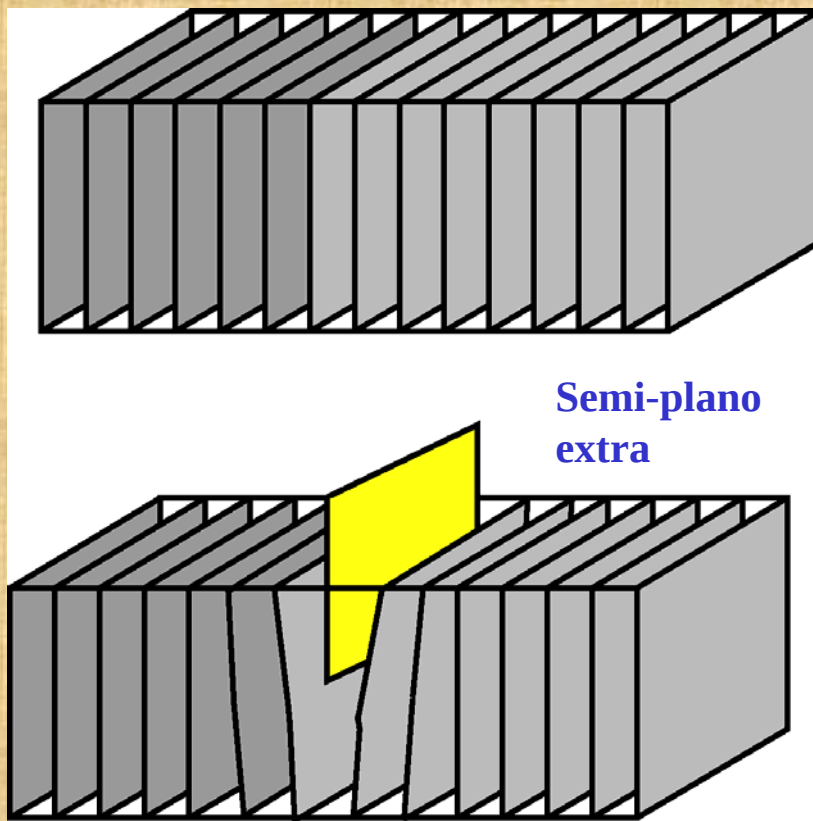
Perfect crystal



Split to center
& insert extra $\frac{1}{2}$ plane of
atoms



**Cómo hacer una
dislocación de borde?**

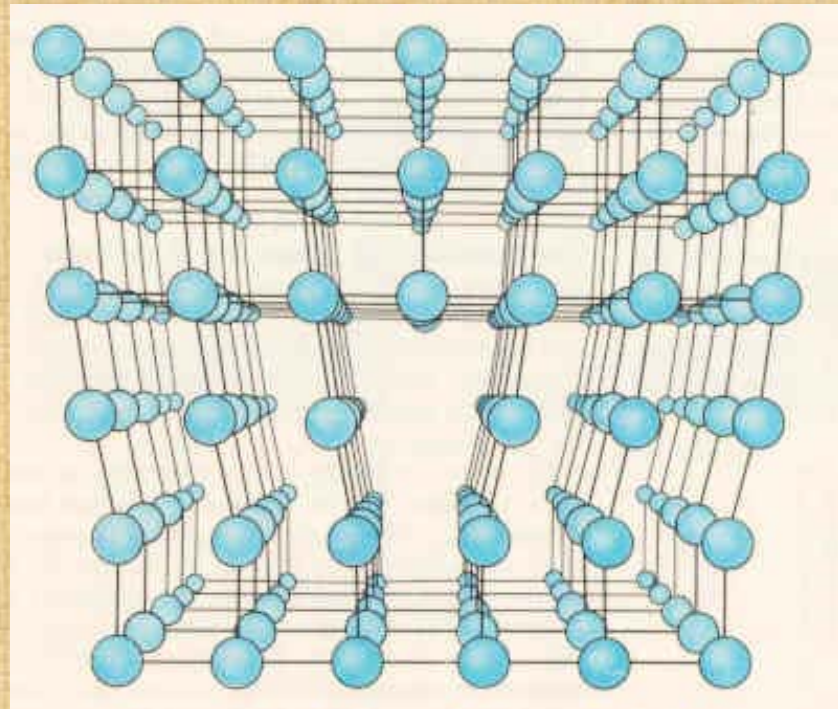


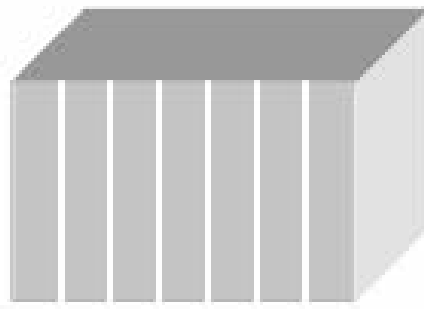
DISLOCACION DE BORDE

b $\perp$ L.D.

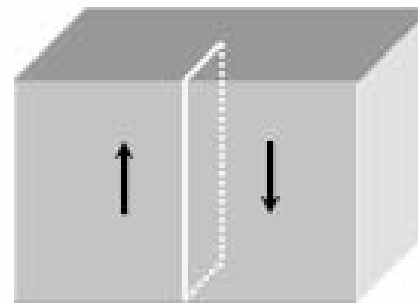
b $\parallel \tau_r$

b $\parallel$ deslizamiento

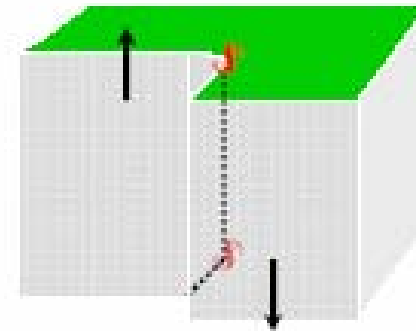




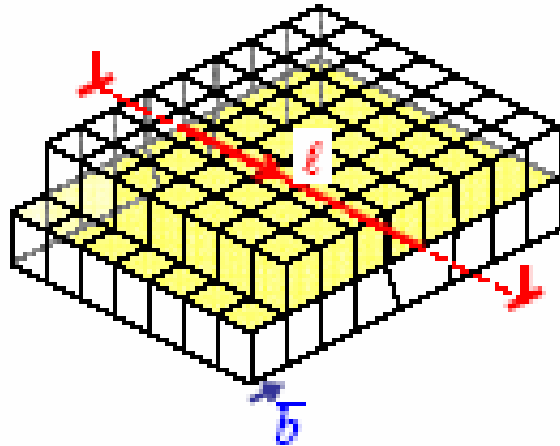
Perfect crystal



Split to center and
slide cut faces across each other
(i.e. shear them)

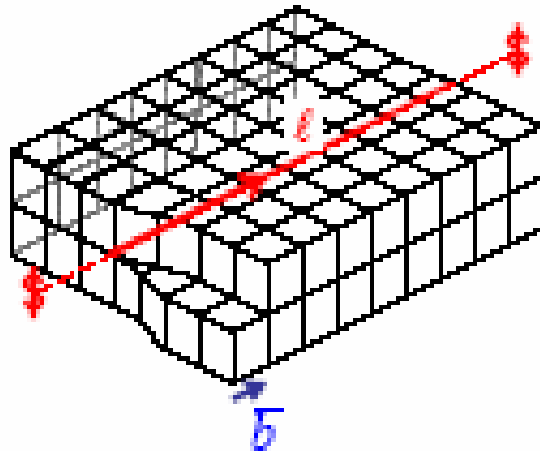


**Cómo hacer una
dislocación de hélice?**



Borde: Vector de Burger perpendicular a la línea de la dislocación $\bar{\mathbf{b}} \perp \bar{\mathbf{l}}$

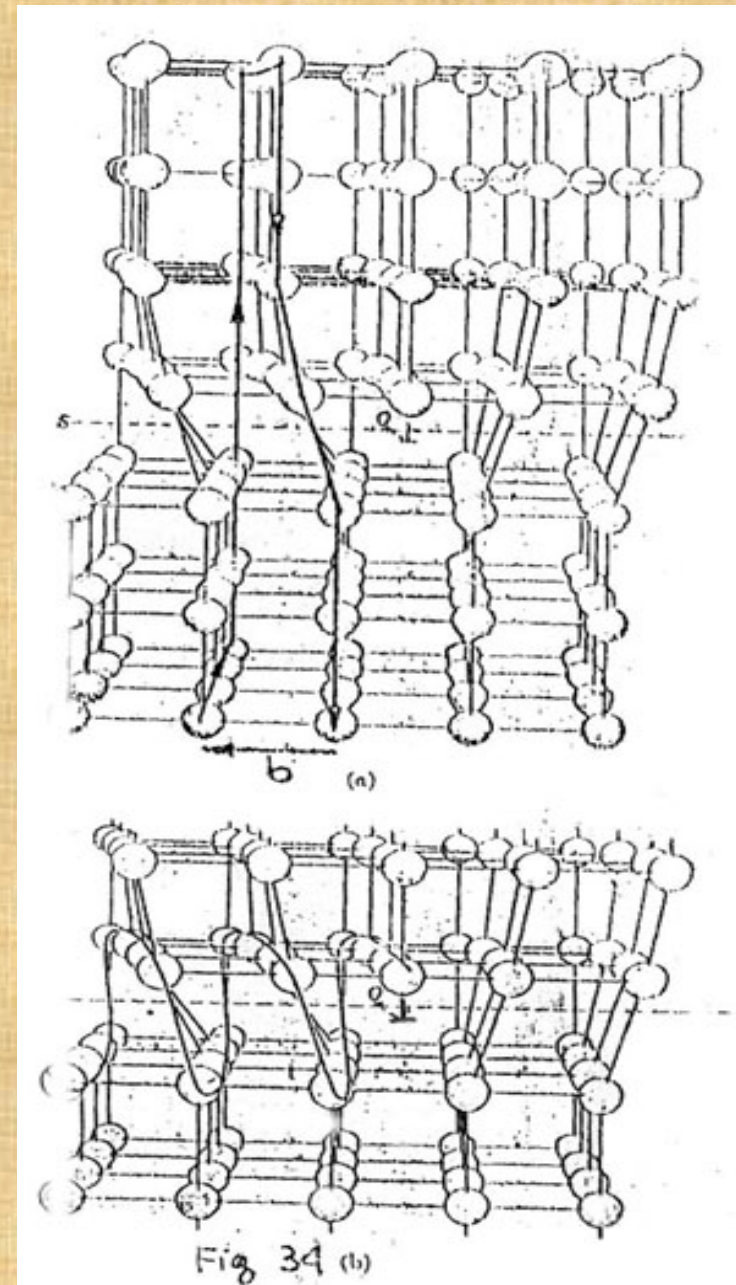
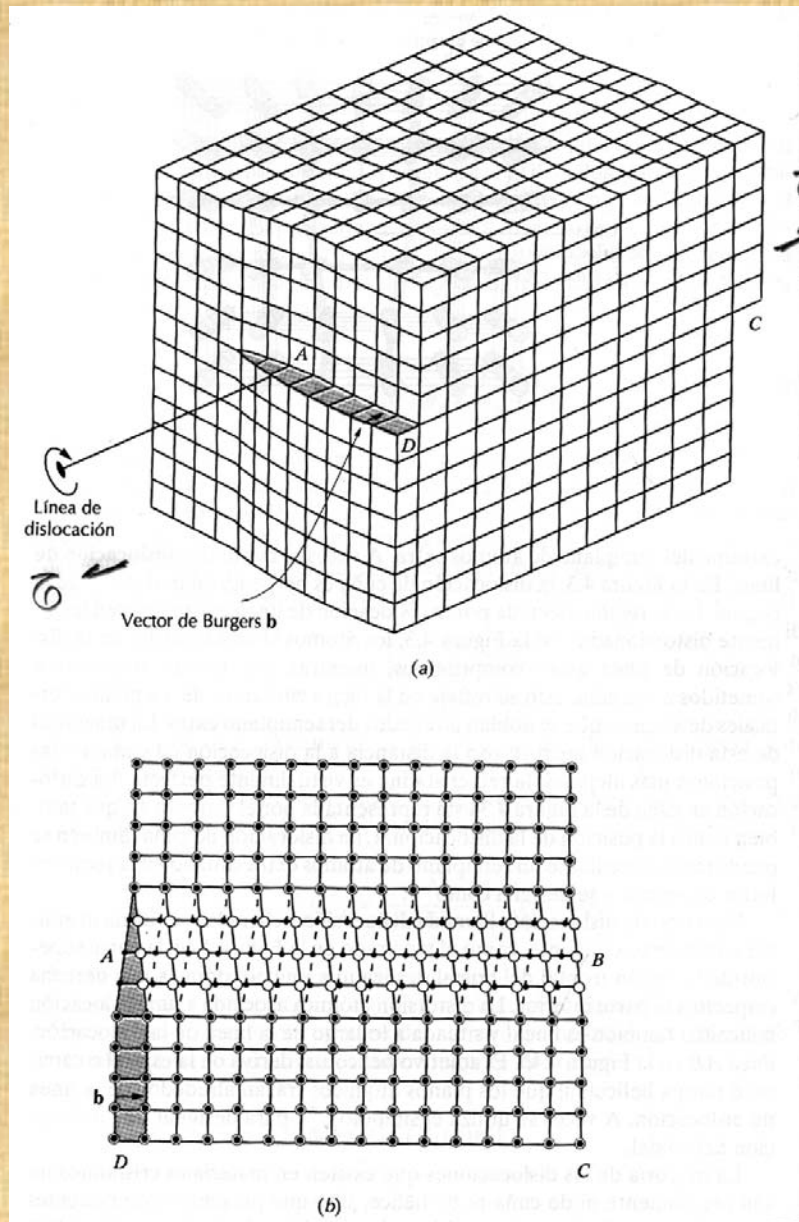
$\bar{\mathbf{b}}$ y $\bar{\mathbf{l}}$ definen un único sistema de deslizamiento

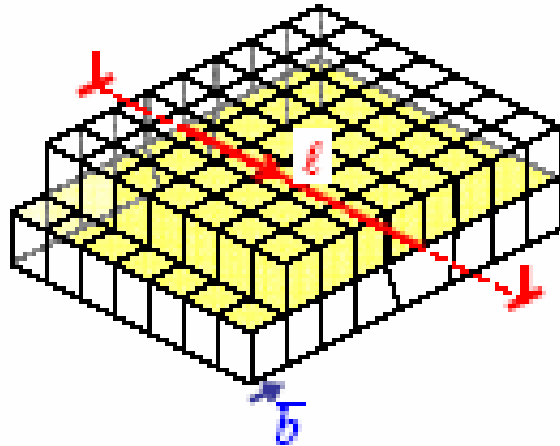


Hélice: Vector de Burger paralelo a la línea de la dislocación $\bar{\mathbf{b}} \parallel \bar{\mathbf{l}}$

$\bar{\mathbf{b}}$ y $\bar{\mathbf{l}}$ no definen un único sistema de deslizamiento

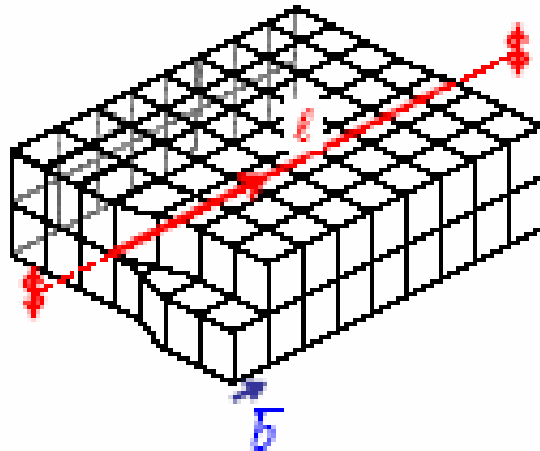
DISLOCACION HELICOIDAL





Borde: Vector de Burger perpendicular a la línea de la dislocación $\vec{b} \perp \vec{l}$

$\vec{b}$ y $\vec{l}$ definen un único sistema de deslizamiento



Hélice: Vector de Burger paralelo a la línea de la dislocación $\vec{b} \parallel \vec{l}$

$\vec{b}$ y $\vec{l}$ no definen un único sistema de deslizamiento

E elástica asociada a dislocaciones de borde y helicoidales

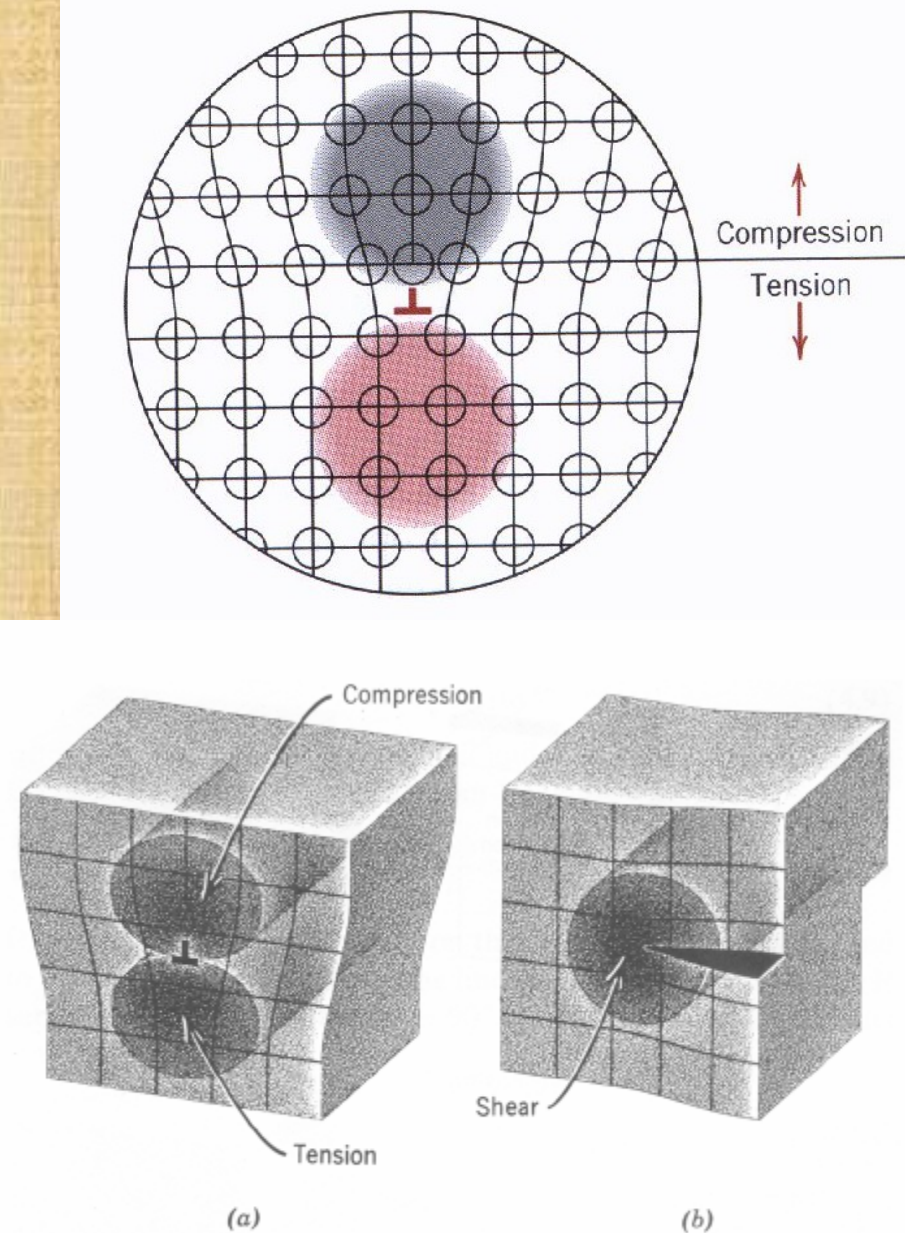
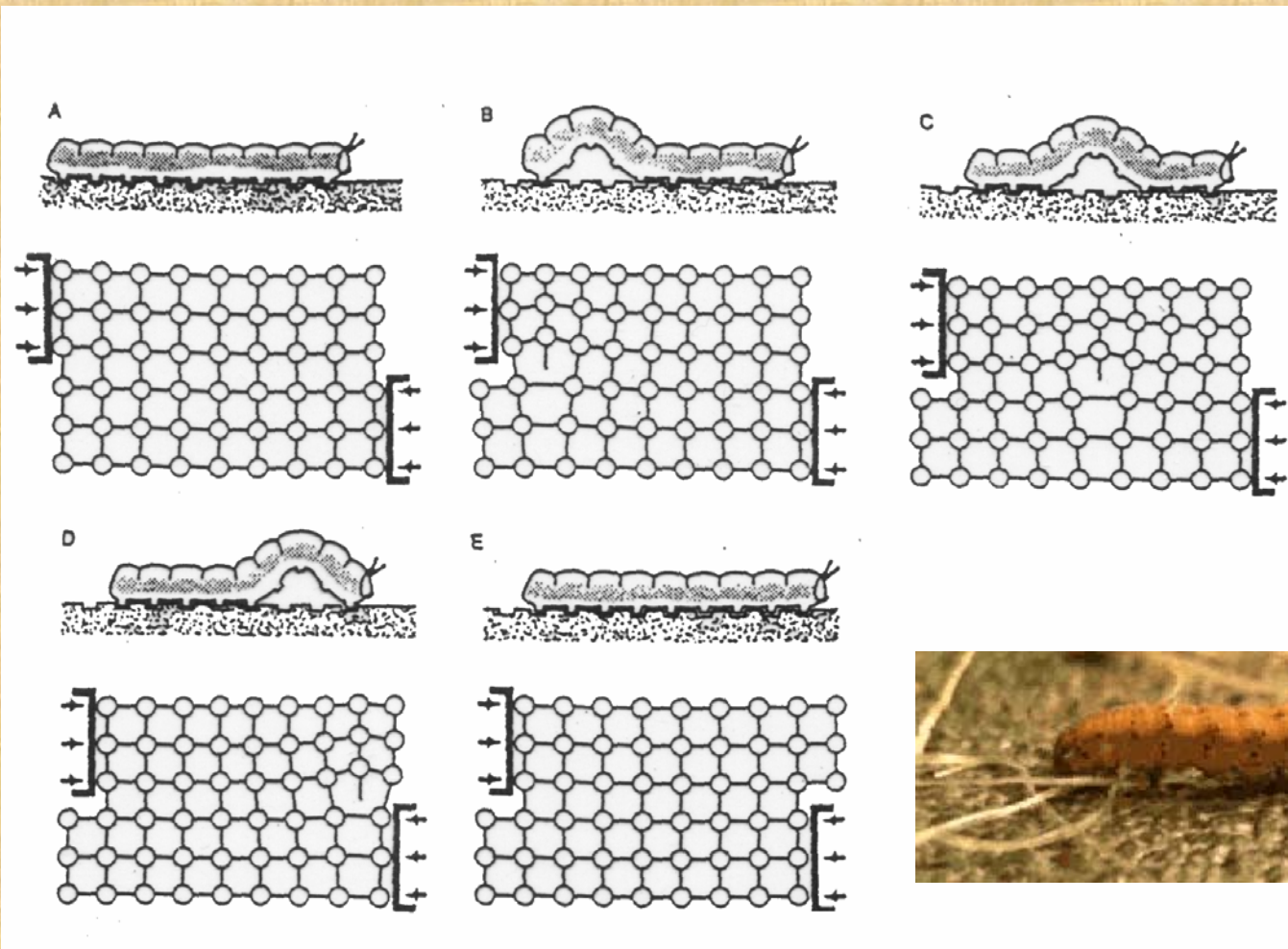
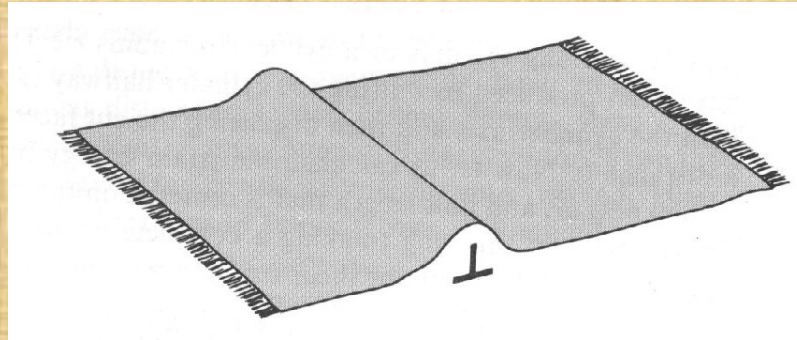
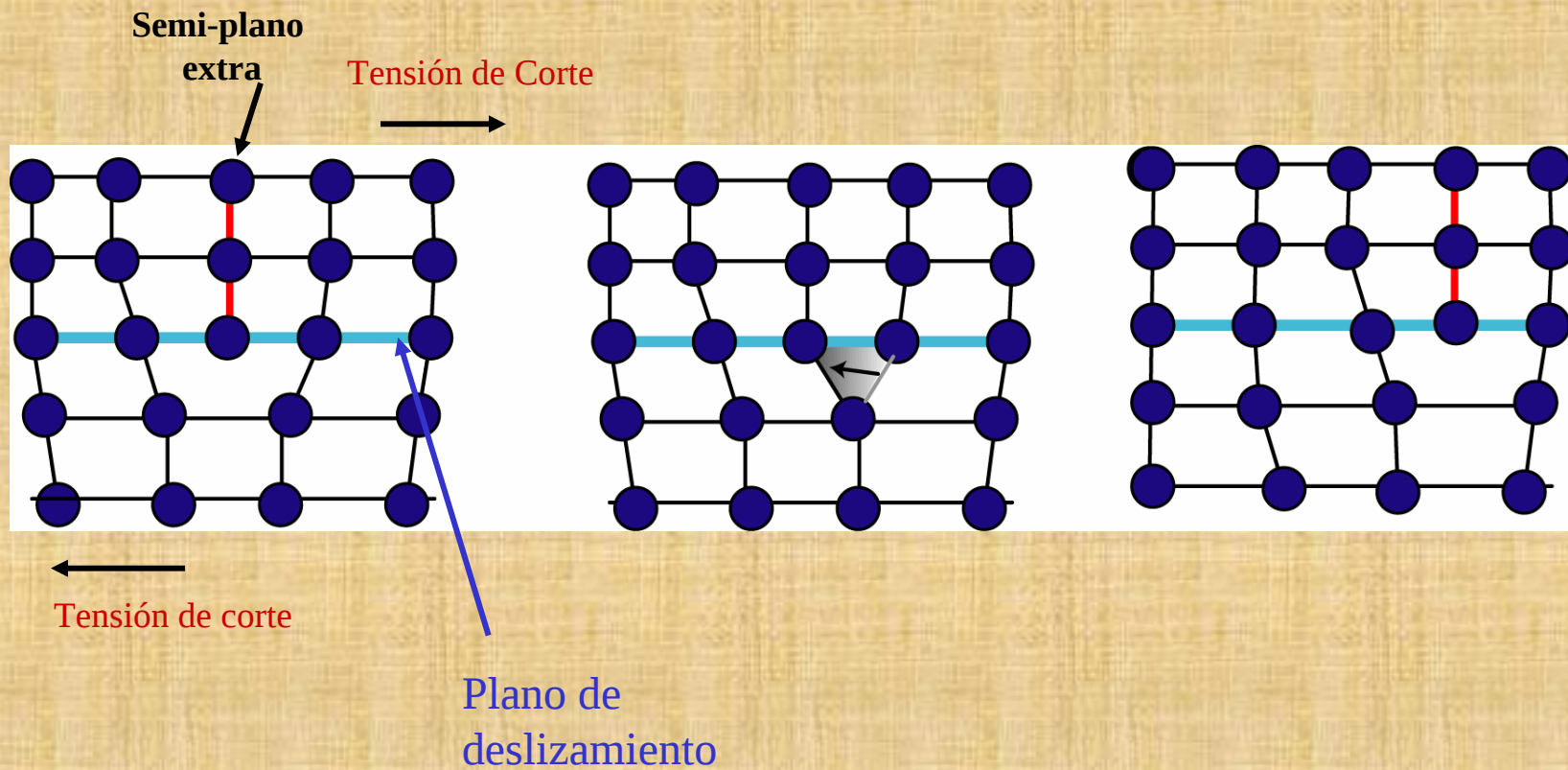


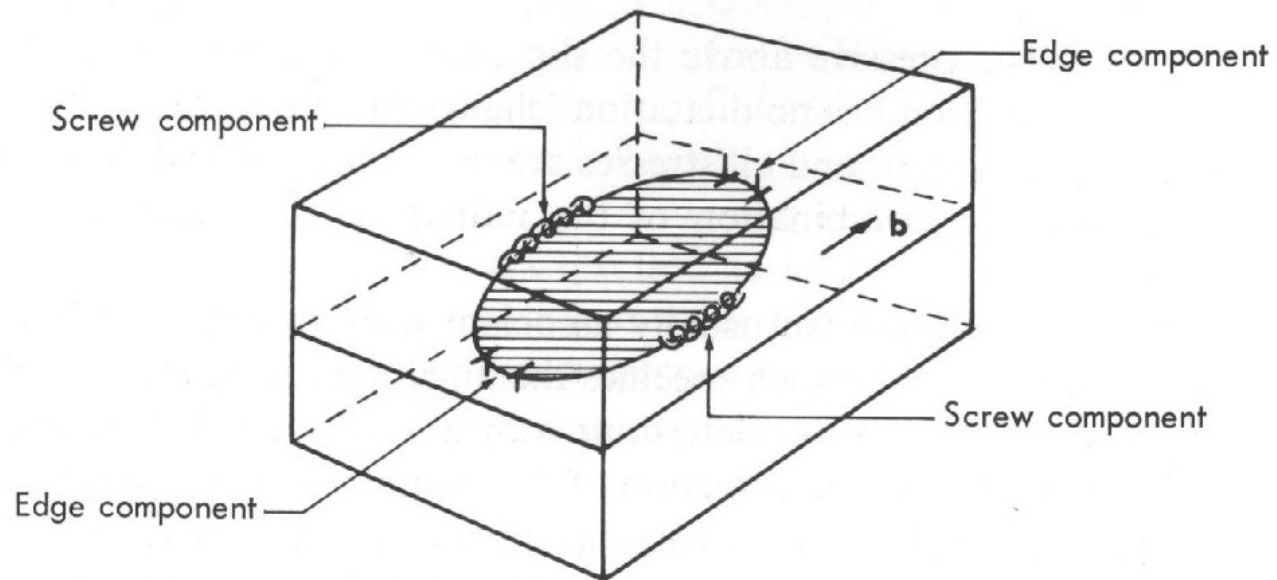
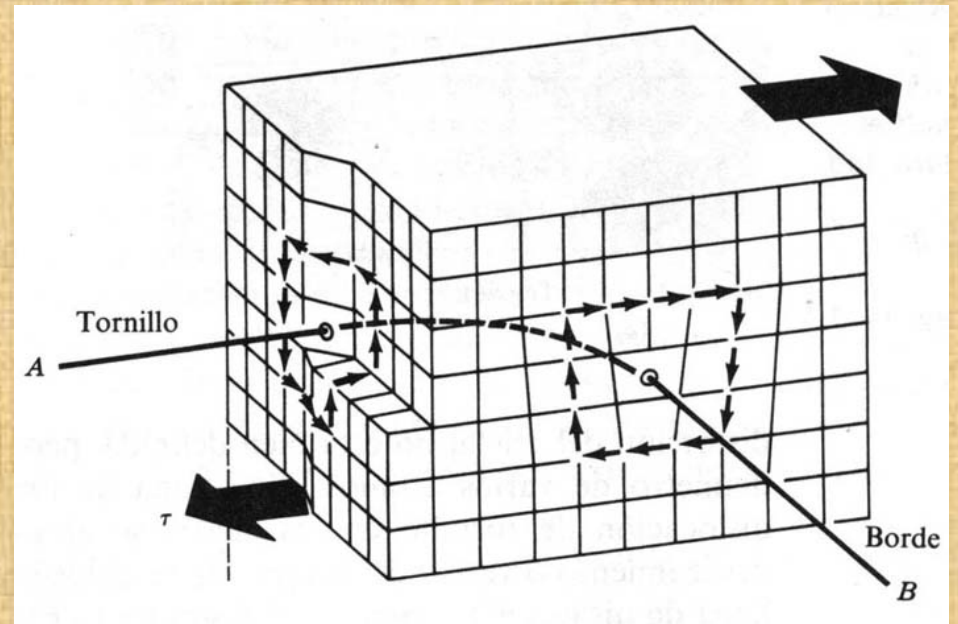
Figure 4.6 Geometry of stress and strain fields surrounding (a) an edge and (b) a screw dislocation.



Movimiento de una dislocación de borde

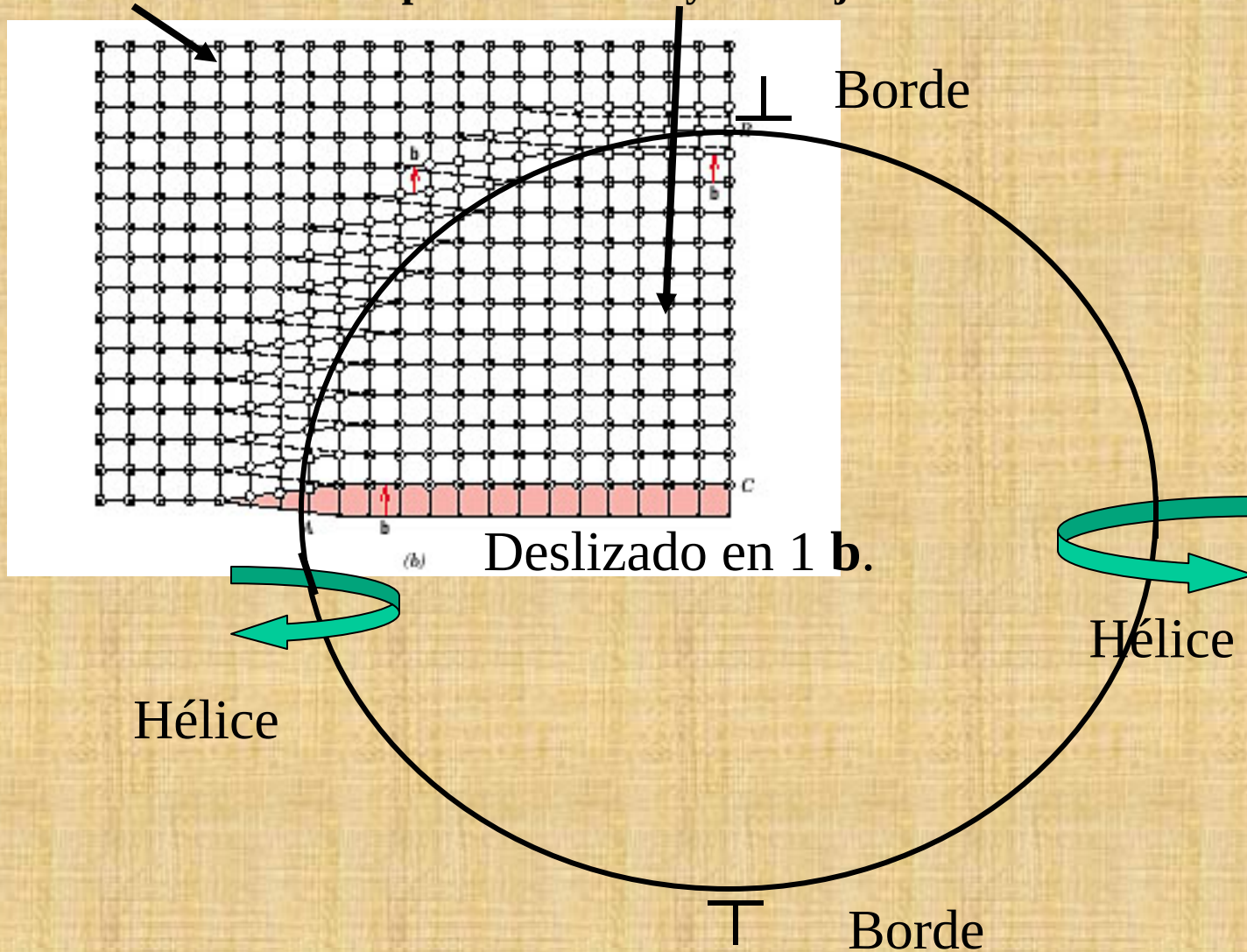


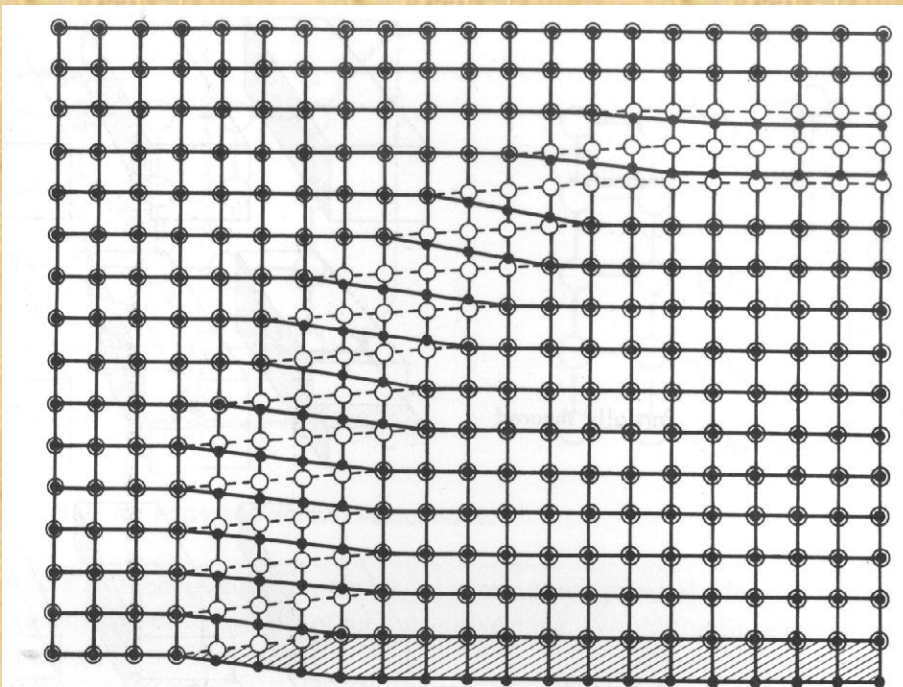
Lazo o bucle de dislocaciones



Lazos de Dislocaciones: Regiones deslizadas dentro del Lazo.

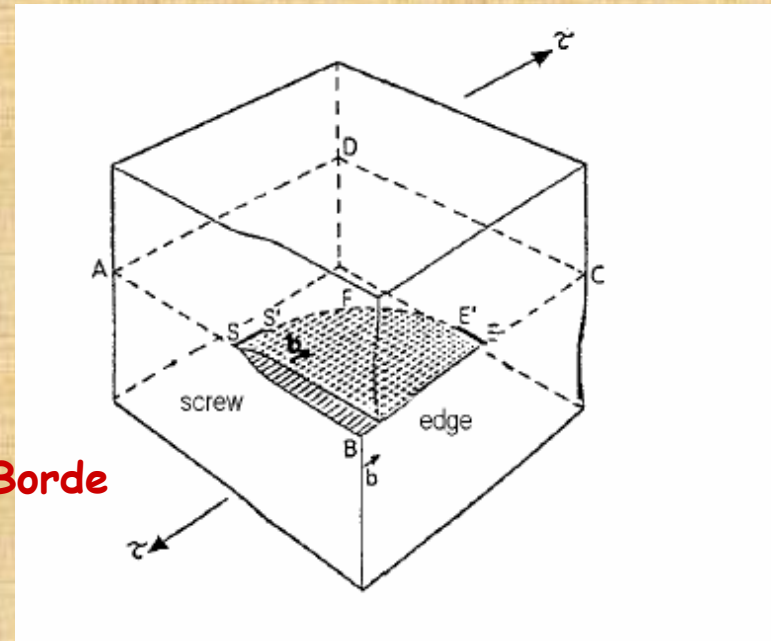
Los átomos de la parte de arriba y de abajo del cristal vuelven a estar alineados..

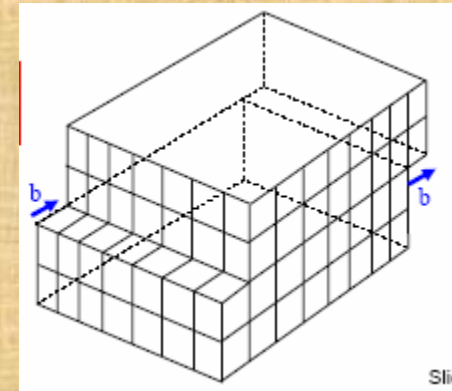
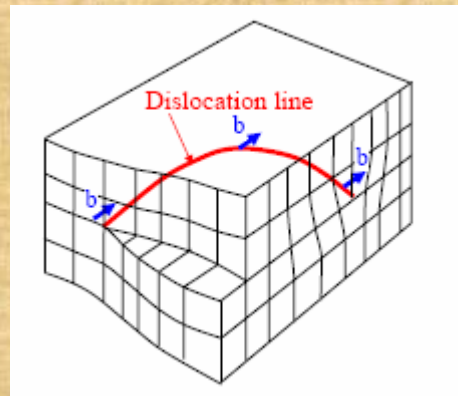
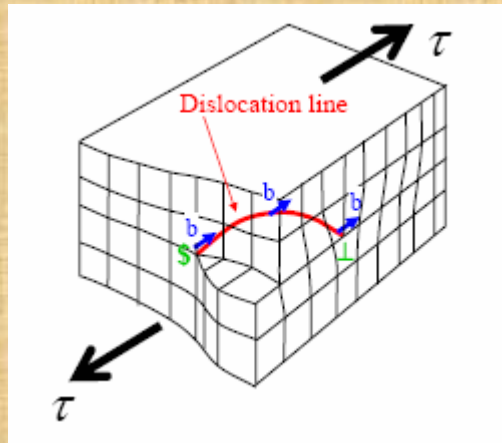




Hélice

- Átomos por encima del plano de deslizamiento
- Átomos debajo del plano de deslizamiento

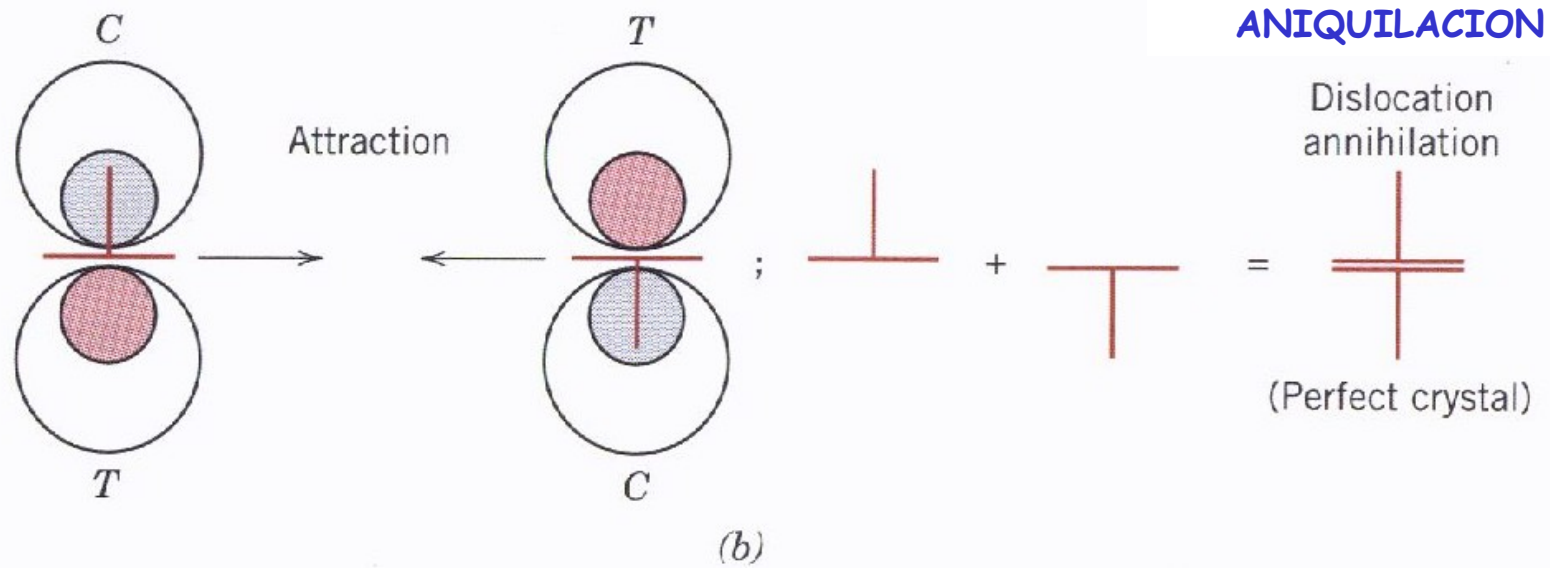
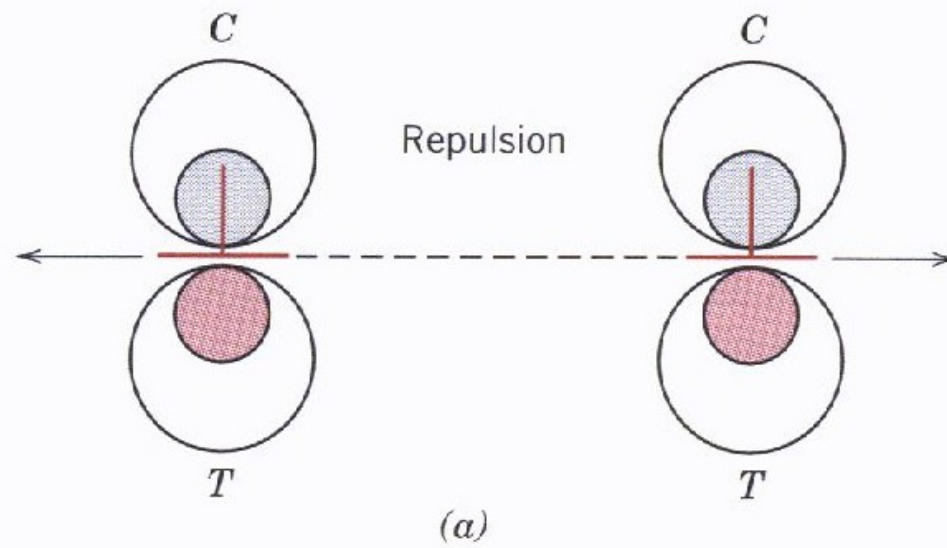




Las dislocaciones se mueven sobre planos de deslizamiento específicos.

Los planos de deslizamiento contienen ambos elementos: el vector de Burger de la dislocación y la línea de la dislocación.

Por lo general las dislocaciones son mixtas

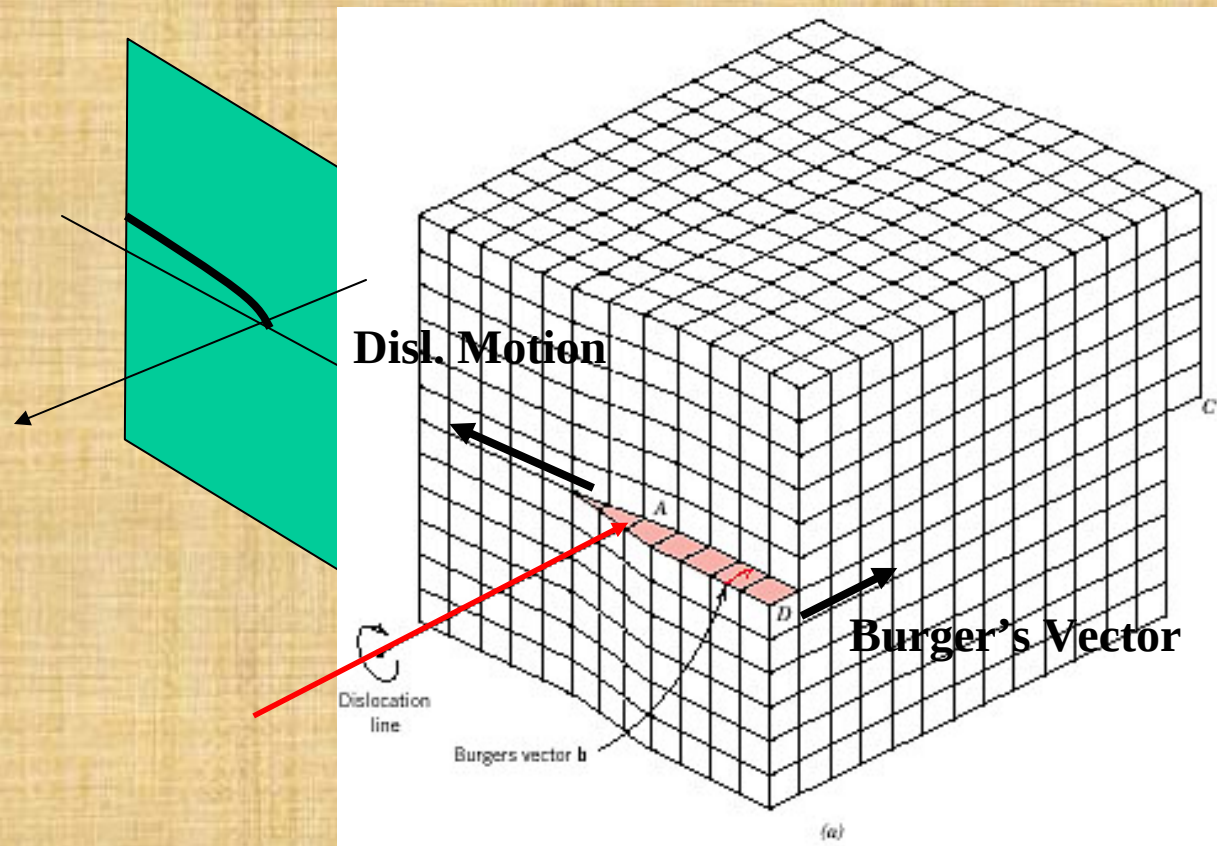


ANILQUILACION

Dislocation
annihilation

(Perfect crystal)

Cómo se aniquilan dos dislocaciones de hélice?



- Las observaciones directas pudieron realizarse recién a partir de 1950

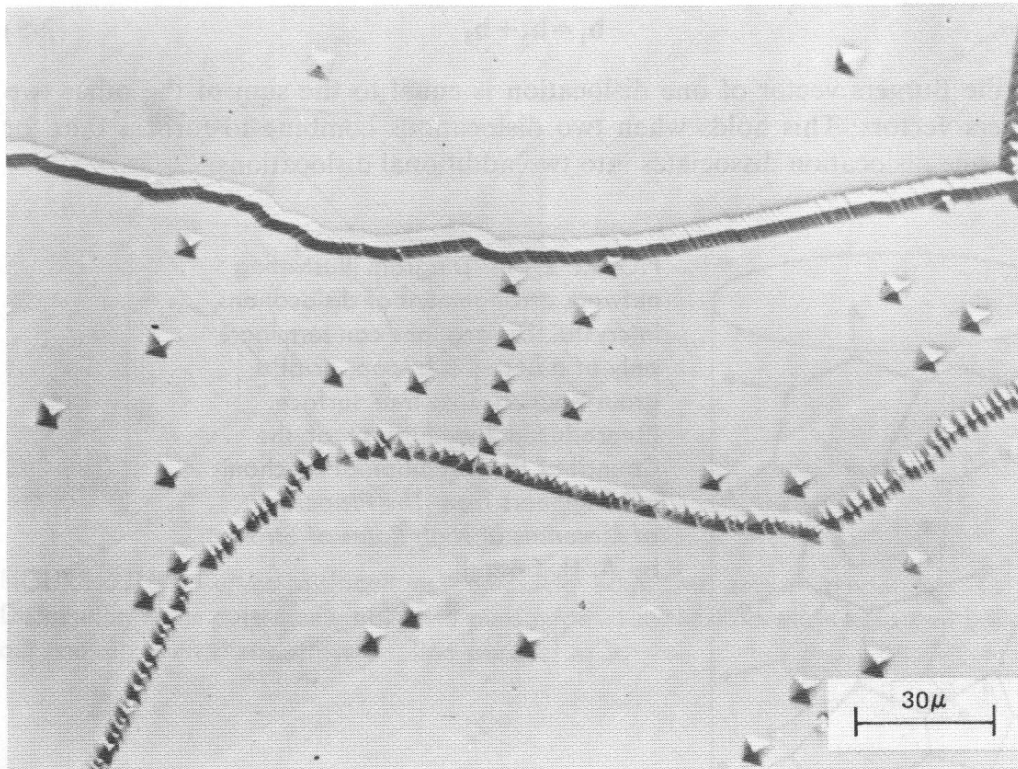


FIGURE 2.12 Etch pits on polished surface of lithium fluoride, each associated with an individual dislocation. The etch pit lineage indicates alignment of many dislocations in the form of low-angle boundaries (see Section 2.6). (From Gilman and Johnston,²³ reprinted by permission of General Electric Co.)

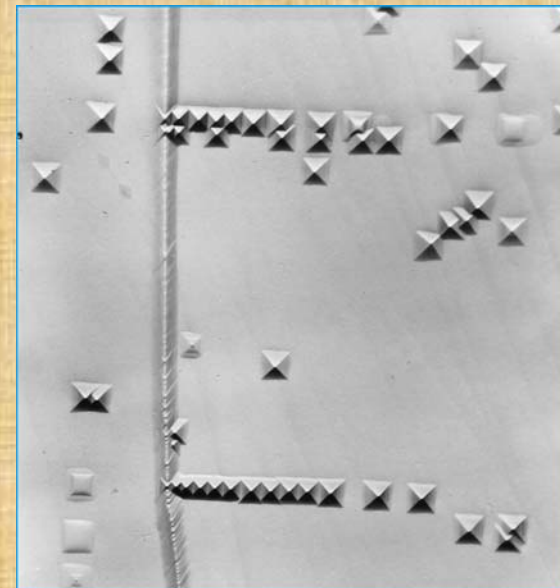
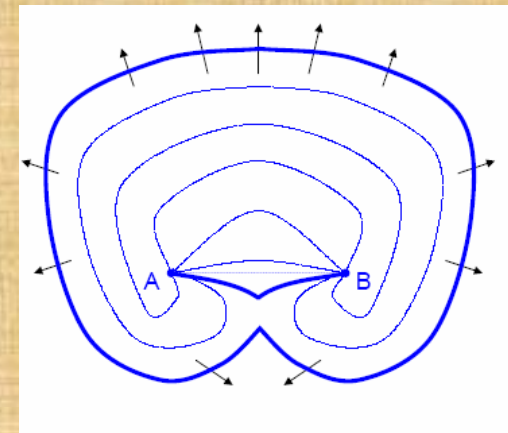
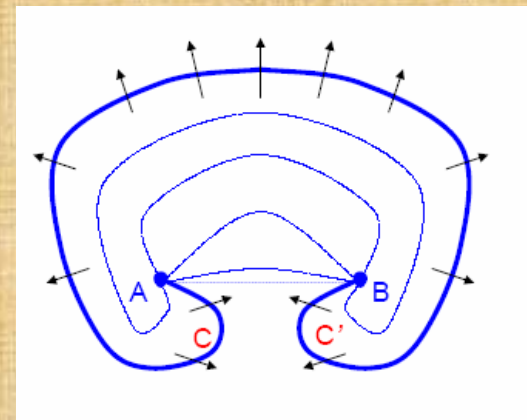
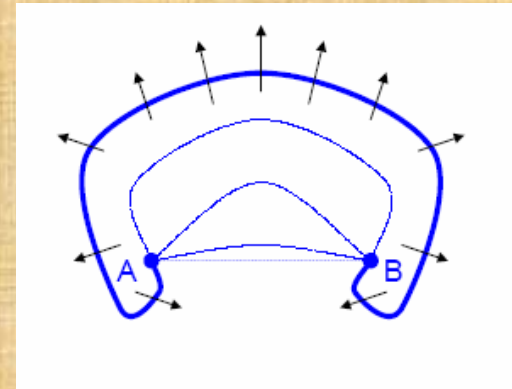
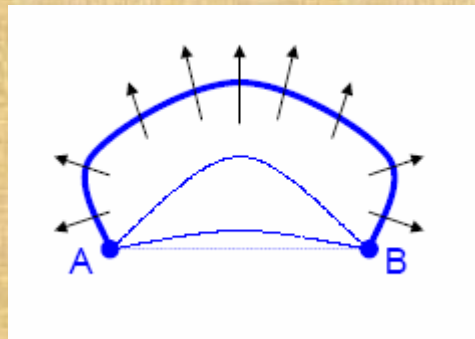
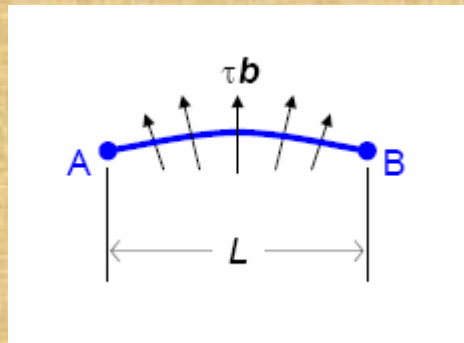
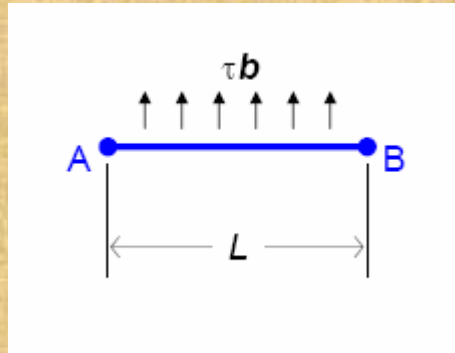


Imagen TEM de Dislocaciones en Ti Alloy



Fuente de Frank-Read



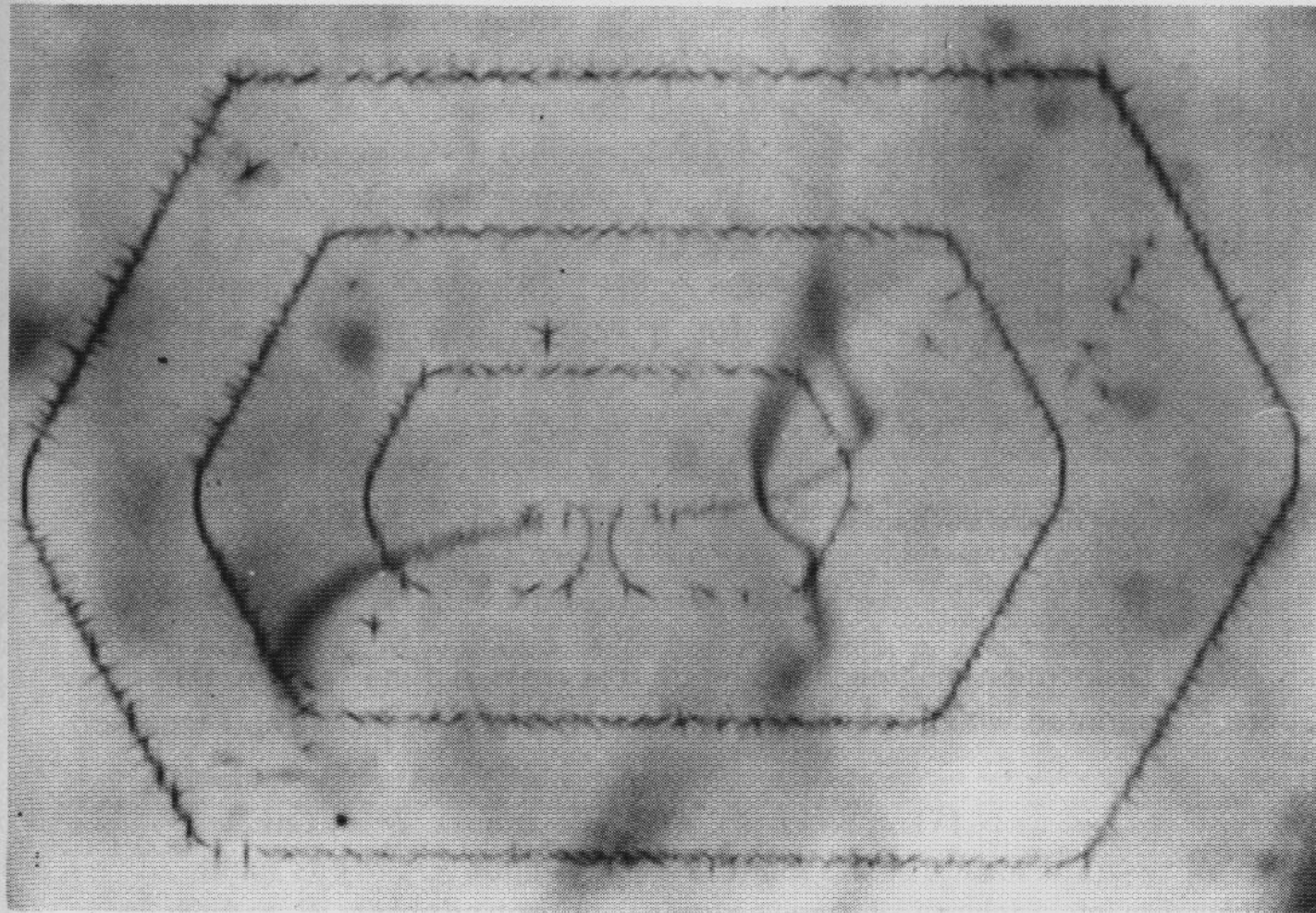
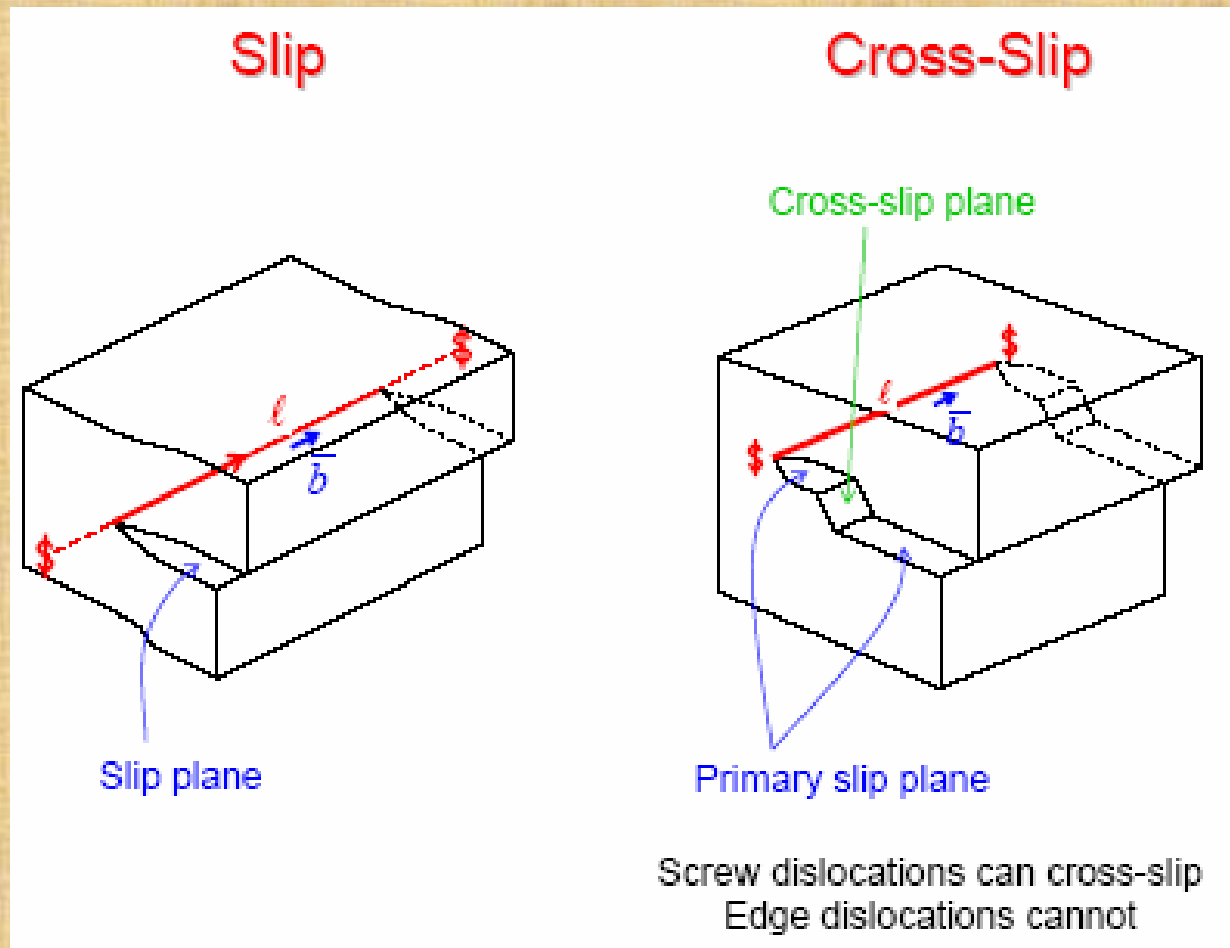
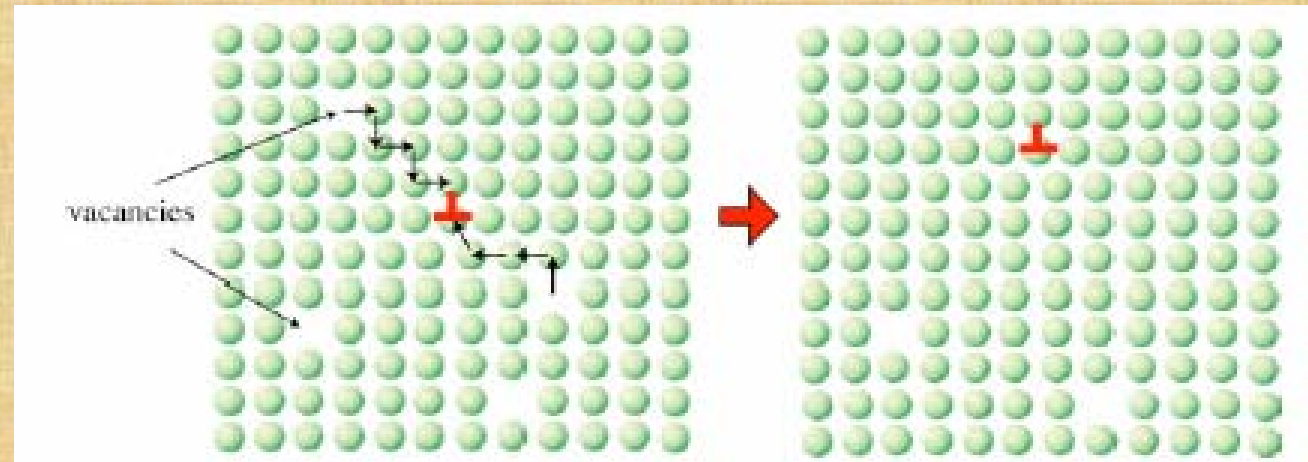


