3.40J / 22.71J
Modern Physical Metallurgy

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Lecture 6: Dislocation self-energy and interactions

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Dislocation identification

Dislocation line ξ and dislocation Burgers vector completely define the dislocation, telling you where and how easily it will move.

Dislocation line ξ:
   defines the long dimension of the extra half-plane

Dislocation slip direction **b**:
        defines the vector that closes a complete circuit of lattice
                sites in an imperfect crystal
        defines the direction of atomic motion during deformation

> RHFS Convention (only):
>   Draw RH circuit that contains dislocation
>   Draw vector from finish point to start point = **b**
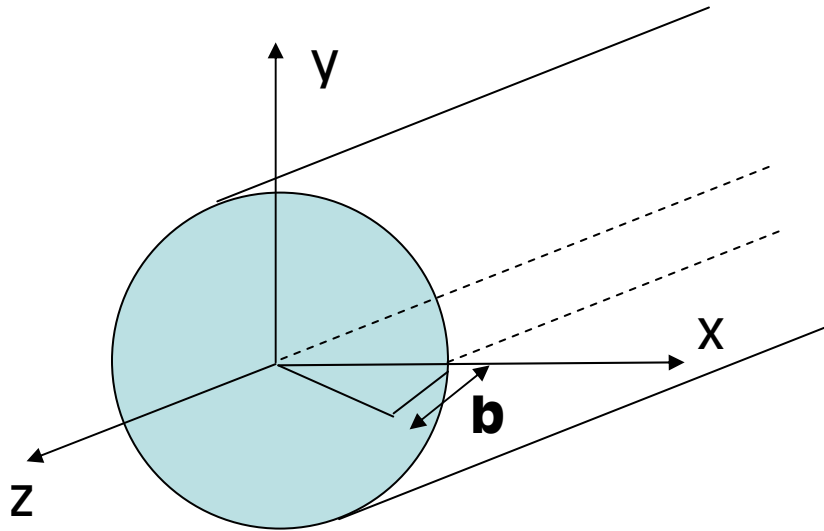
Go to next slide and show the circuit

How edge and screw are different:

Edge	**b** perpendicular to ξ
	moves parallel to **b**
Screw	**b** parallel to ξ
	moves perpendicular to **b**

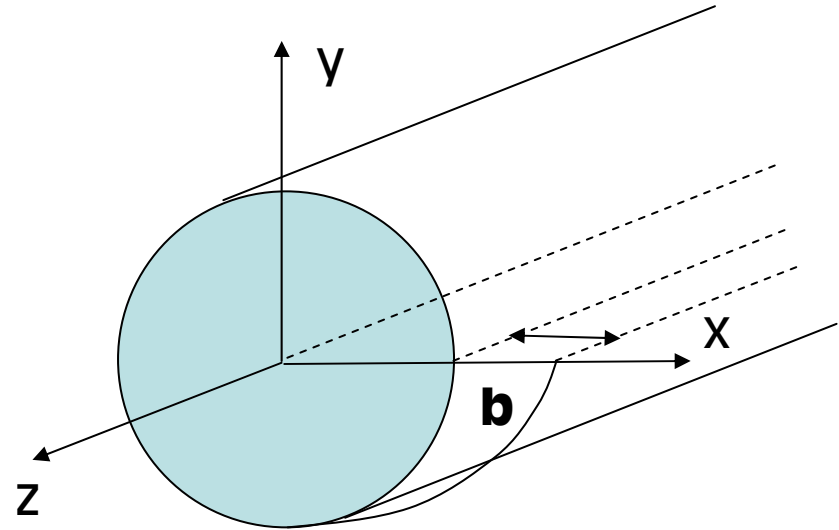Burgers vector
b

Edge dislocation line
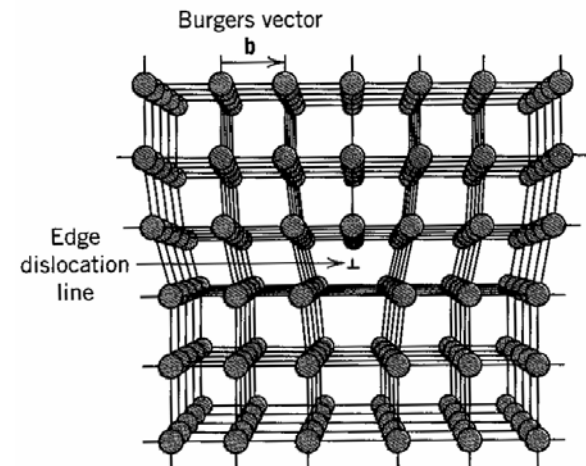
Elastic energy of dislocation:

Distortion around straight dislocation is like a cylinder of strained material
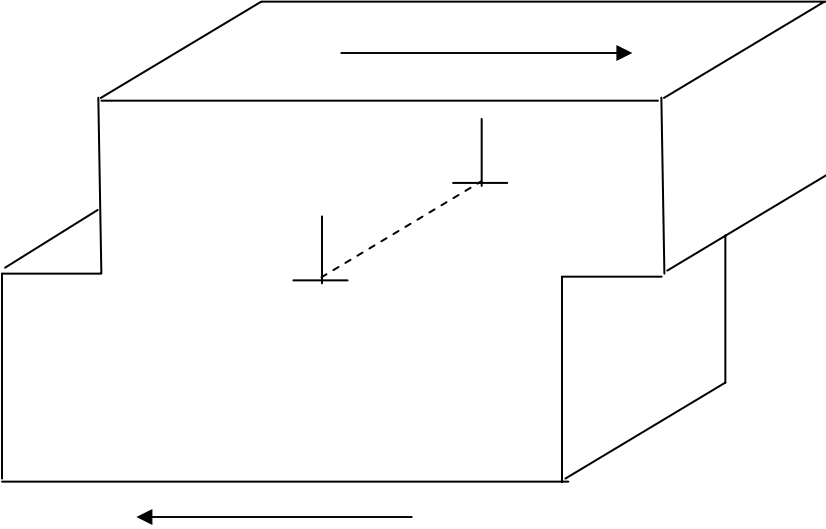

Screw dislocation displacement field:

Edge dislocation displacement field:

Force acting on a dislocation:

Peach-Kohler formulation for calculating effects of stress acting on a dislocation line:
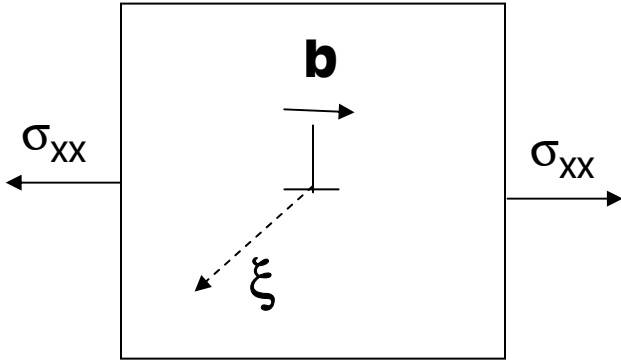
Mental process:

      (1)

      (2)

      (3)

If a uniform stress S acts on the dislocation line, it does work:

Example of Peach-Kohler:

How does a dislocation move in the presence of a tensile stress σ_{xx}?

Application to metals:

(1) Hydrogen embrittlement:

(2) Serrated yielding: