METE 230/MECH 227
CHAPTER 18
ELECTRICAL PROPERTIES

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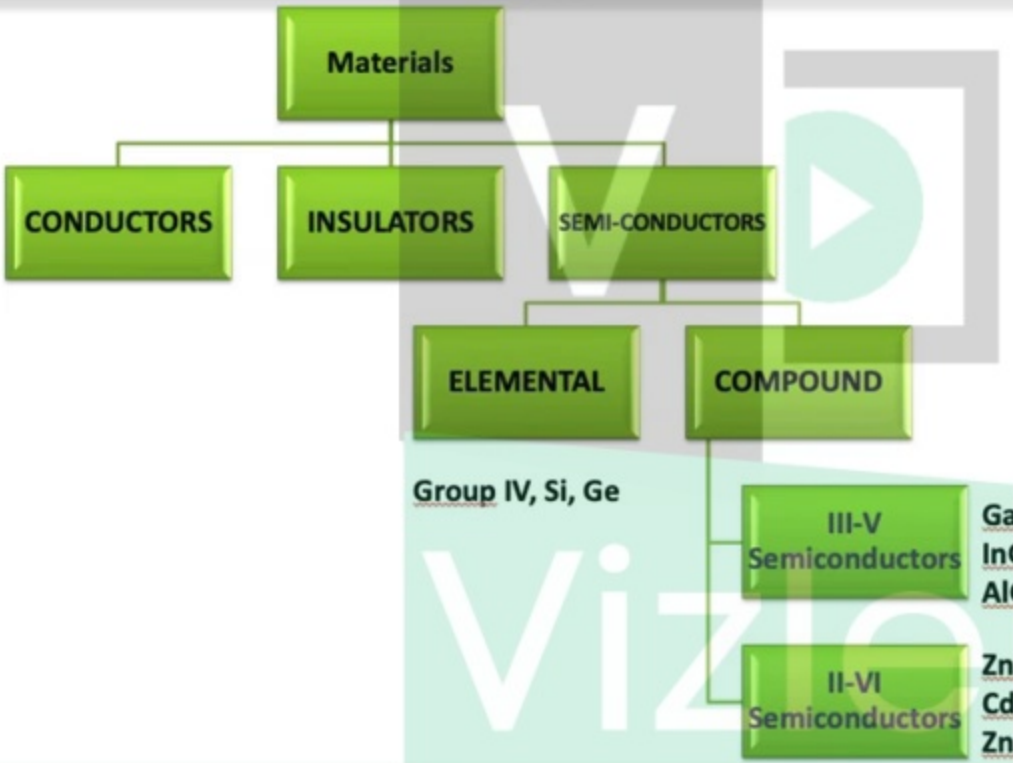
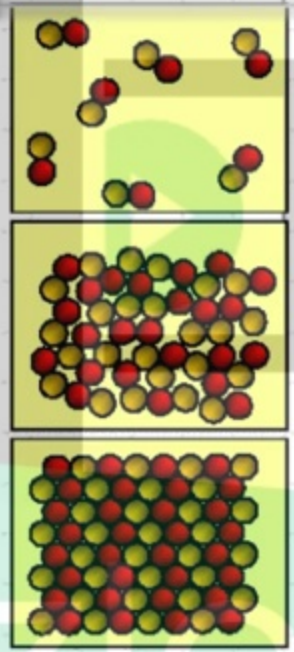


Basics of atomic bonding in solid state

Gas: changes shape and volume
statistically homogeneous
isotropic

Liquid: changes shape, constant volume
statistically homogeneous
isotropic

Solid: shape and volume stable
periodically homogeneous
anisotropic/isotropic



Crystal is a solid composed of atoms, ions or molecules that demonstrate long range periodic order in three dimensions

CONDUCTION in terms of BAND & ATOMIC BONDING

Metals

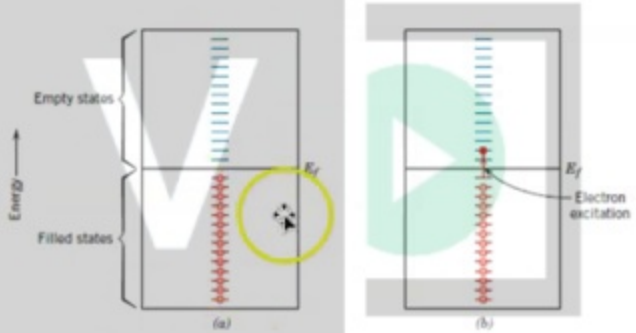


Figure 18.5 For a metal, occupancy of electron states (*a*) before and (*b*) after an electron excitation.

Insulators and Semiconductors

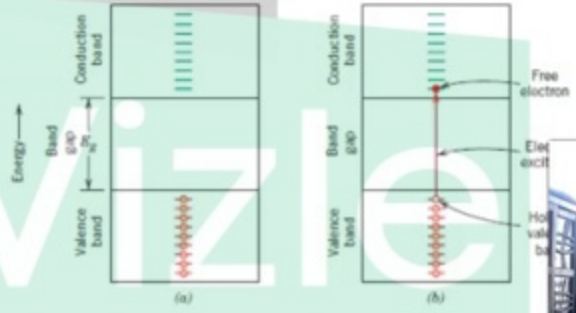
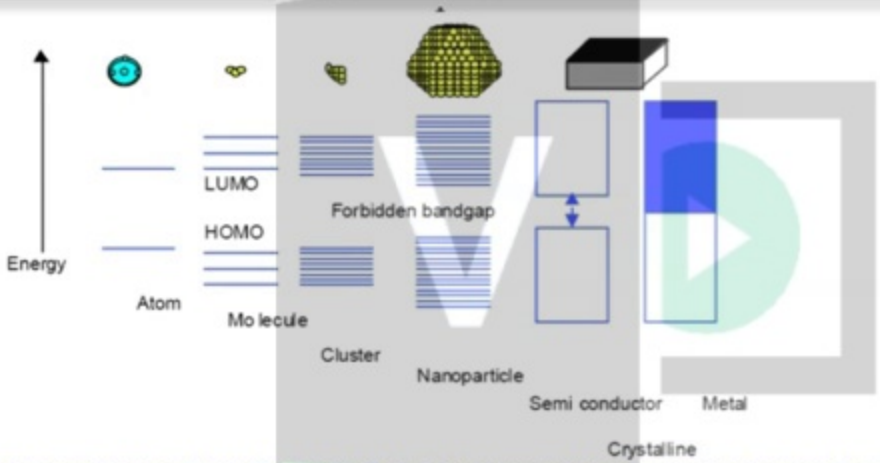


Figure 18.6 For an insulator or semiconductor, occupancy of electron states (*a*) before and (*b*) after an electron excitation from the valence band into the conduction band, in which both a free electron and a hole are generated.

OW DOES BANDGAP CHANGE?



Band gap decreases as we move down the periodic table; larger atoms have greater overlap and therefore broader bands.

Band gap increases as the material becomes more ionic or less covalent; less sharing of electrons leads to narrower bands and wider gap

Metallicity increases down the groups, so the band gap decreases because bandwidth increase result is greater electron overlap.

Ionicity increases as the group number increases; electrons are less covalently bonded so the increases because bandwidth decreases

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