Day - 23

→ Geometry of Ds → how Ds is formed

$\vec{b}$ and $\vec{t}$ and the relation between them defines a type.

→ Plastic deformation: motion of Ds → because a stress is applied

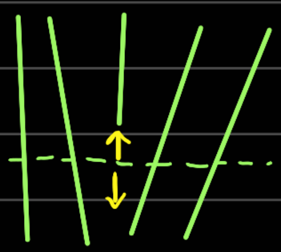
(annihilation of Ds)

→ Glide → conservative (rearrangement of bonds at the core of the Ds)

→ Climb → non-conservative (⊥ to Burgers' vector)

↓

Thermally activated



↑ : +ve climb

↓ : −ve climb

vacancy

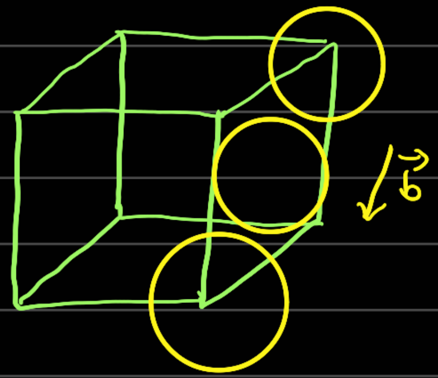
→ Glide of several Ds leads to slip.

→ Boundary between regions of the crystal that have slipped and regions that have not slipped

→ Surface step

→ Plane on which slip occurs is the one that contains the line vector and the Burgers' vector

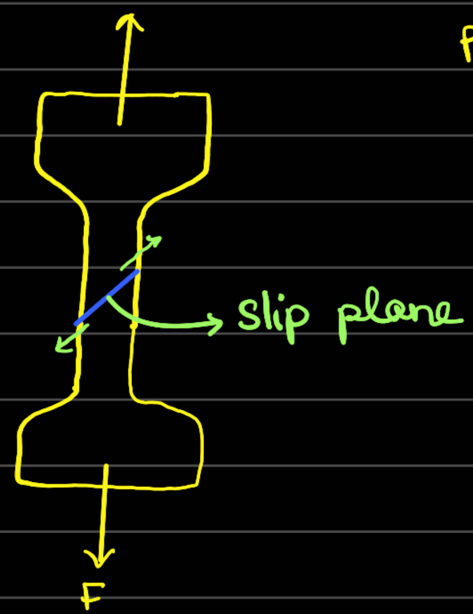
→ Slip system = slip direction + slip plane
→ Burgers' vector defines the slip direction
→ Slip plane is close-packed.
→ slip direction is close-packed in that plane



$E \propto |\vec{b}|^2$

→ microscopic aspects/physical model (is what we saw till now).

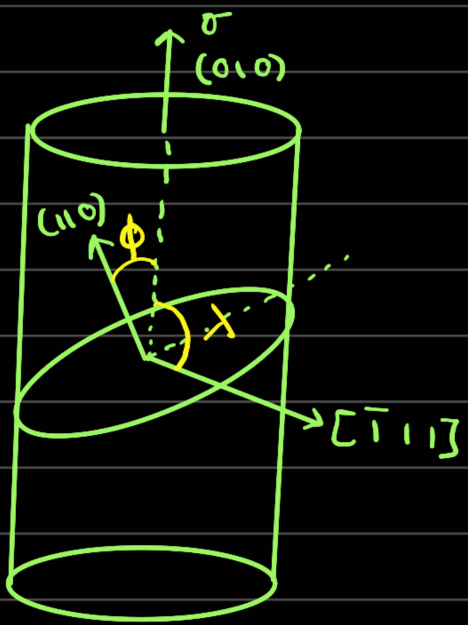
→ Universal Testing Machine (UTM) –



Peierls – Nabarro stress
↓
stress need to move a DS.

→ Single crystal (BCC Fe)
Tensile stress on (010)
Slip initiated in a slip system
τ_{CRSS} = 30 MPa

compute RSS when tensile stress of 52 MPa is applied and the yield strength.



Ans.)

$$\cos\phi = \frac{(110).(010)}{|(110)|.|(010)|} = \frac{1}{\sqrt{2}}$$

$$\cos\lambda = \frac{(010).[\bar{1}11]}{|(010).[\bar{1}11]|} = \frac{1}{\sqrt{3}}$$

$\sigma = 52$ MPa

$$\tau_{RSS} = 52 \times \frac{1}{\sqrt{2}} \times \frac{1}{\sqrt{3}} = 21.23 \text{ MPa}$$

(< 30 MPa)

↓

No slip

$$\text{Yield strength} = \frac{30}{\frac{1}{\sqrt{2}} \times \frac{1}{\sqrt{3}}} = 73.485 \text{ MPa}$$