Answer on Question #57438 – Chemistry – Physical Chemistry

Question:

What is Frenkel defect

Answer:

Defect according to Frenkel (Frenkel's couple of) is the dot defect of a crystal representing couple consisting of vacancy and interstitial atom (ion). It is formed as a result of movement of atom (ion) of knot of a crystal lattice in an interstice, that is in such situation which in an ideal lattice atoms (ions) don't occupy. It is called by the name of J. I. Frenkel who for the first time developed ideas of the education mechanism thermodynamic of equilibrium dot defects.

Defects according to Frenkel are formed as a result of heating of crystals, and also at radiation of crystals by streams of particles or high-vigorous quanta of electromagnetic radiation.

When heating a crystal the amount of atoms with the kinetic energy sufficient for an exit from lattice knot increases, also the amount of defects according to Frenkel respectively increases. Their equilibrium concentration corresponding to crystal temperature can be estimated on a formula

$$n \approx \sqrt{NN'} \exp(-\Delta E/2kT),$$

where N and N'— concentration of knots and interstitial provisions respectively;

ΔE – the energy necessary for movement of atom from lattice knot in an interstice – Boltzmann's constant.

In crystals with wide interatomic intervals defects according to Frenkel arise with bigger probability, than in the densely packed crystals. So, they are typical for pure crystals of halogenides of silver. Unlike defects according to Schottky, their education doesn't influence the crystal density as migration of an ion doesn't lead neither to change of volume, nor to change of mass of a crystal.

Formation of defects according to Frenkel in case of ions of the small size (Li +, Ag +, F-), in structure like fluorite (in an anion sublattice) and ZnS (vyurtsit, in a cationic sublattice), and also in the presence of the stoichiometric defects is most probable.