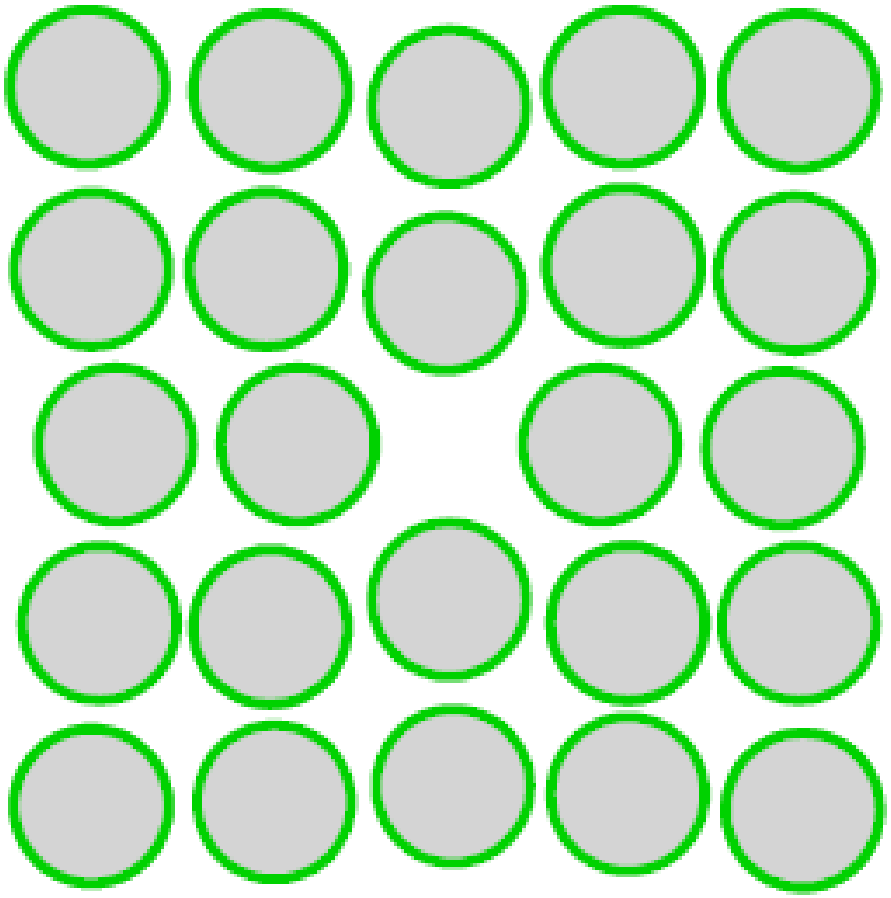
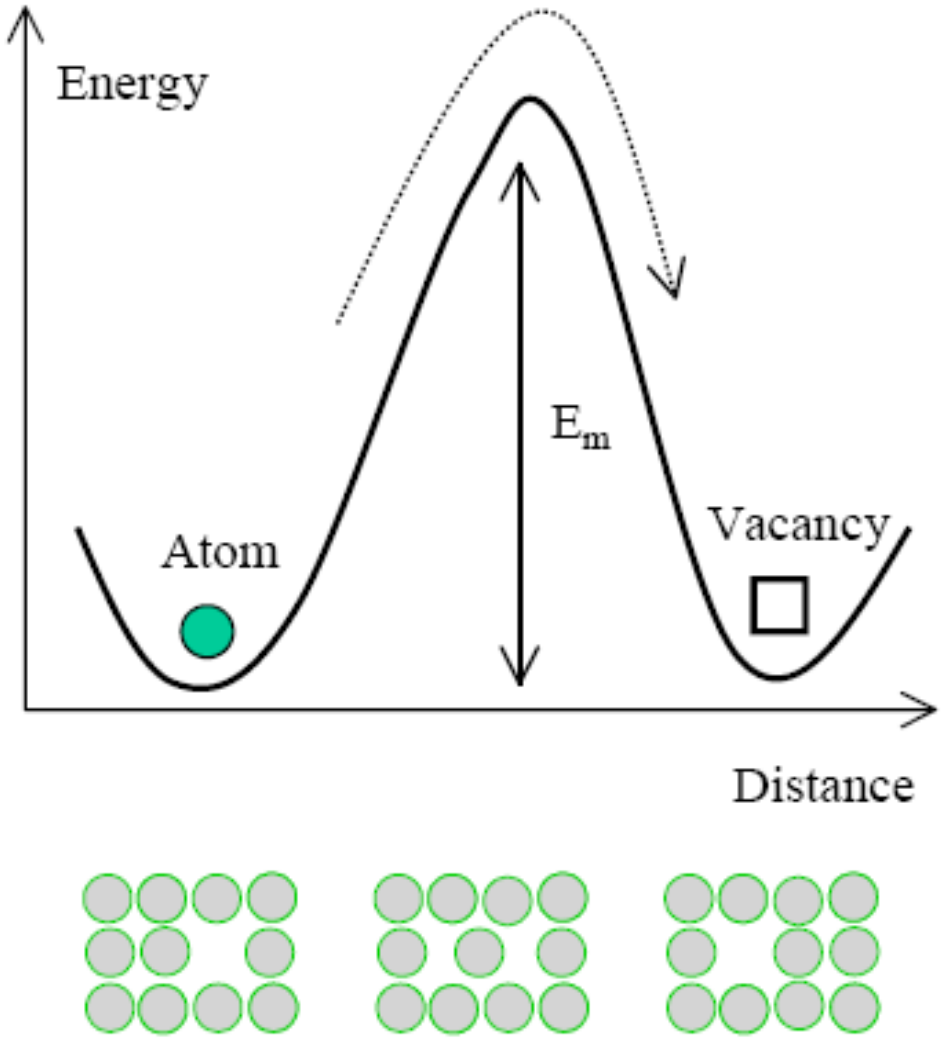
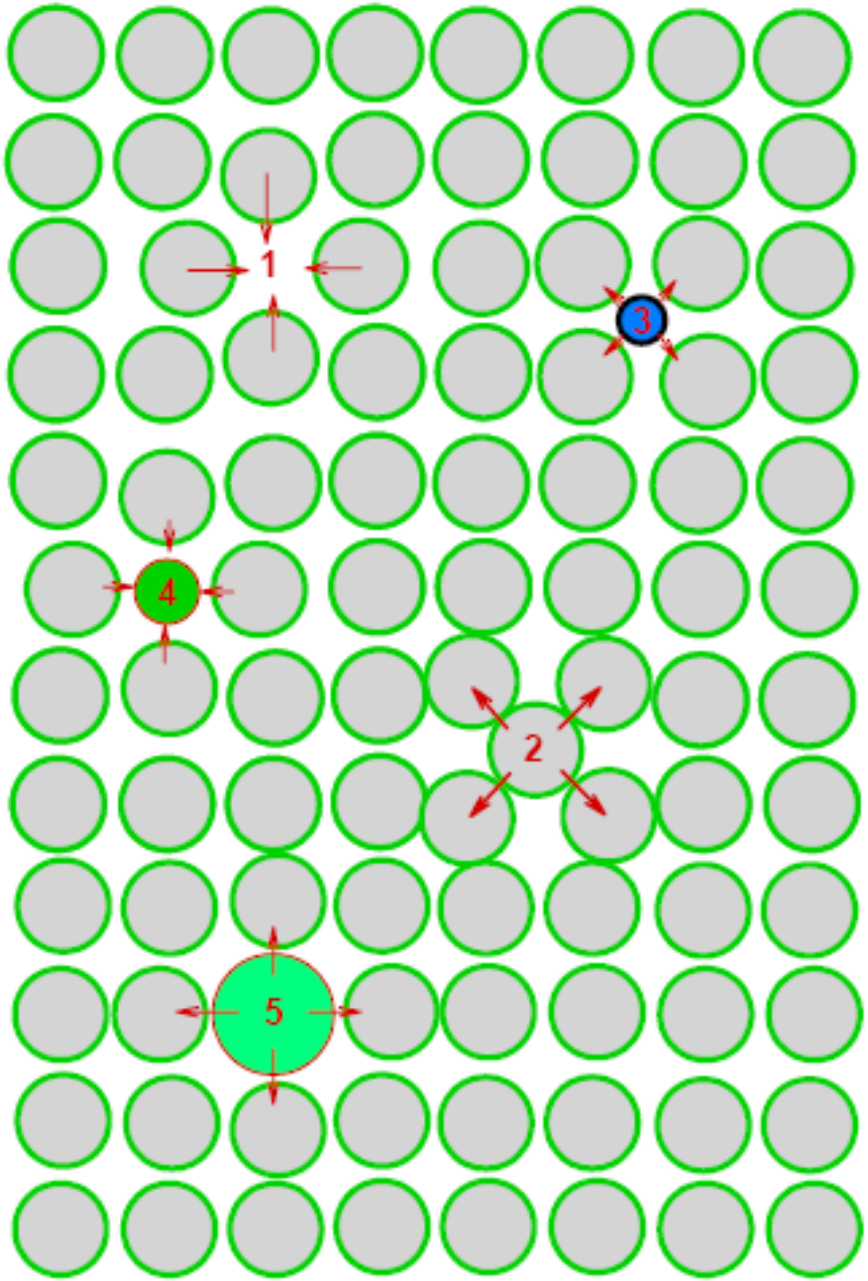
CRYSTAL DEFECTS



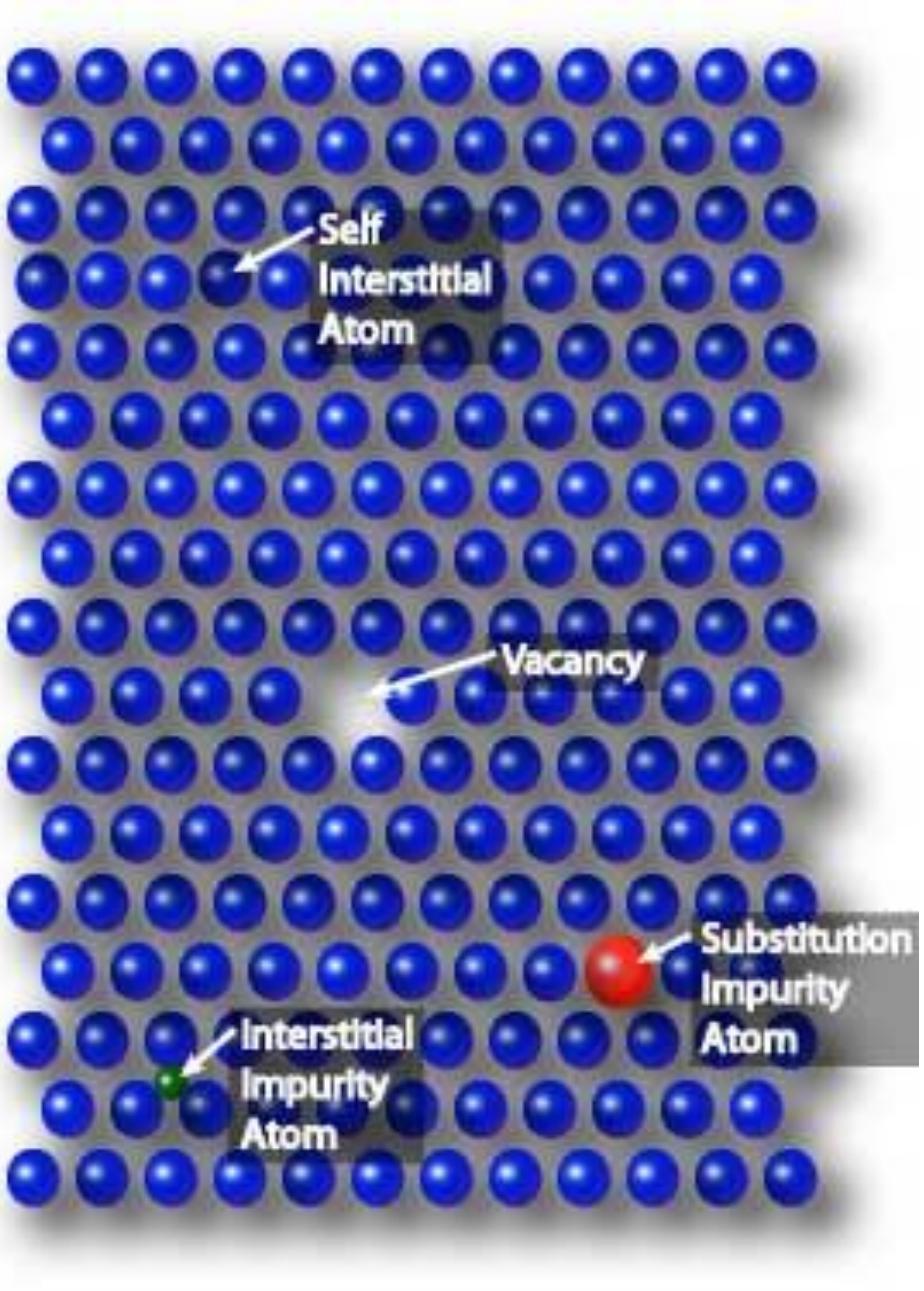
$$N_v = N_s \exp\left(-E_v / k_B T\right)$$

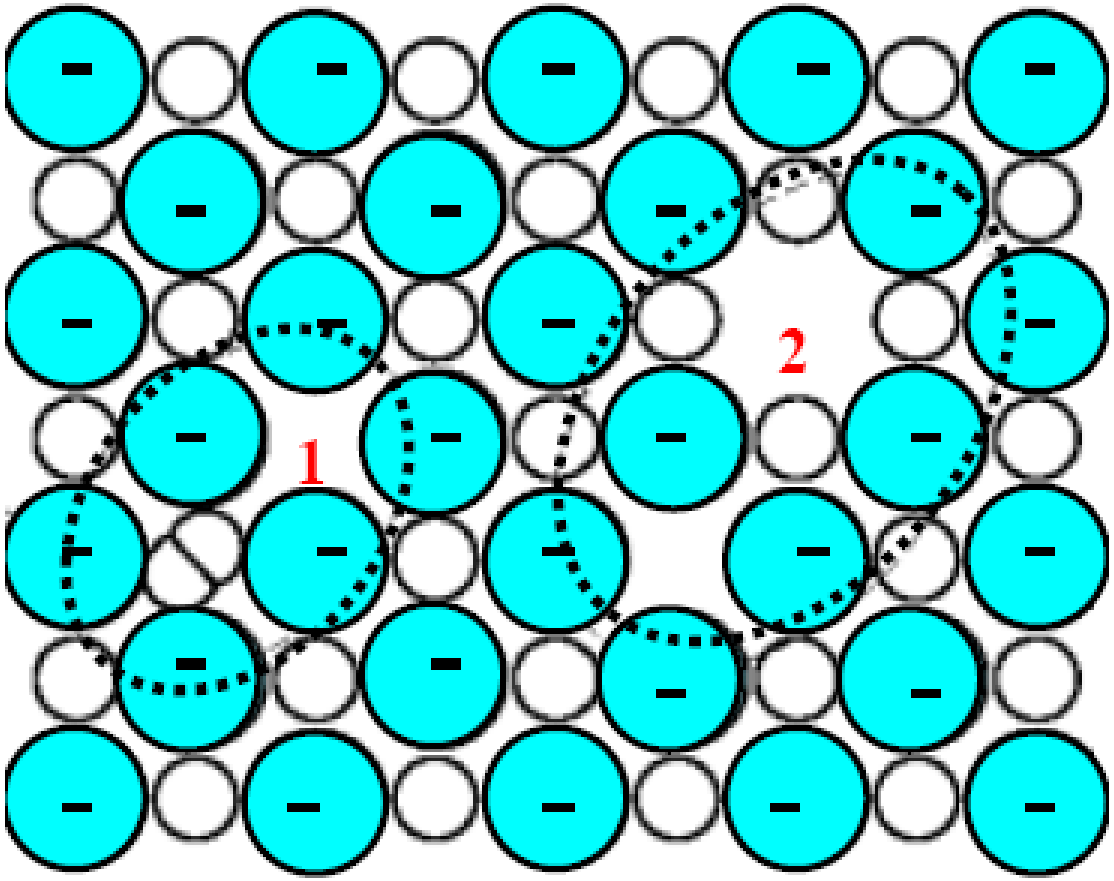
Schematic representation of vacancy in a two-dimensional crystal.


Energy
E_m
Atom
Vacancy
Distance



Schematic representation of different point defects in a crystal. (1) vacancy; (2) self-interstitial; (3) interstitial impurity; (4), (5) substitutional impurities. The arrows show the local stresses introduced by the point defects.

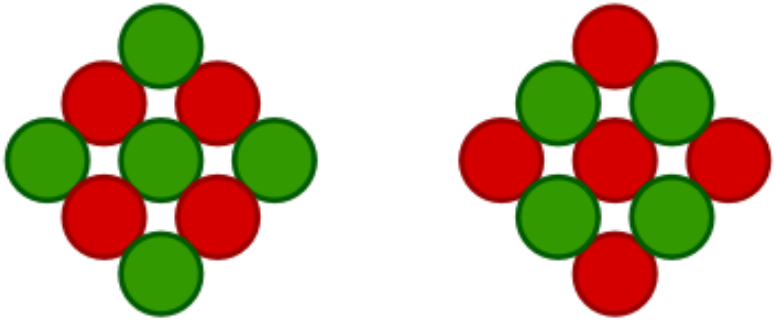

Self
Interstitial
Atom
Vacancy
Substitution
Impurity
Atom
Interstitial
Impurity
Atom



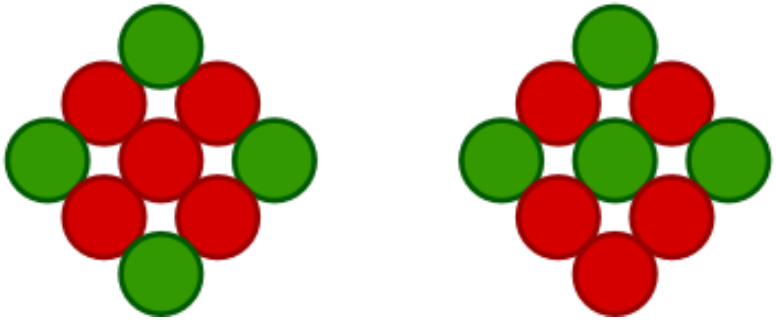
Schematic representation of (1) Frenkel defect (vacancy-interstitial pair) and (2) Schottky defect (a pair of cation and anion vacancies) in an ionic crystal.

Anti-site defects

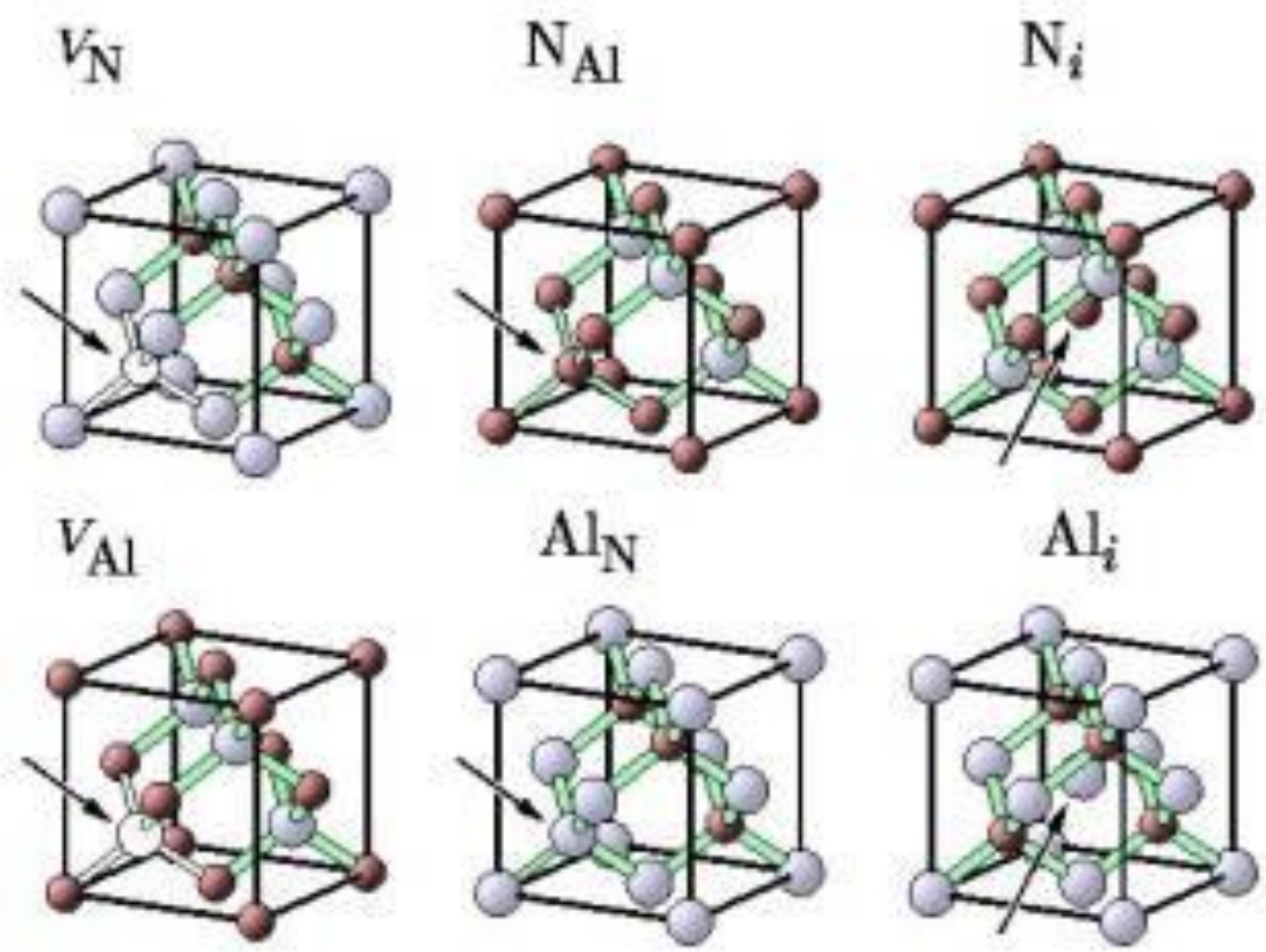
Crystal Neighborhoods

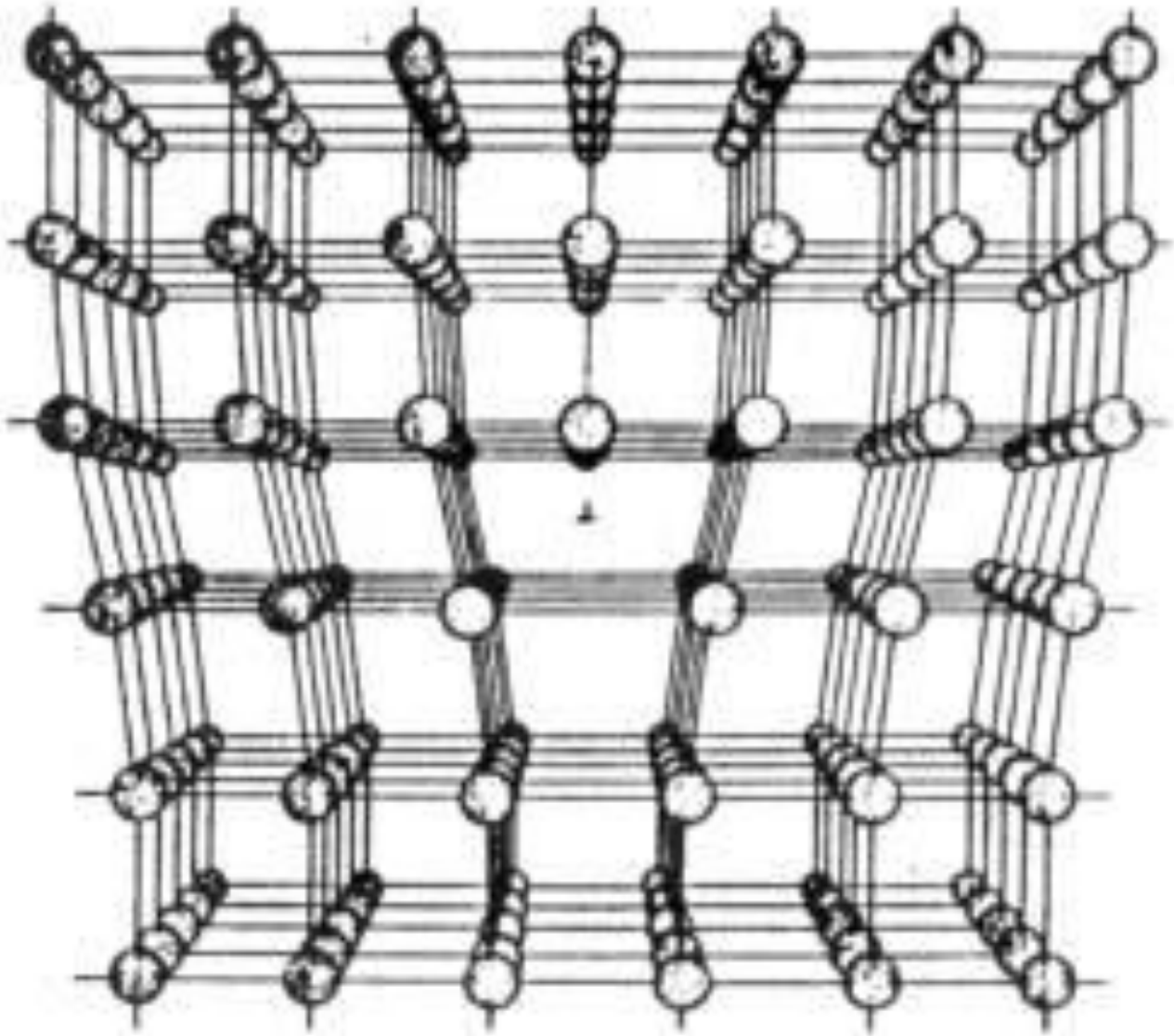


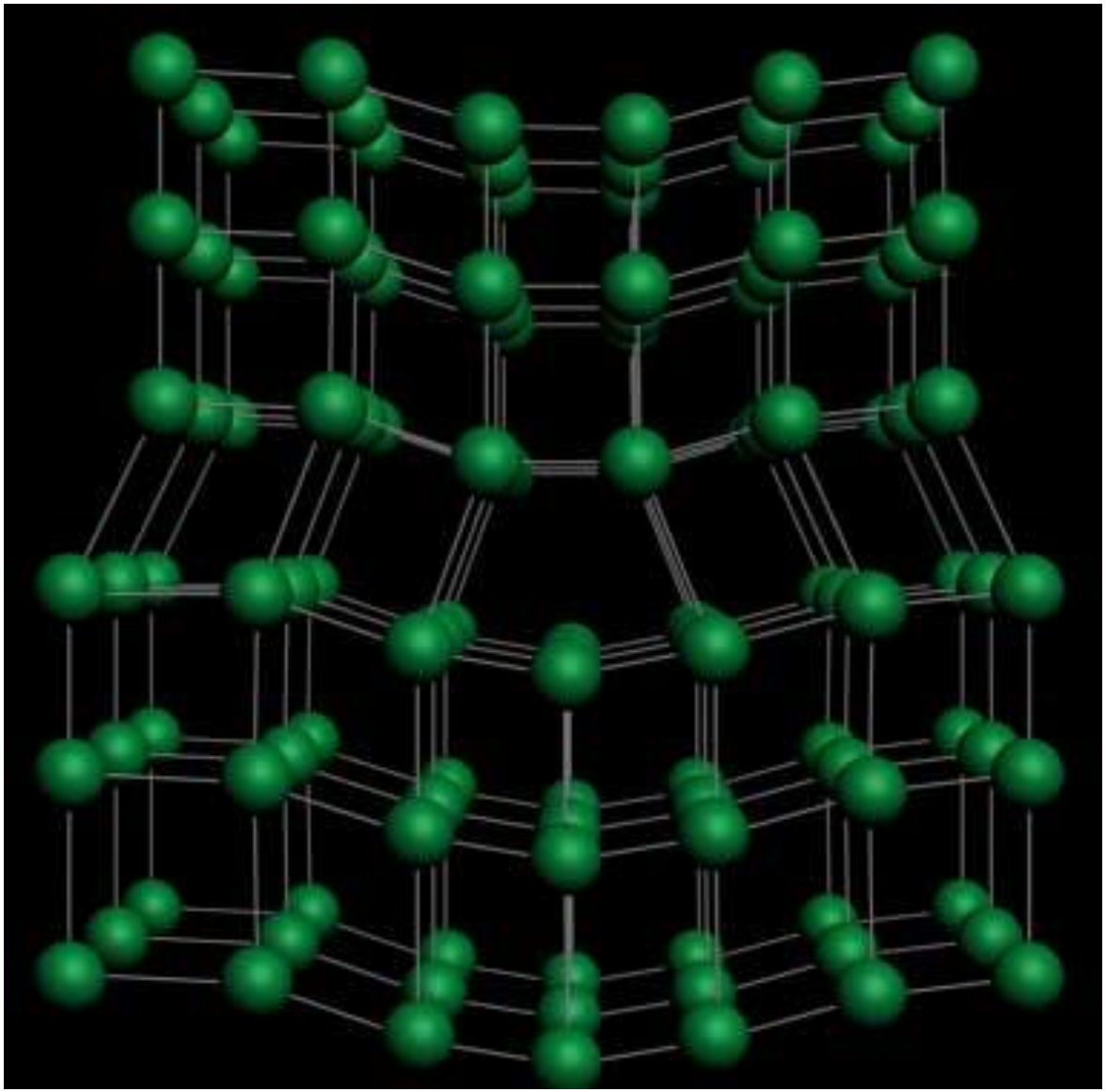
At or Near an Antisite Defect

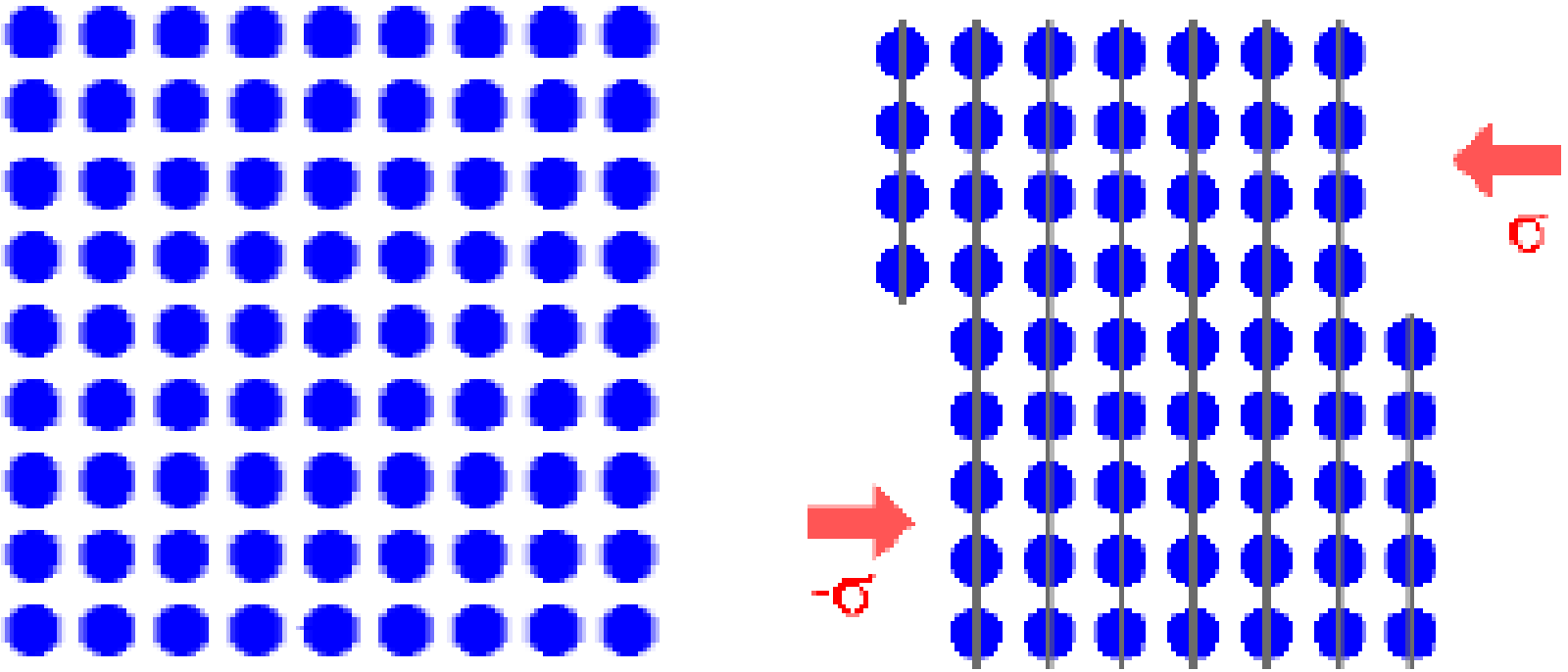


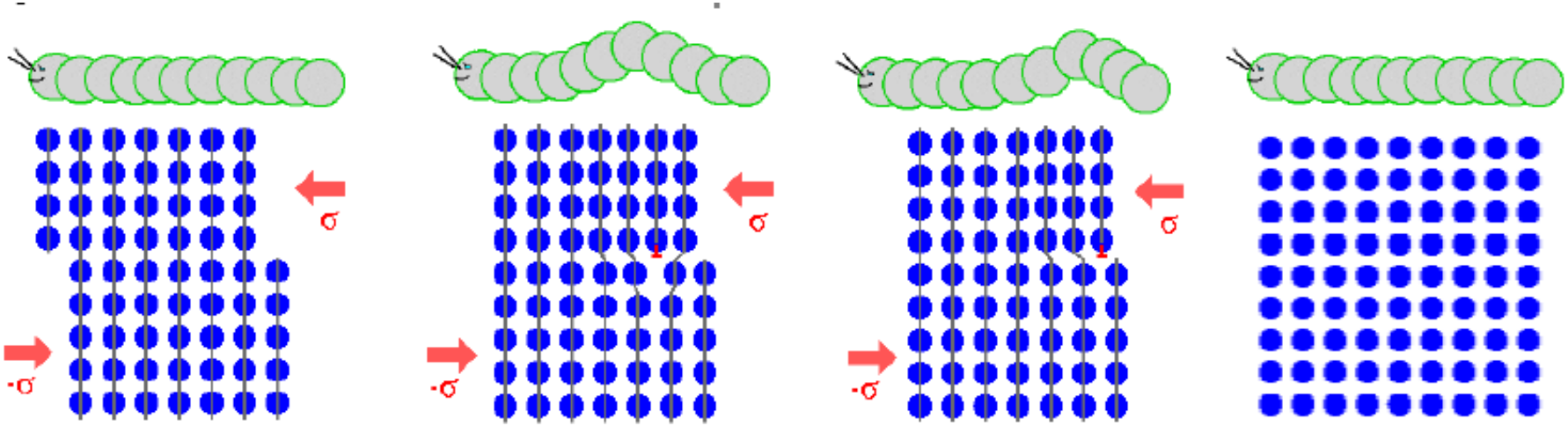
Native Point Defects in AlN

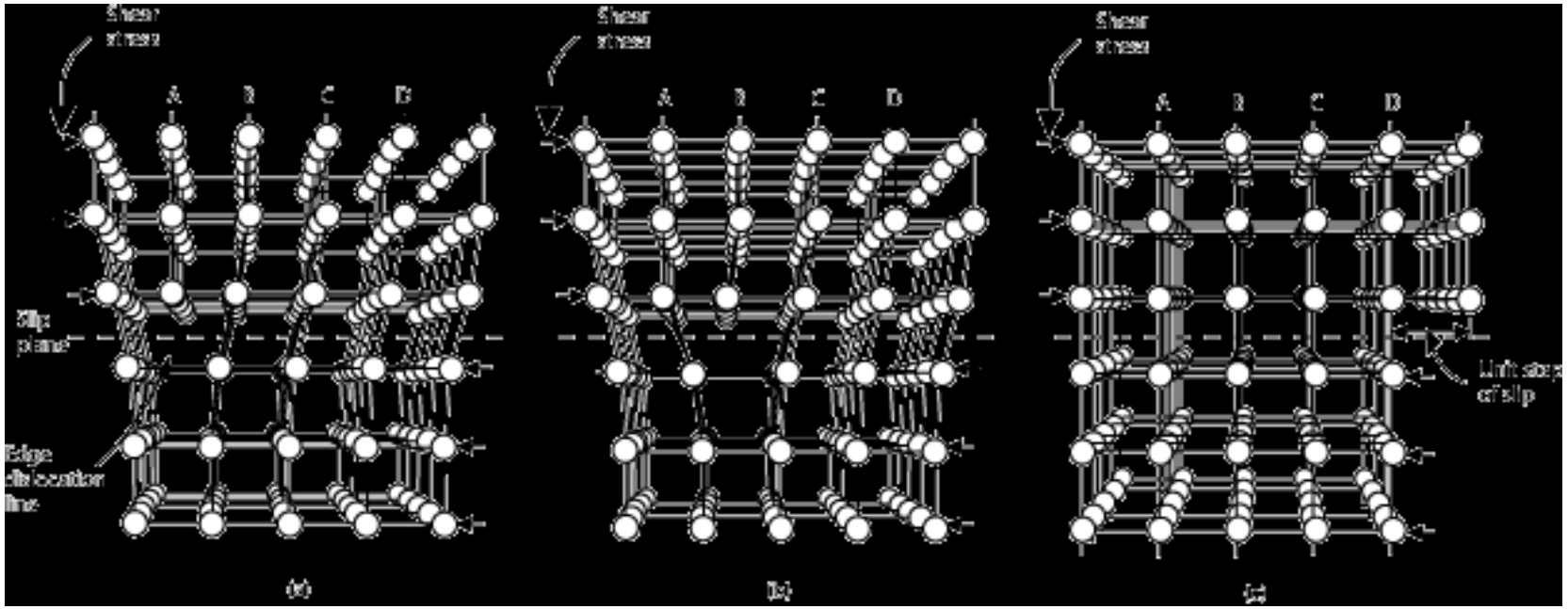




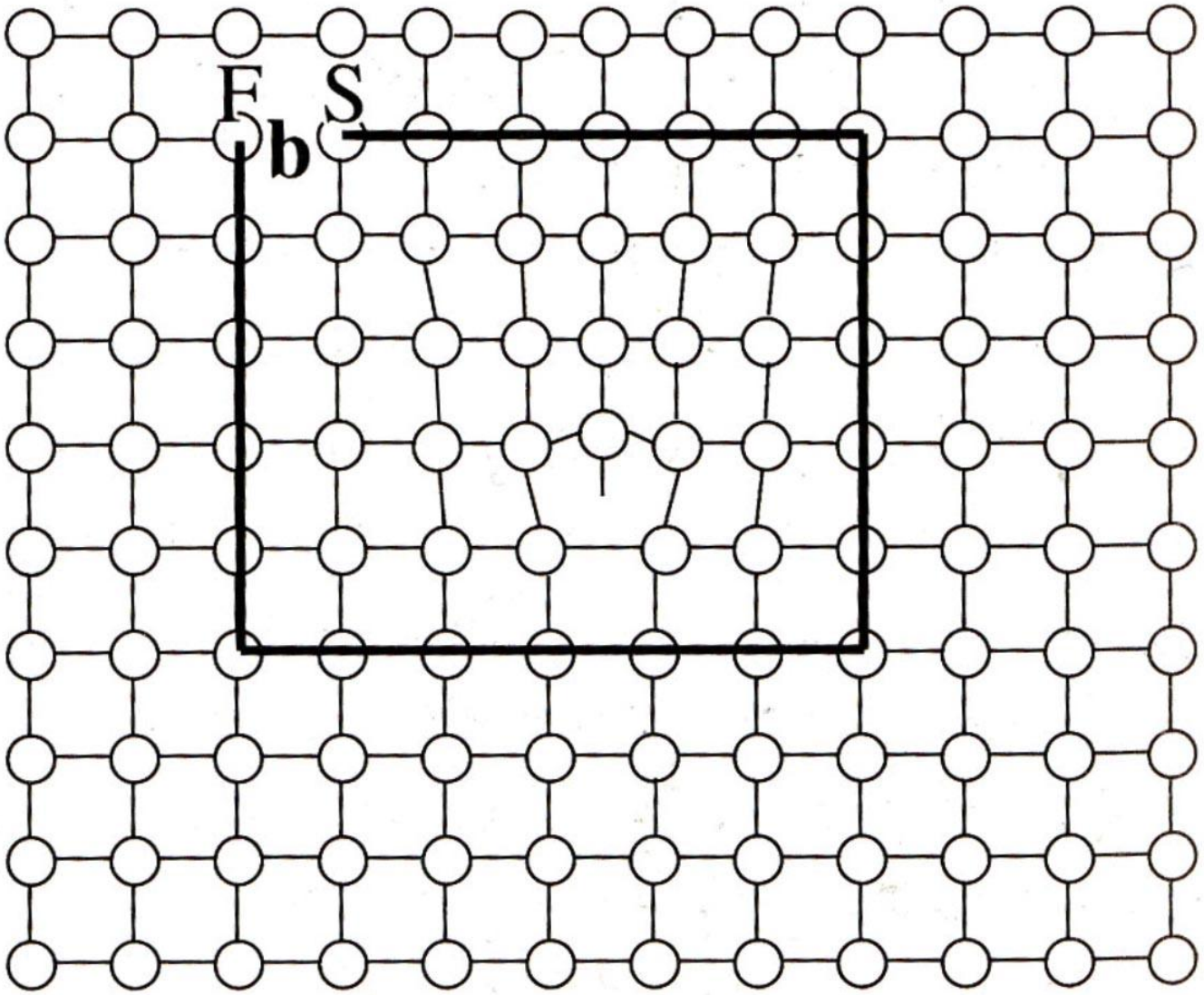


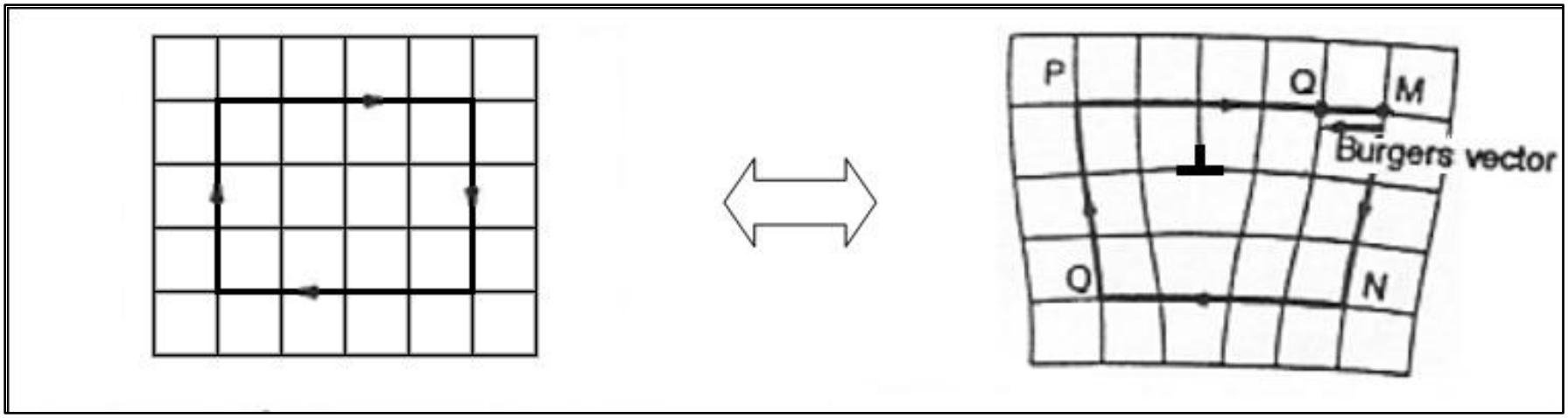

σ
-σ

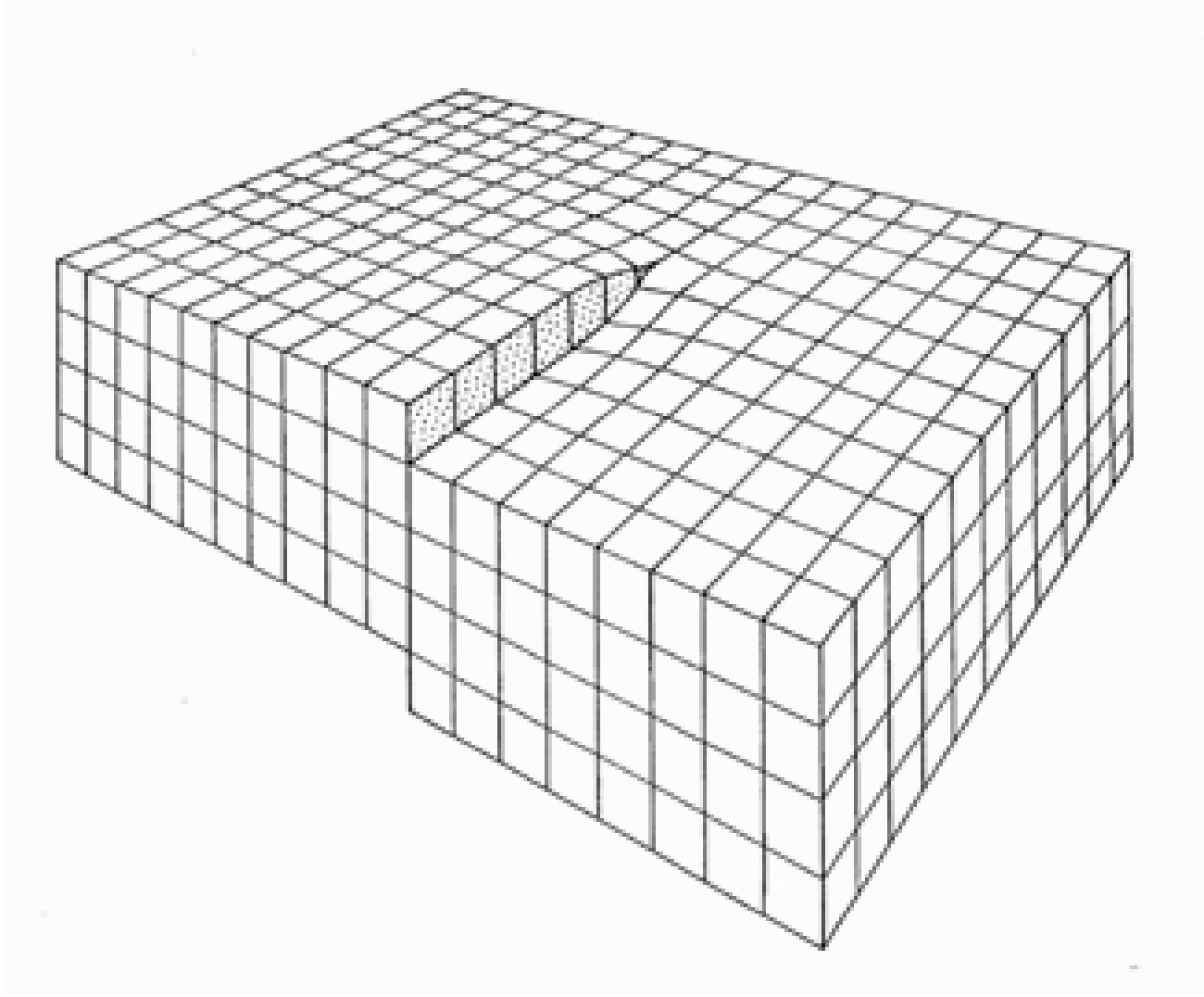

σ
-σ
σ
-σ
σ
-σ

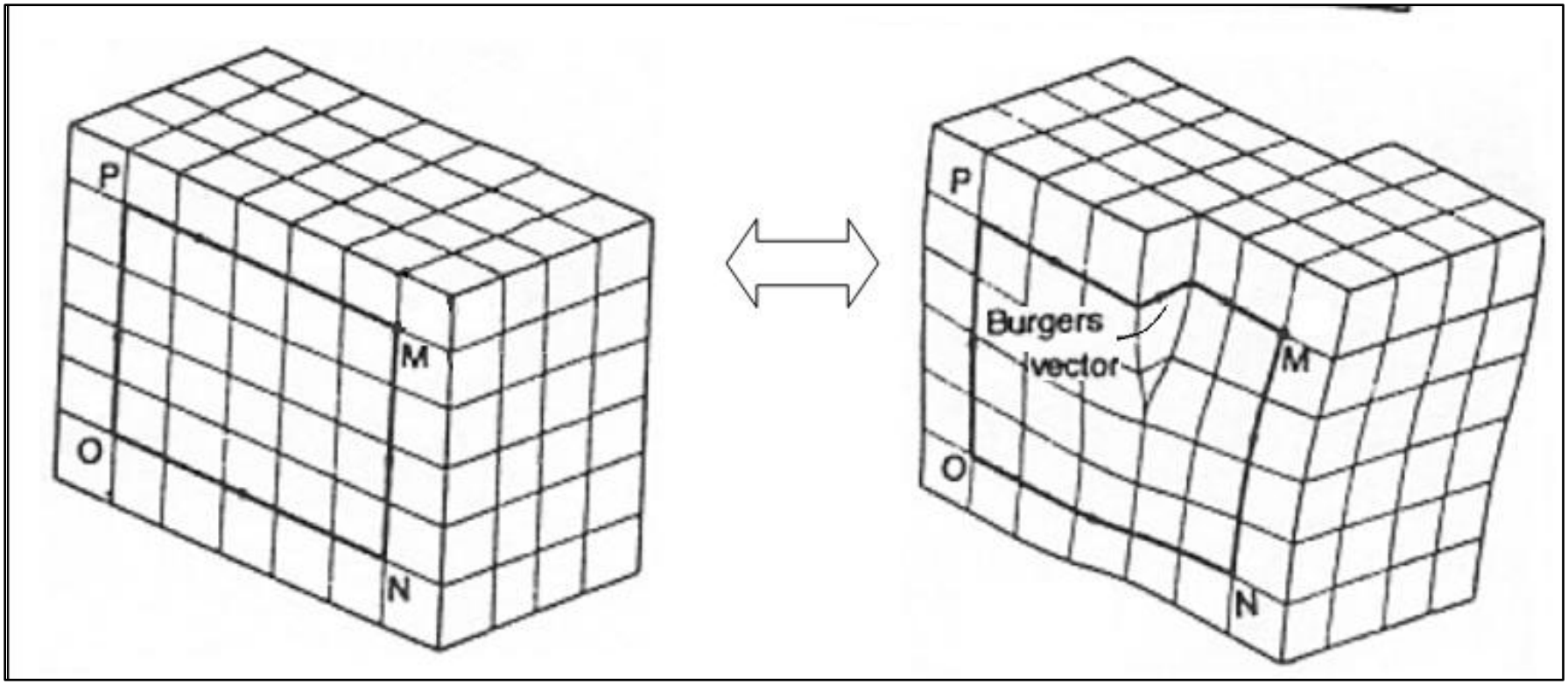

A
B
C
D
Slip plane
Edge dislocation line
Unit step of slip

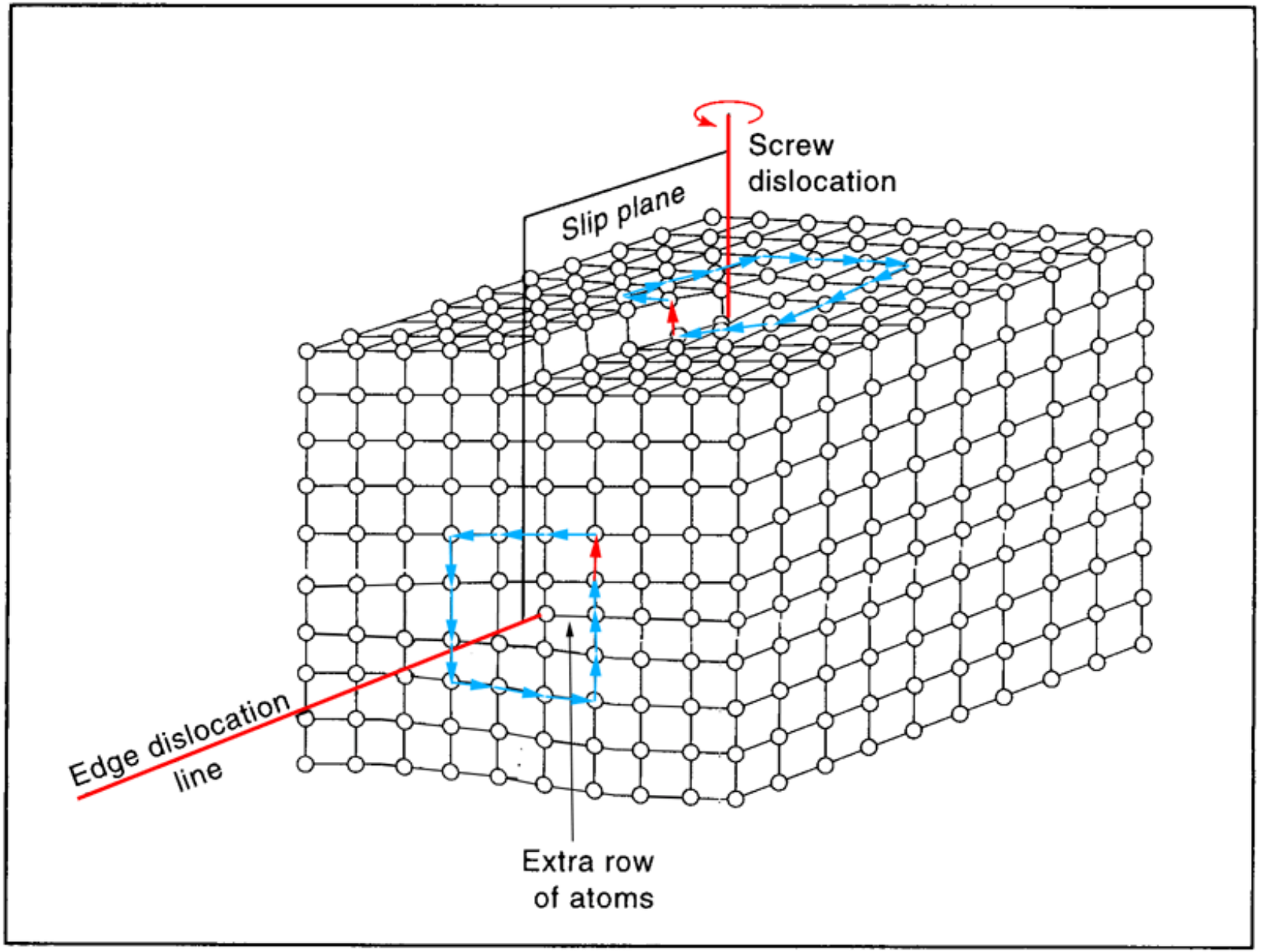
Johannes (Jan) Martinus Burgers (January 13, 1895 – June 7, 1981) Dutch physicist

