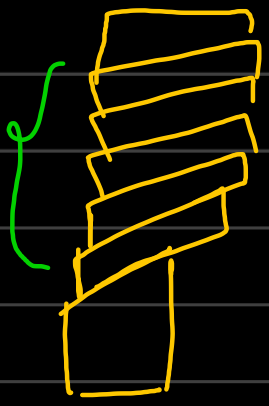
Lecture 12

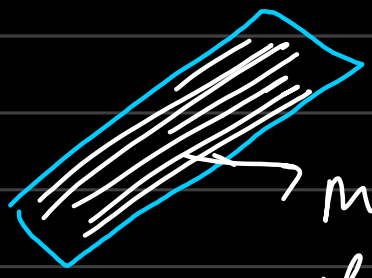
for a well annealed crystal:

$\rho = 10^{8} - 10^{10}\ m^{-2}$

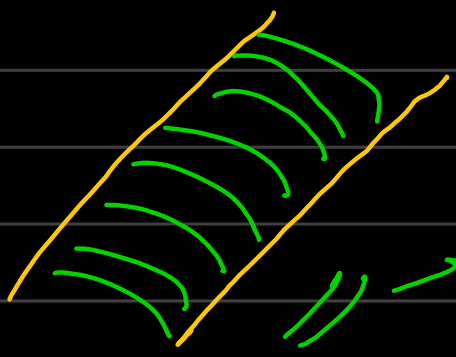
for a cold worked crystal: $\rho = 10^{12} - 10^{14}\ m^{-2}$

→ Slip Bands:



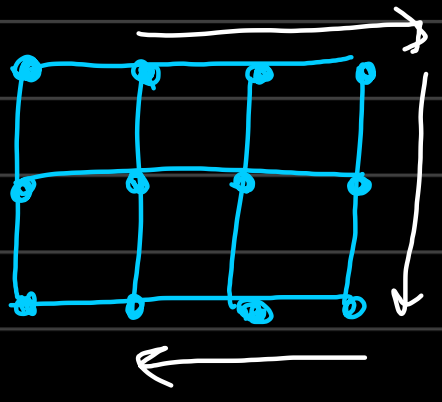


microscopic slip bands

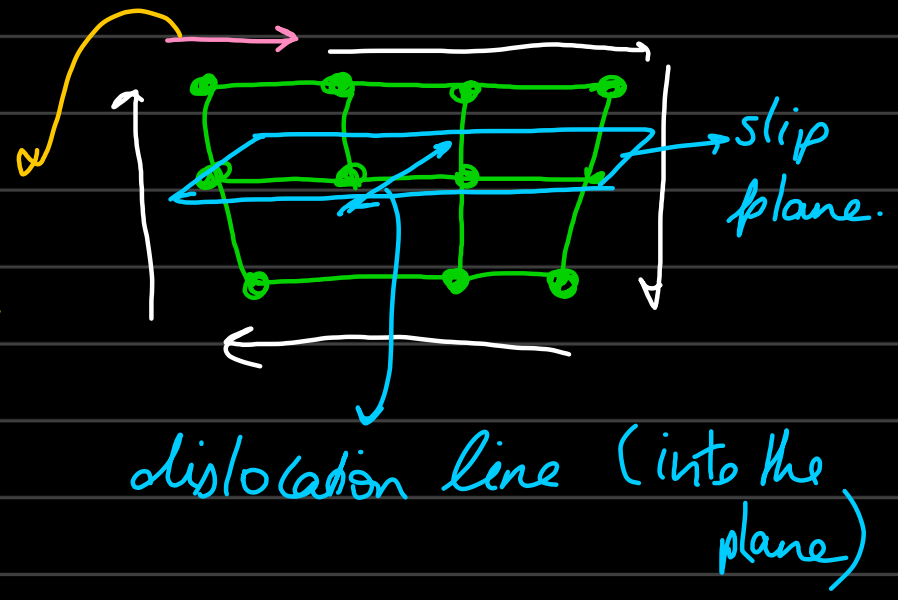


→ partial dislocations { leading and lagging pair }

Perfect Crystal:



Defect in crystal:



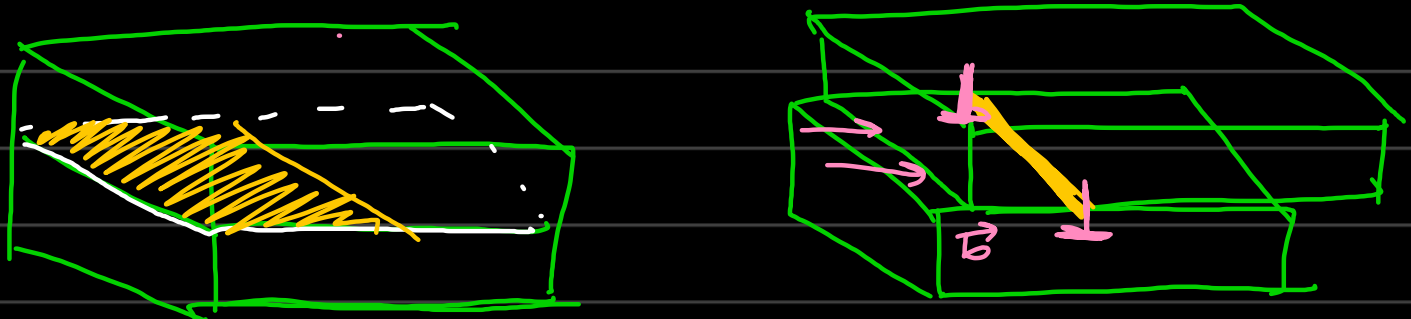
Movement of Dislocations:

1) Glide / Slip step.

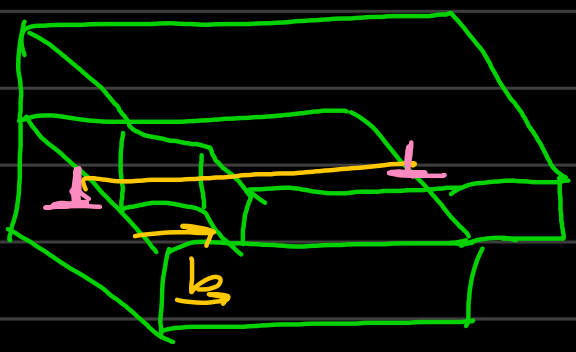
2) Climb

Schematic of a Zinc (HCP):

↳ before deformation. ↳ after deformation



{Dislocation anhilation}



Screw Dislocation:

* slip direction: $\parallel$ to $\vec{b}$ in both edge and screw

dislocation line: $\perp \vec{b} \Rightarrow$ edge

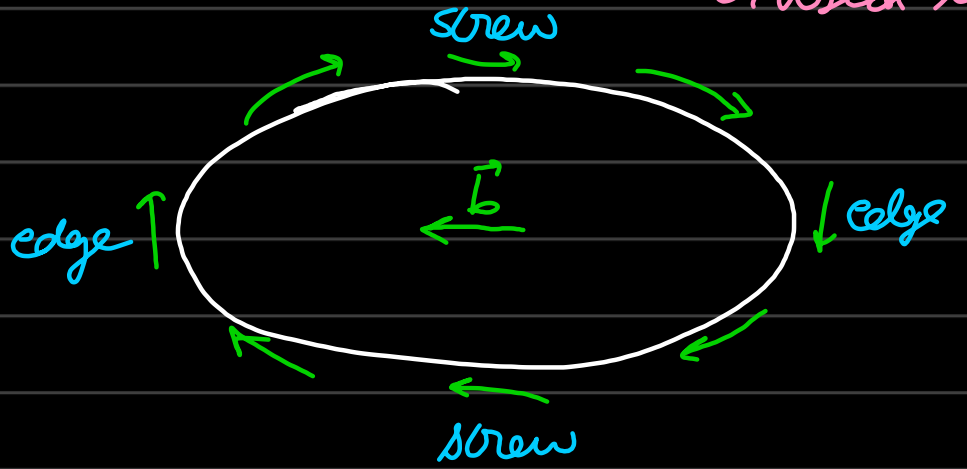
$\parallel \vec{b} \Rightarrow$ screw

not $\parallel$ nor $\perp$ to $\vec{b} \Rightarrow$ mixed.

dislocation line movement: $\parallel \vec{b} \Rightarrow$ edge

$\perp \vec{b} \Rightarrow$ screw

* Mixed dislocation: observed in nuclear materials.
is used in nuclear reactors.



dislocation loop

* Permanent Magnets: SmCo, NdFeYB.

* Edge dislocation requires a slip plane to move.
  ↳ plane formed by $\vec{b}$ and $\vec{t}$

* A screw dislocation does not require a slip plane to move.

→ Glide is a conservative movement
Climb is non-conservative.

↳ glide happens at high temperatures.