

## **Taxonomy of Defects: Classify by Dimensionality**

*0-dimensional*: point defects

*1-dimensional*: line defects

*2-dimensional*: interfacial defects

*3-dimensional*: bulk defects

### **Point Defects**

- localized disruption in regularity of the lattice
- on and between lattice sites

#### 1. Substitutional Impurity

- occupies normal lattice site
- dopant ☺, e.g., P in Si; or B in C<sub>(diamond)</sub>
- alloying element ☺, e.g., Mg in Al; or Ni in Au
- contaminant ☹, Li<sup>+</sup> in NaCl

#### 2. Interstitial Impurity

- occupies position between lattice sites
- alloying element ☺, e.g., C in Fe; or H in LaNi<sub>5</sub>
- contaminant ☹, H in Fe

#### 3. Vacancy

- unoccupied lattice site
- formed at time of crystallization
- formed in service under extreme conditions

### **Point Defects in Ionic Crystals**

- special issues associated with the need to maintain global charge neutrality

#### 1. Schottky Imperfection

- formation of equivalent (not necessarily equal) numbers of cationic and anionic vacancies

#### 2. Frenkel Imperfection

- formation of an ion vacancy and an ion interstitial

#### 3. F-Center

- formation of an ion vacancy and bound electron