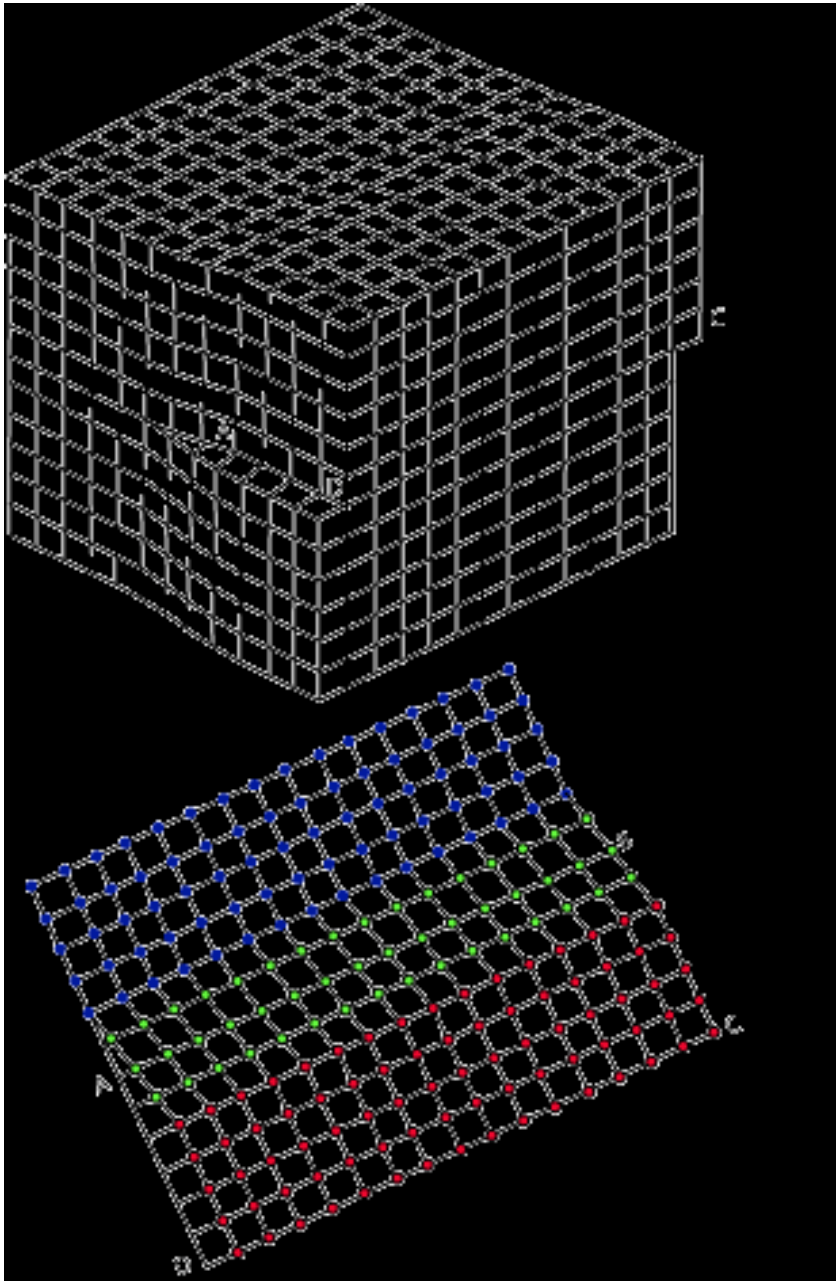


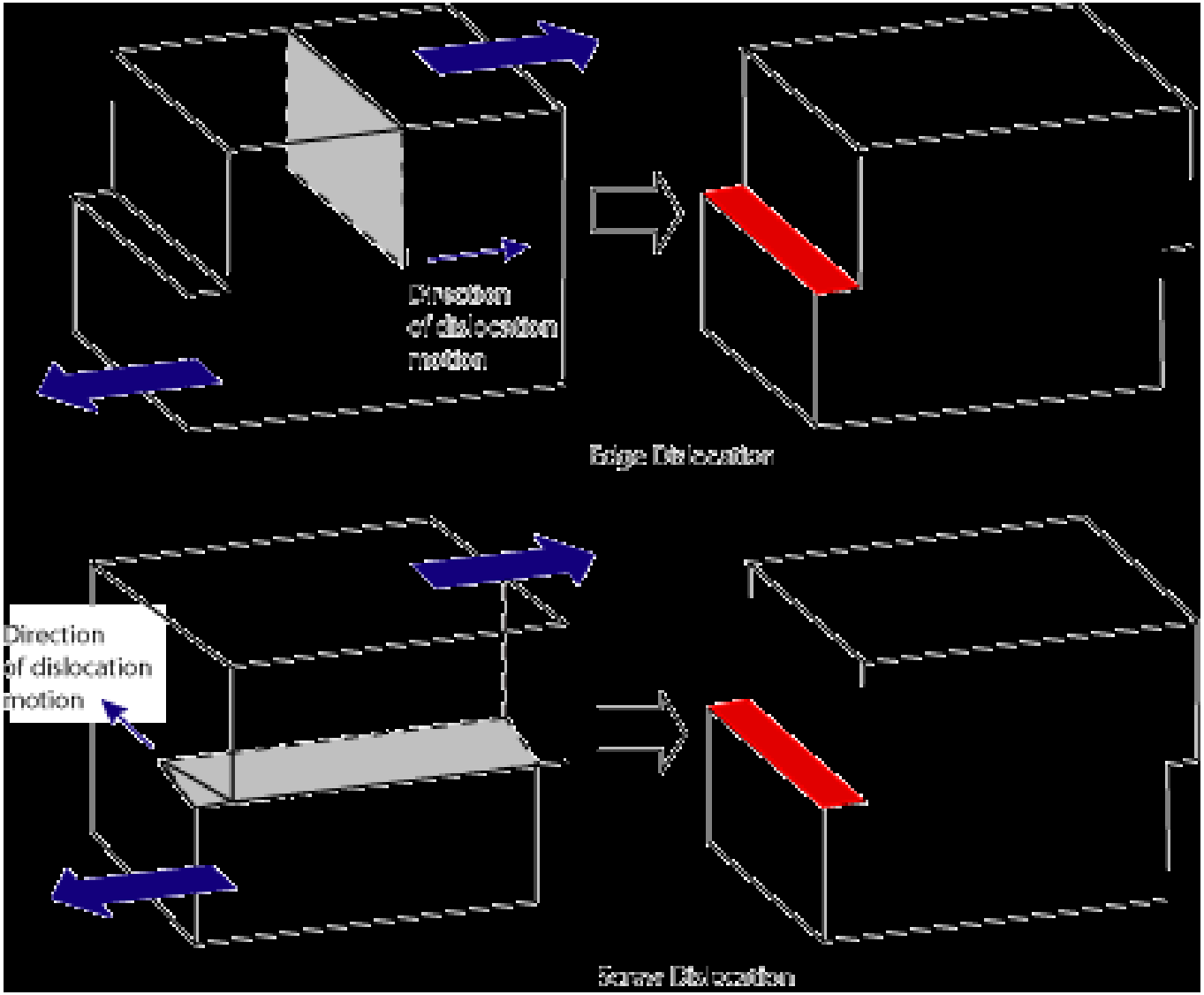

P
Q
M
Burgers vector
O
N

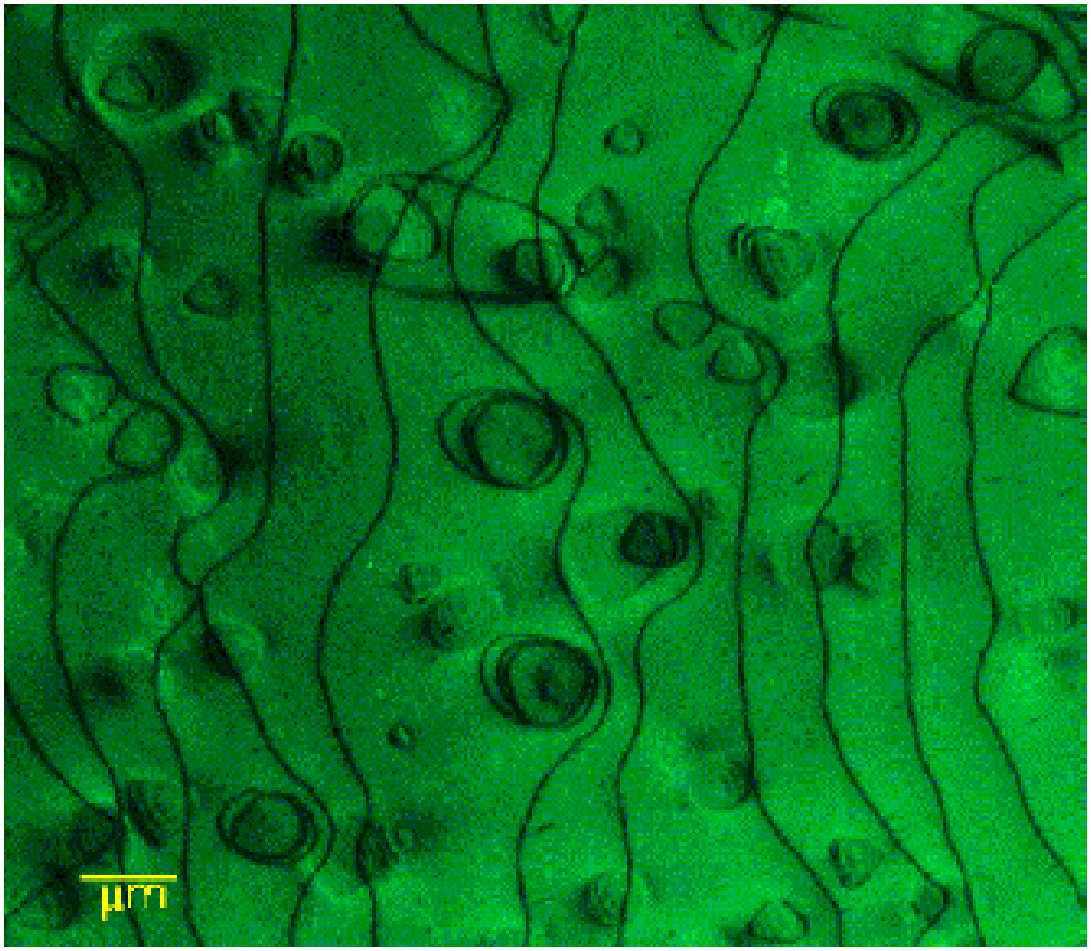



P
M
O
N
P
Burgers
vector
M
O
N


Screw
dislocation
Slip plane
Edge dislocation
line
Extra row
of atoms

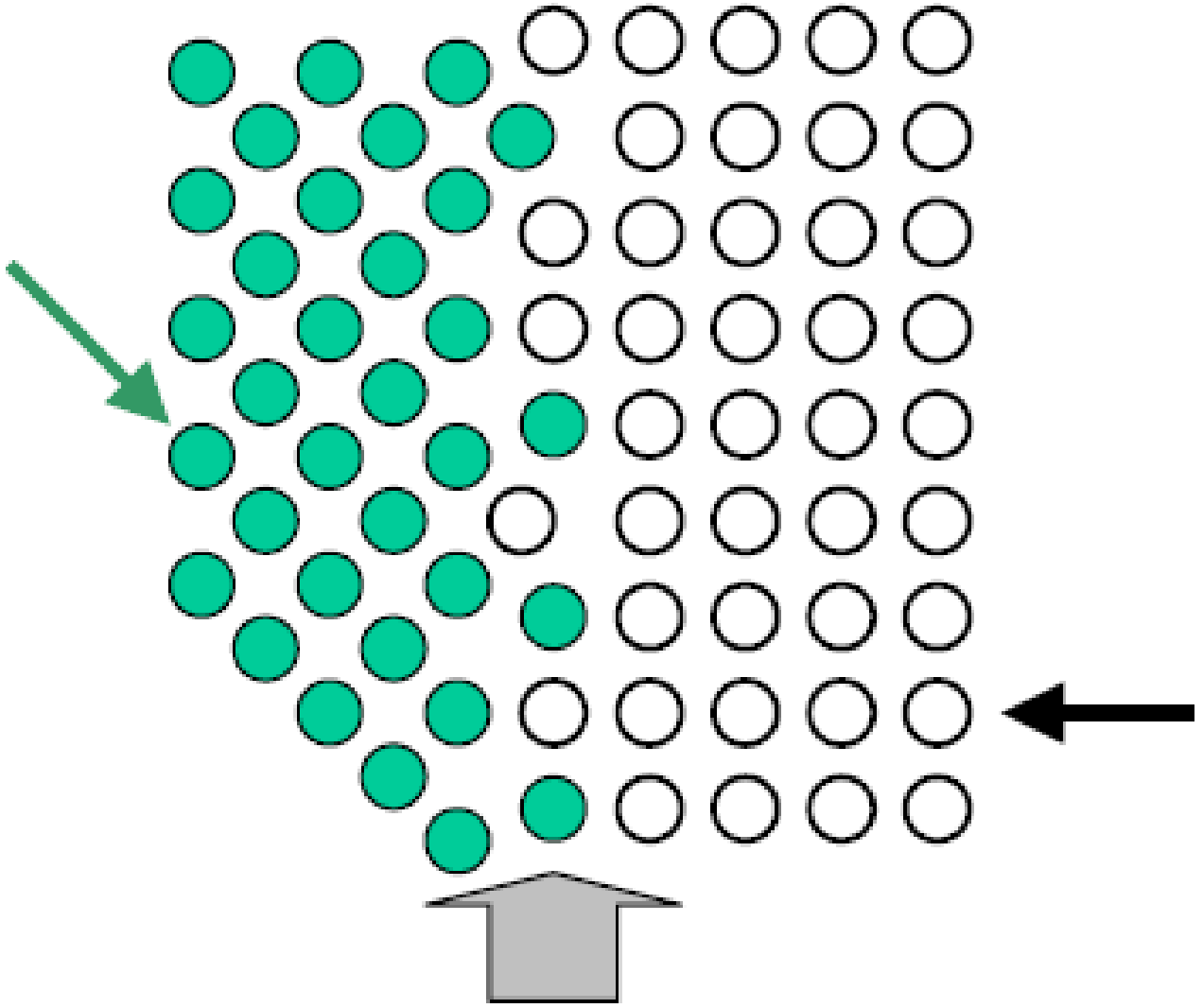


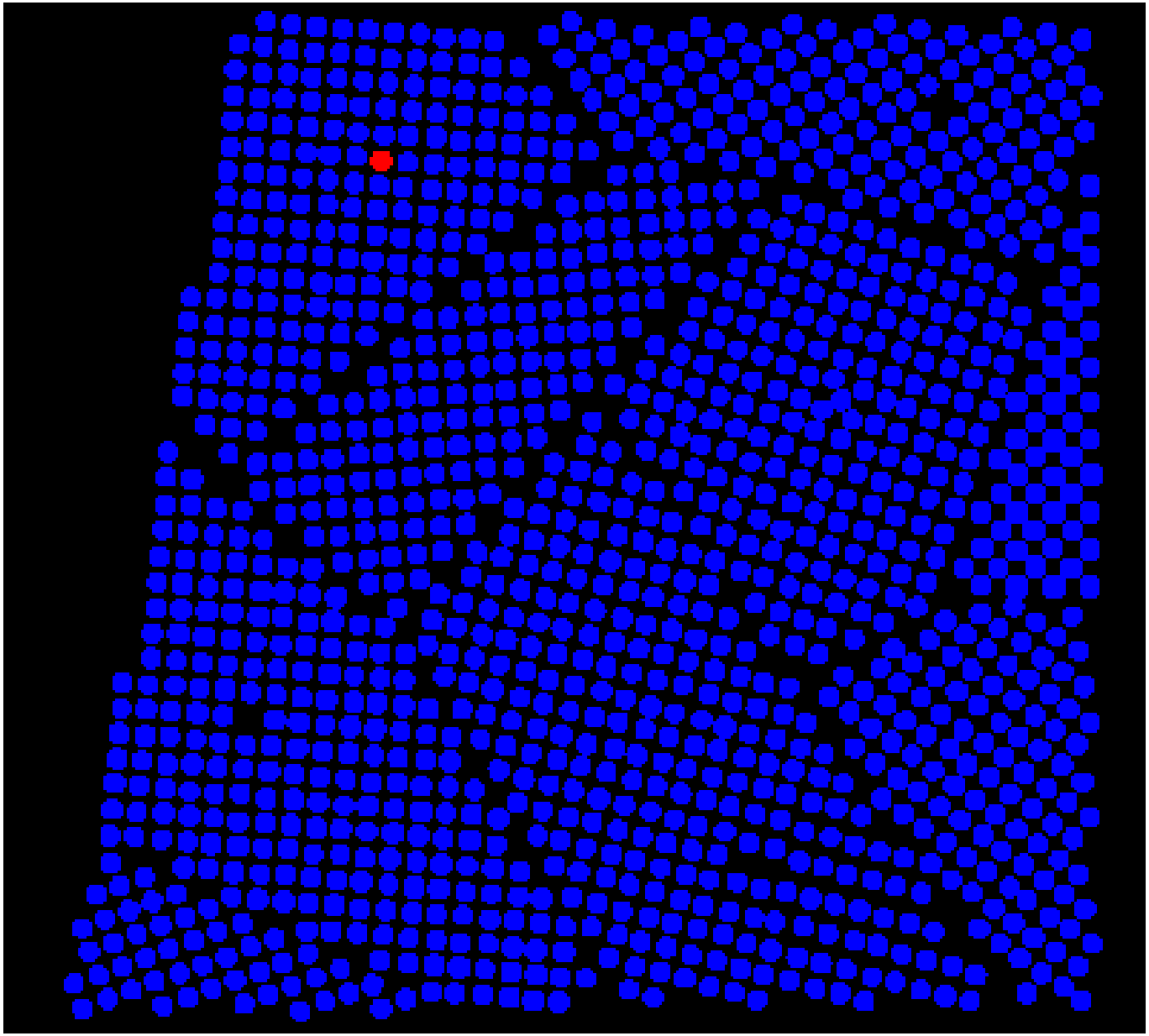

Direction
of dislocation
motion
Edge Dislocation
Direction
of dislocation
motion
Screw Dislocation

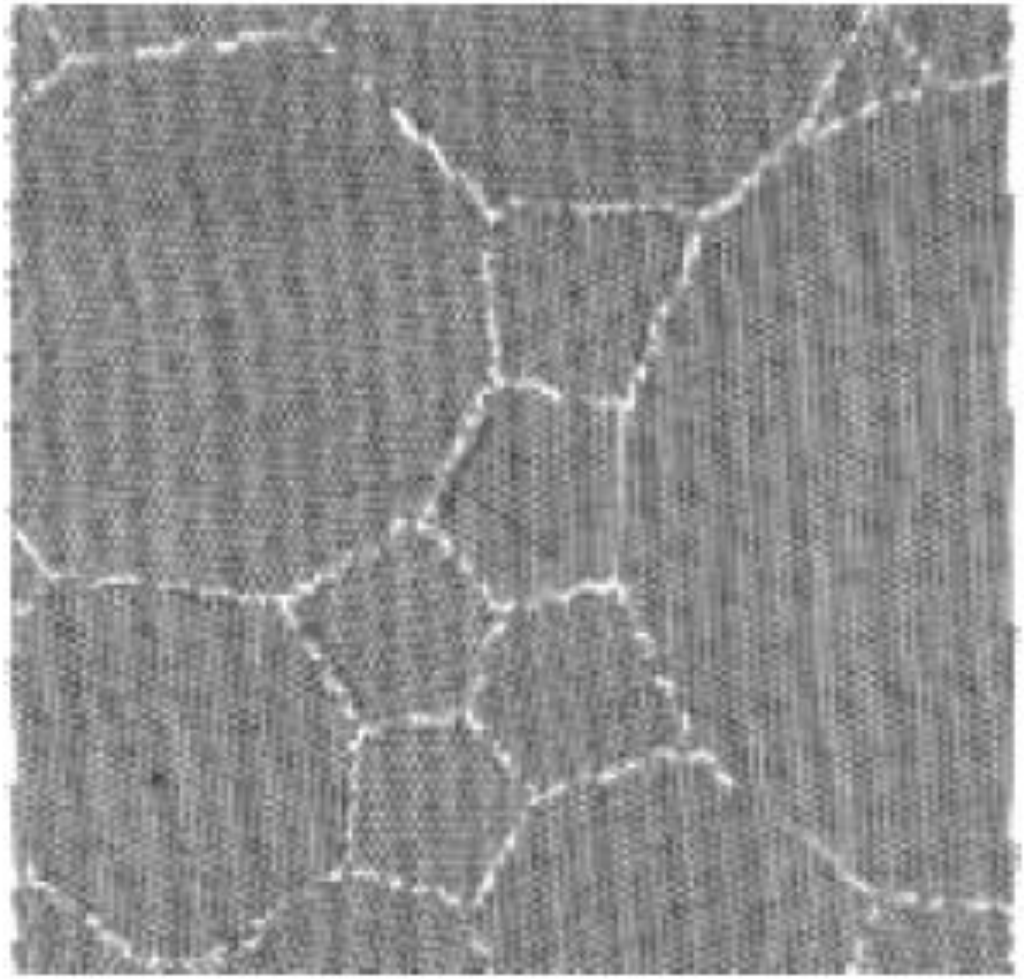


Dislocations in Nickel (the dark lines and loops), transmission electron microscopy image, Manchester Materials Science Center.

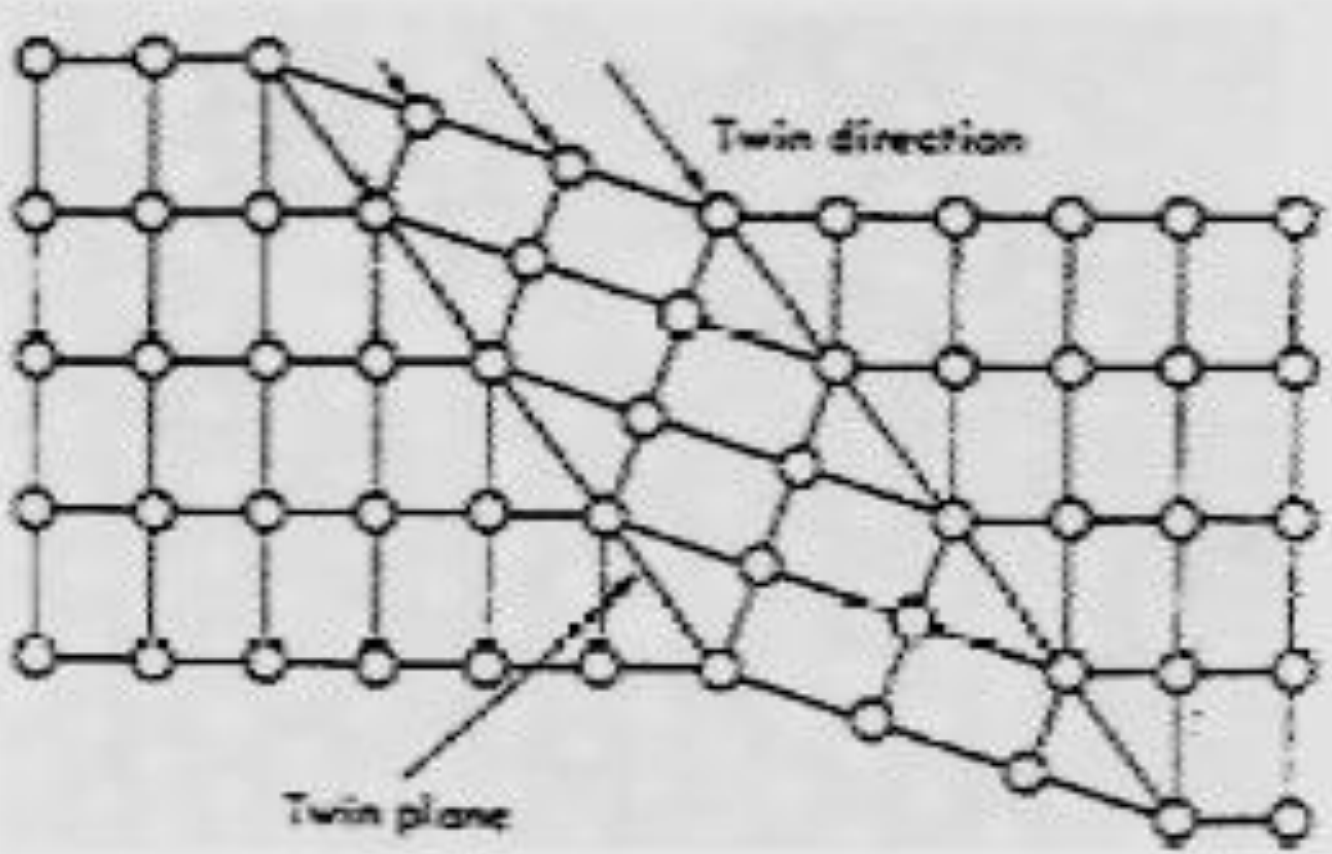
Videos

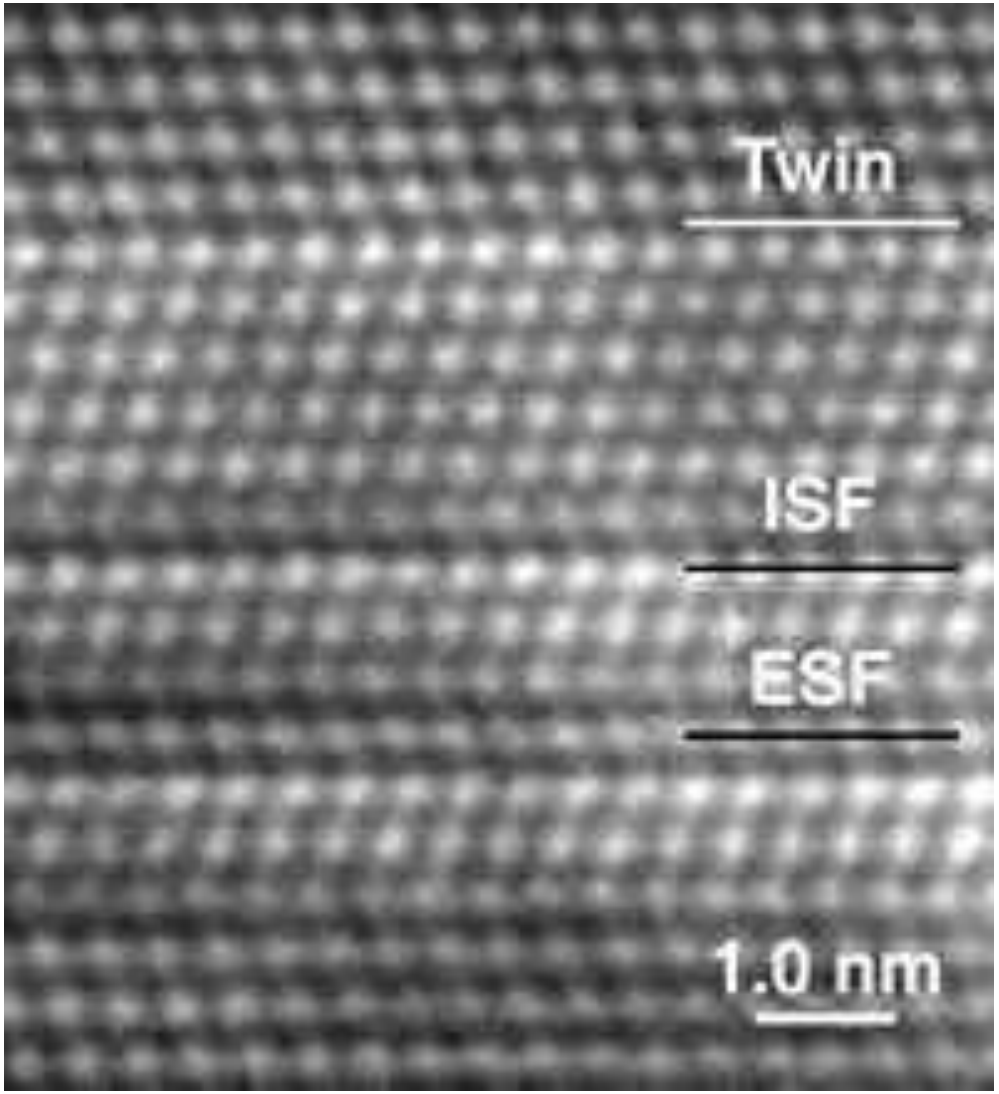

Grain Boundary





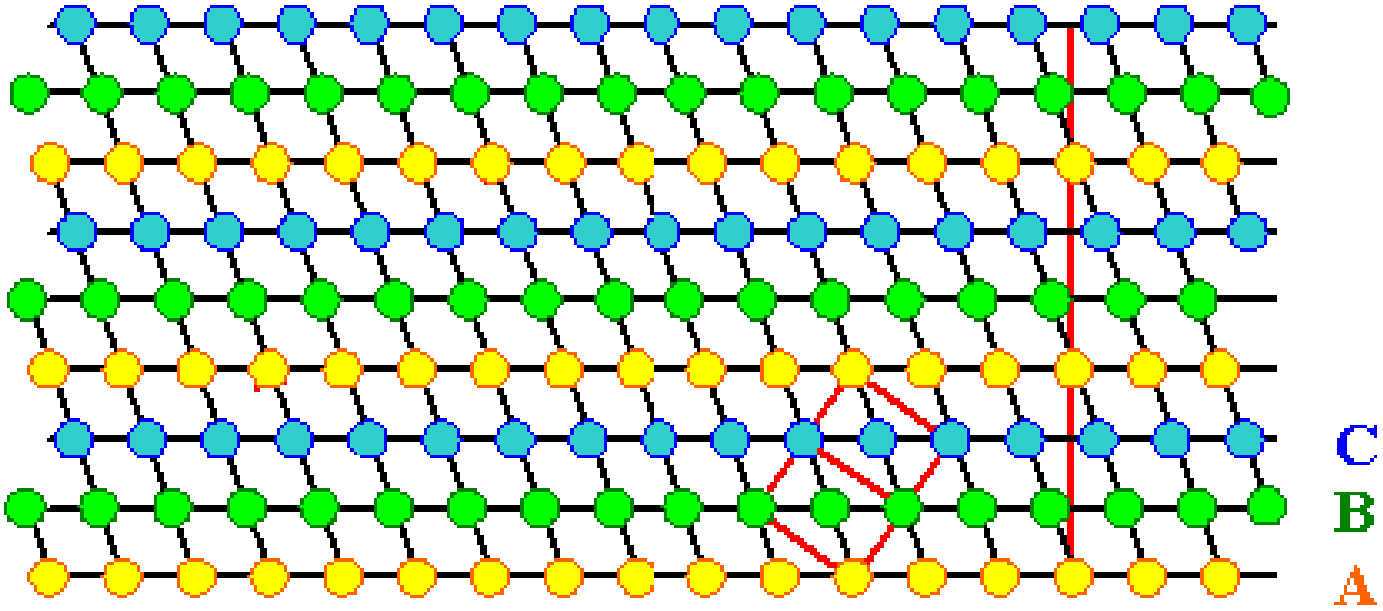
Atomistic model of a nanocrystalline solid
by Mo Li, JHU


Twin direction
Twin plane



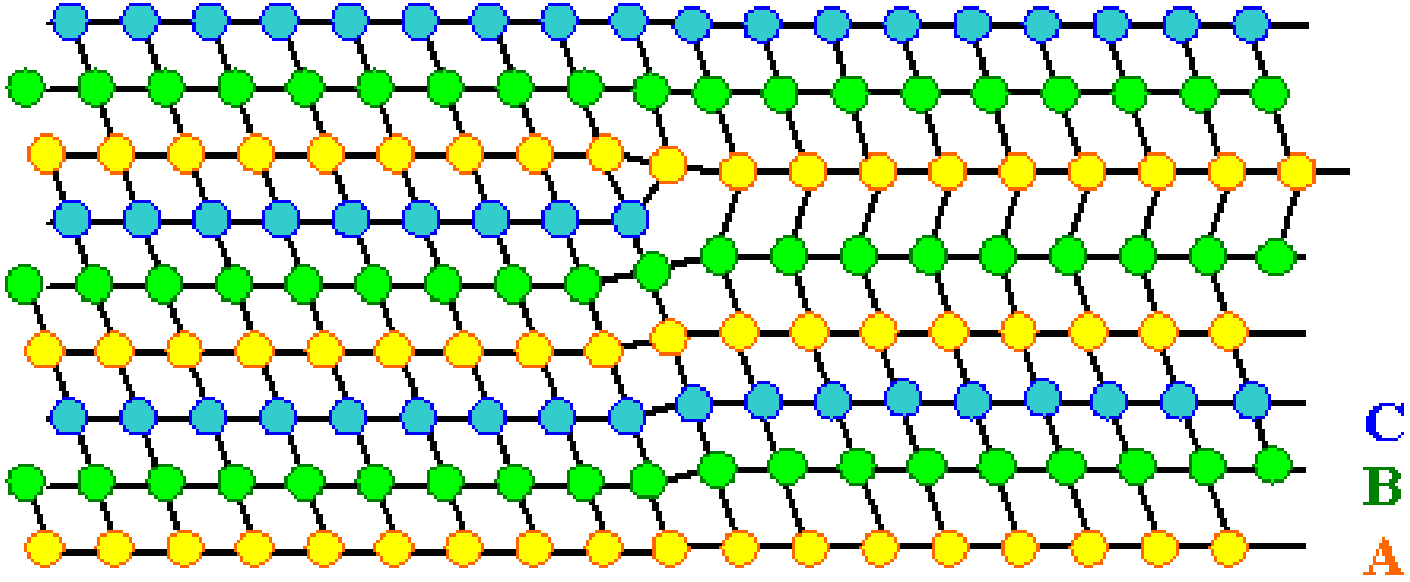
This is a HRTEM (high-resolution TEM) image. The image shows the atomic structure of planar defects in thin-film silicon: a twin defect (in which the upper layers are rotated 180º from the lower layers), an intrinsic stacking fault (ISF—in which adjacent layers are shifted slightly), and an extrinsic stacking fault (ESF—in which there is an intervening layer between two layers slightly shifted from each other)

http://www.nrel.gov/measurements/trans.html



ABCABCA...

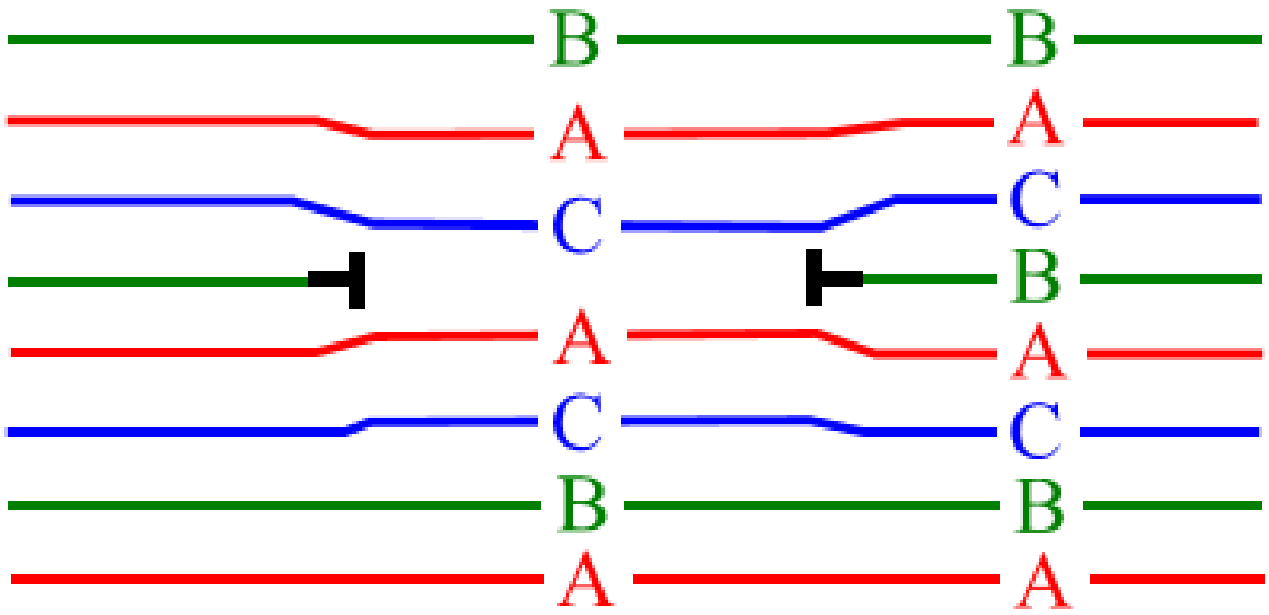
condense *vacancies* on a plane



ABCABABCA... **intrinsic stacking fault**

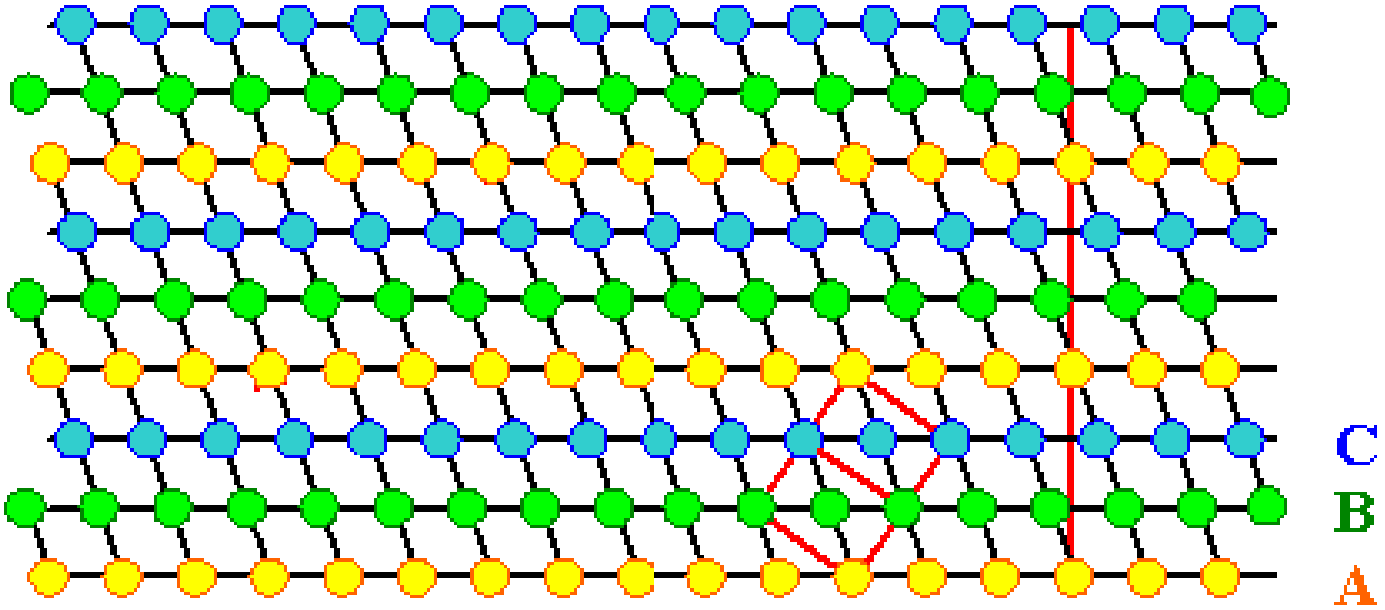
intrinsic: …ABC**A**C**A**BCA…

(same as created by Shockley partial)



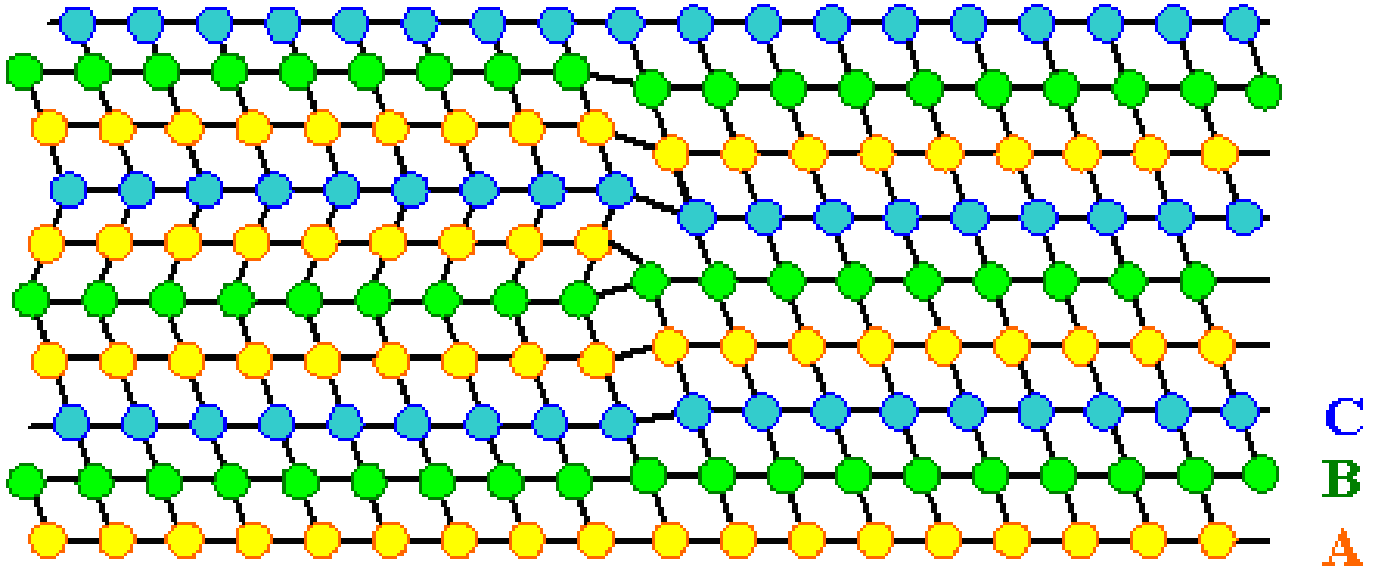
loop of *negative Frank partial* dislocation

(can be produced by collapse of platelet of vacancies)



ABCABCA...

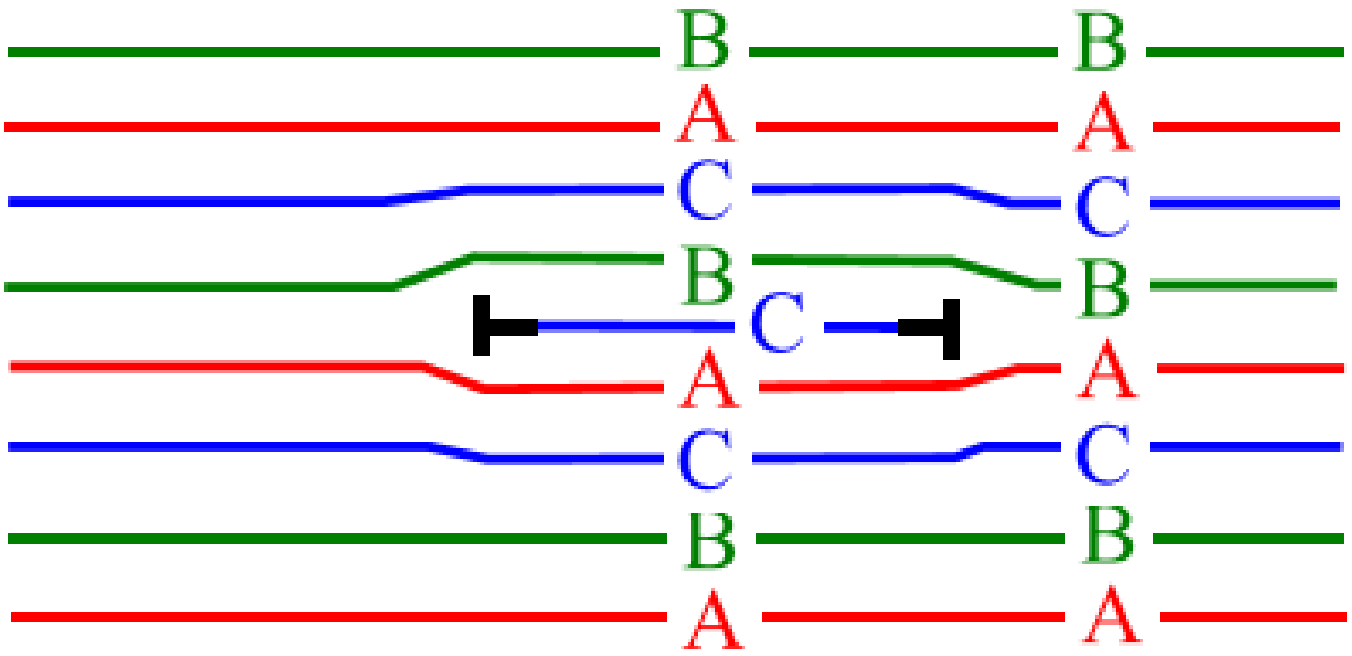
fill in a disc of agglomerated *interstitials*



ABCABACABCA... .

extrinsic stacking fault

extrinsic: …ABC**ACB**CABC…



loop of *positive Frank partial* dislocation

(can be produced by precipitation of interstitials)