

# Lectures 21-22

## Solid state materials. Electronic structure and conductivity

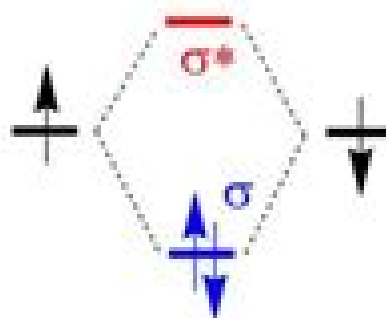
### 1) Band theory

- The electronic structure of **solids** can also be described by MO theory.
- A solid can be considered as a **supermolecule**.
- One mole of atoms ( $N_A$ ), each with  $X$  orbitals in the valence shell contributes  $X$  moles of atomic orbitals producing  $X$  moles of MO's.

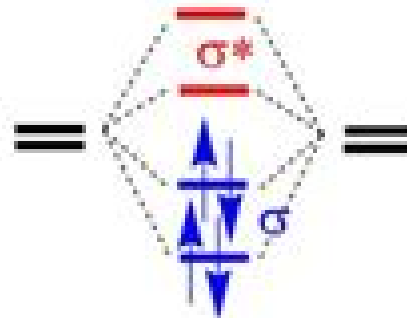
Consider qualitatively bonding between  $N$  *metal atoms* of  $ns^1$  configuration (Li, Na etc) arranged in a *chain*;  $N = 2, 4, N_A$ . Assume that  $X=1$  for simplicity.

- In the case of  $N \sim N_A$  atoms they form not **bonds** but **bands**.
- The band appearing in the *bonding* region is called **valence band**. The *antibonding* region is called **conduction band**.
- In the case of metals the **valence** and **conduction** bands are immediately **adjacent**.

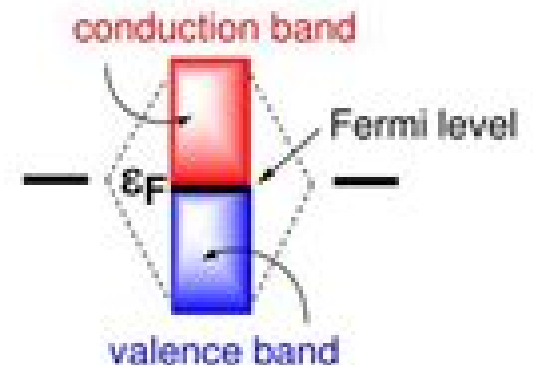
$N = 2$  Li atoms



4 Li atoms



$N_A$  Li atoms



# Electronics Of Solids

**Ensheng Dong**



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