FIGURE 2.25 Photomicrograph showing Frank-Read source in silicon crystal. (From Dash,²⁰ reprinted with permission of General Electric Co.)

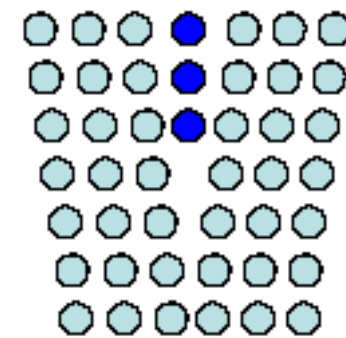
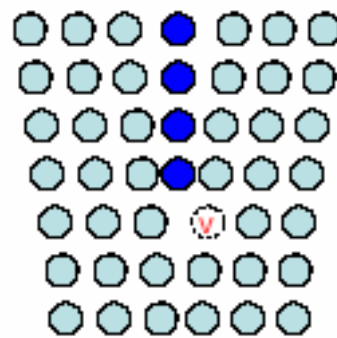
Movimiento de una dislocación de hélice



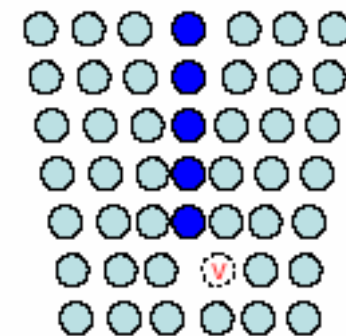
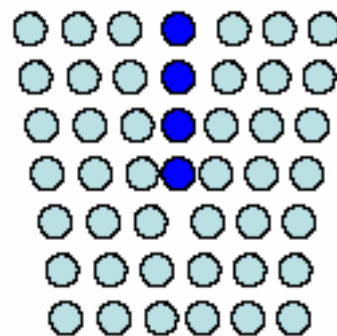
Trepado de una dislocación de borde



Climb

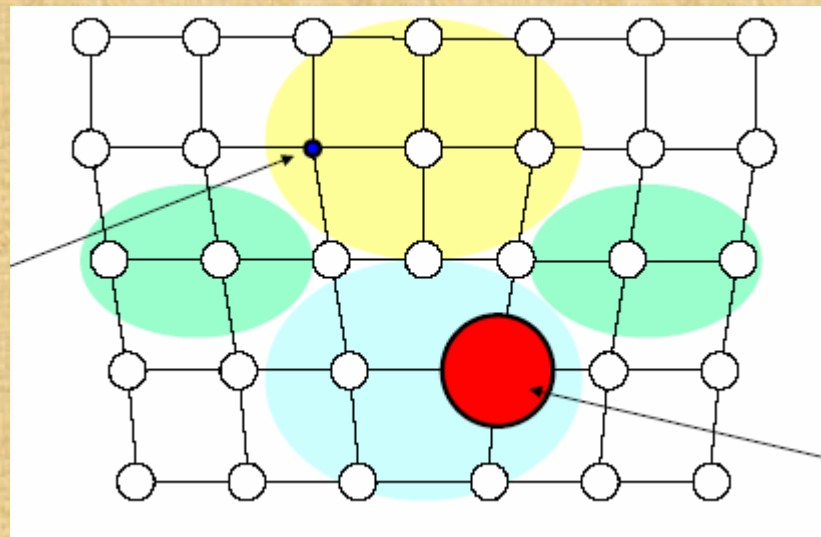


Climb of a dislocation to annihilate



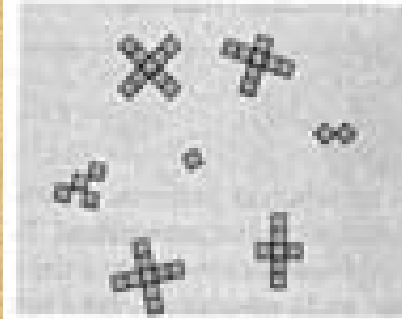
Interacción de solutos con las dislocaciones

Pequeños
solutos
segregan hacia
regiones bajo
compresión

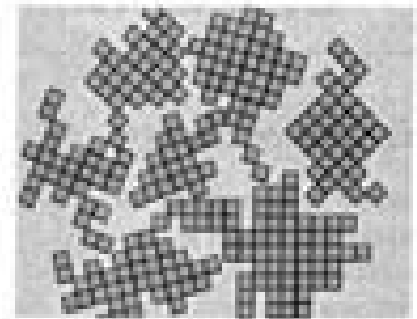


Grandes solutos
segregan hacia
regiones bajo
tracción

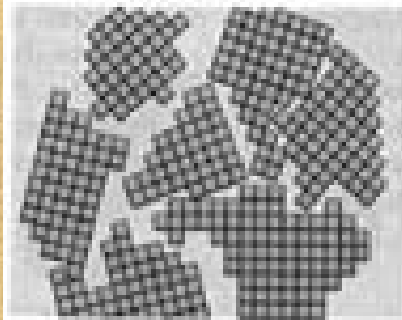
BORDES DE GRANO



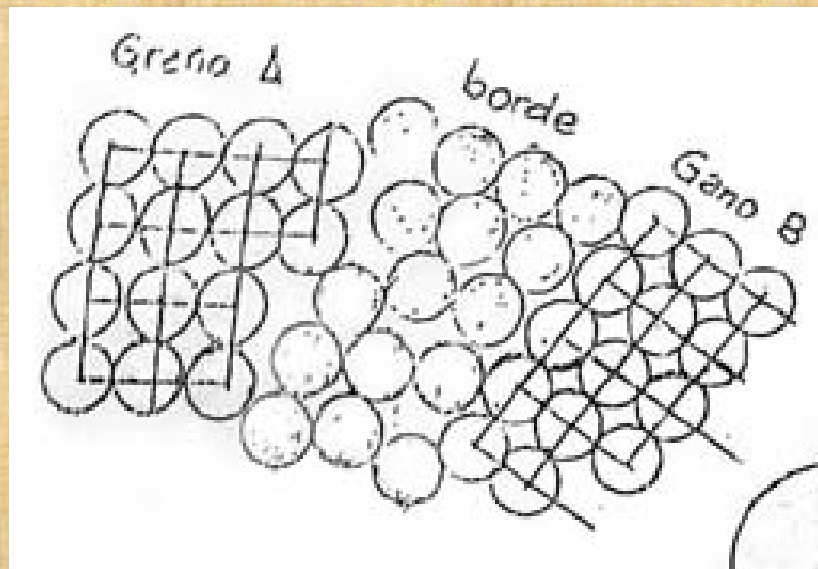
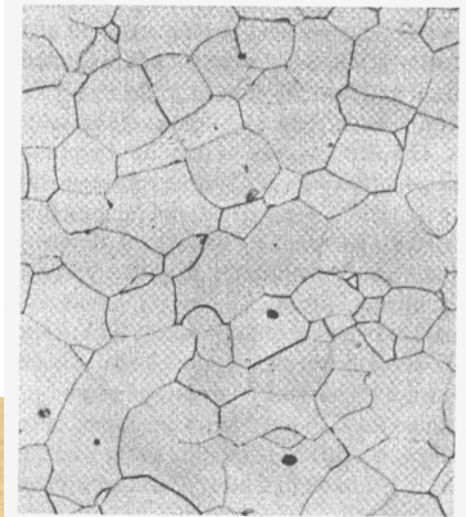
(a)



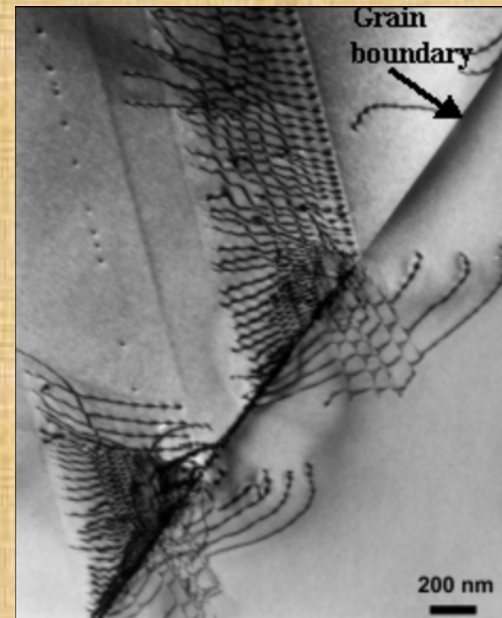
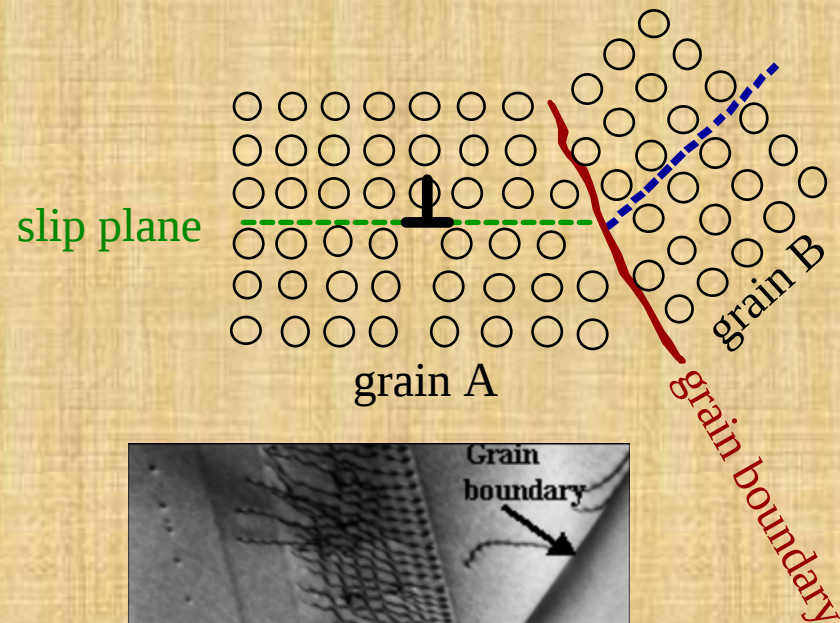
(b)



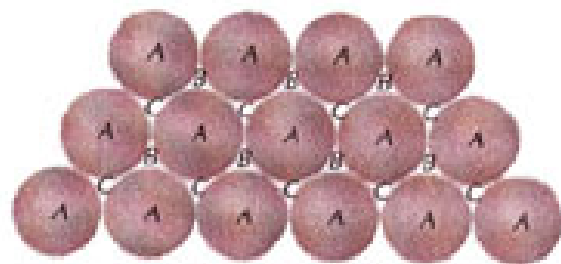
(c)



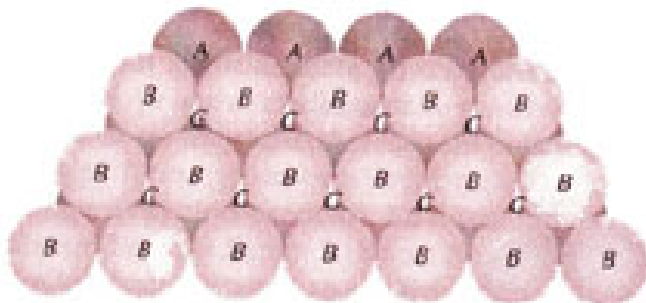
Interacción de dislocaciones con bordes de grano



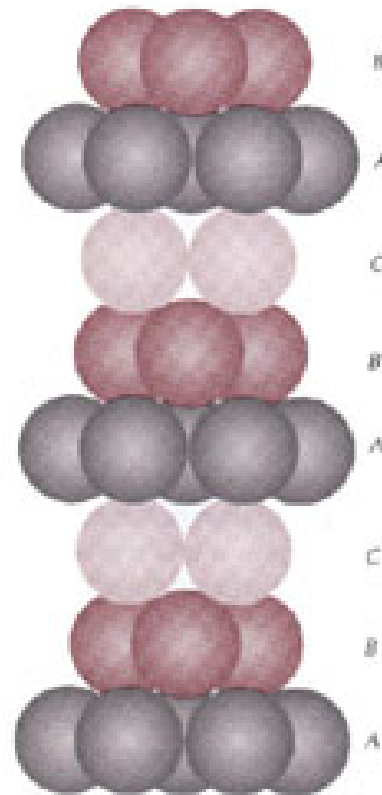
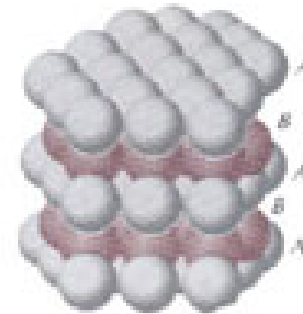
FALLAS DE APILAMIENTO



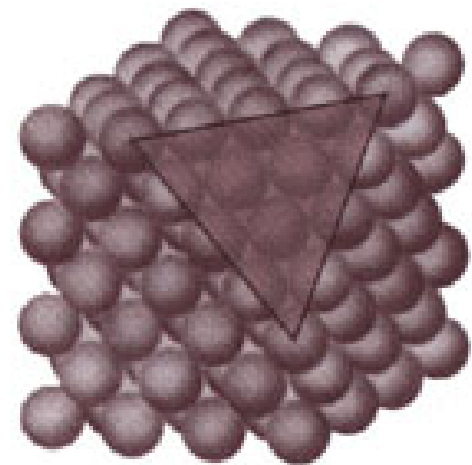
(a)



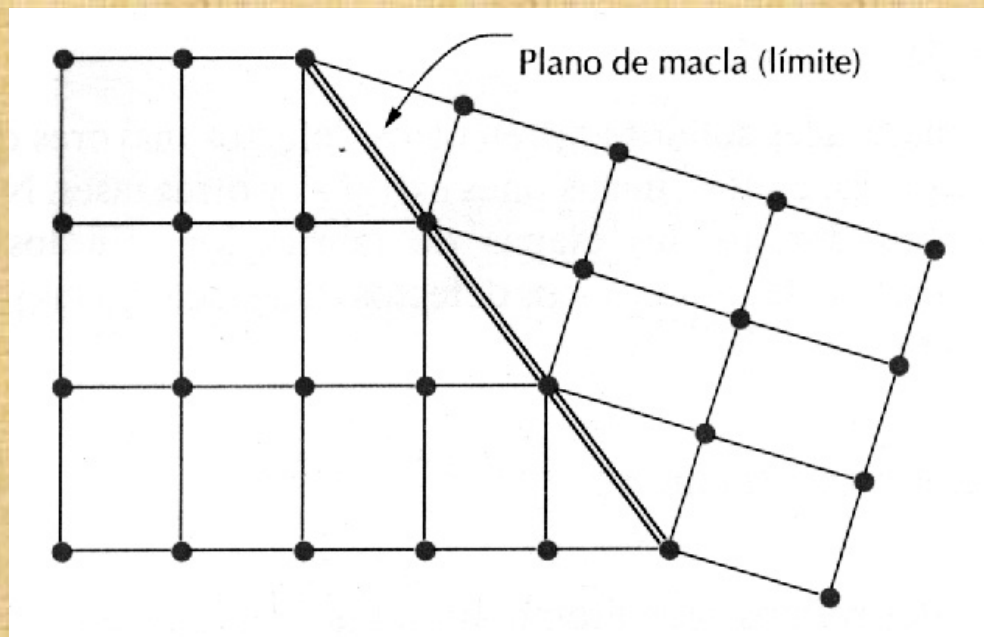
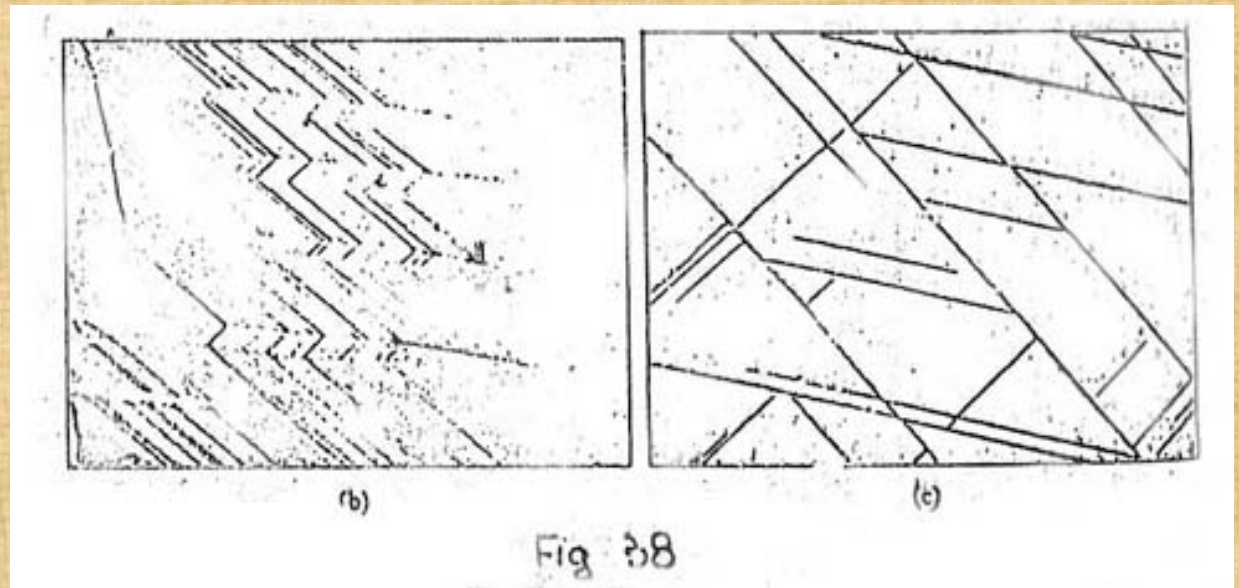
(b)



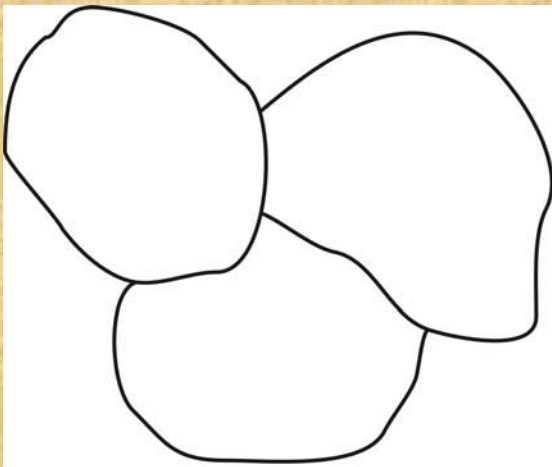
(c)



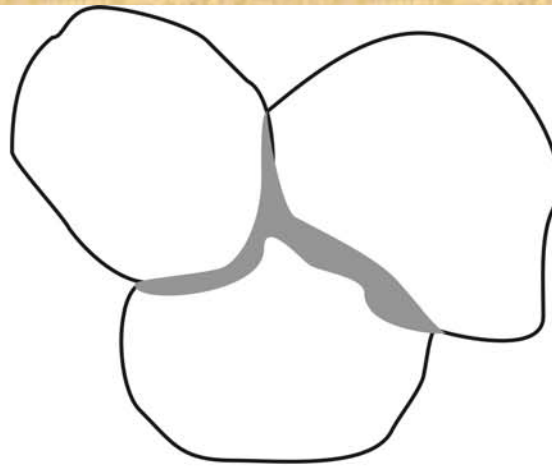
BORDES DE MACLA



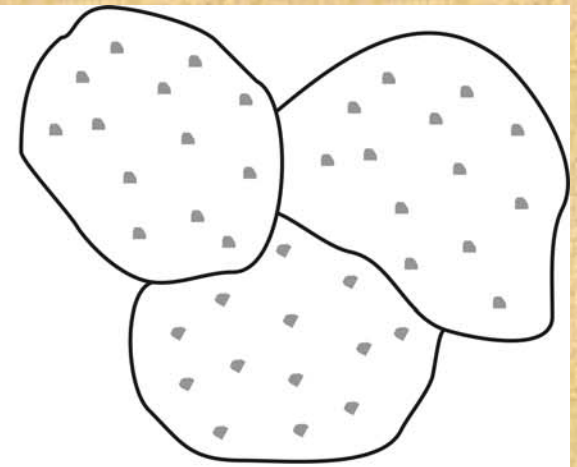
PRECIPITADOS



Granos de solución sólida α
(500 °C)



α y precipitado Θ en bordes de grano
(20°C)



α + Θ disperso en los granos
(20°C)

SPIKES

ZONAS DE
SEEGER

