

Point defects and diffusion

Introducing

Description

Program (detailed contents):

Introduction: The role of diffusion mechanisms and defects in materials.

I - Nature of defects: volumetric, surface, linear, point defects, in crystalline materials, ionic crystals, amorphous solids.

II - Thermodynamic aspects of point defects: enthalpy of formation, enthalpy of migration, defect concentration at thermodynamic equilibrium.

III - Basics of diffusion: flow equation, Fick's laws, macroscopic aspects, microscopic aspects, calculating the diffusion coefficient, influence of temperature.

IV - Defect generation and annihilation: generation of defects by radiation exposure and diffusion (lacunae, amorphization, doping), annihilation of defects by heat treatment.

V - Electronic and optical properties: colored centers in ionic crystals, the effect of doping in semiconductor materials.

VI - Techniques for measuring defect concentration: electrical, geometric and specific heat measurements.

VII - Applications.

properties induced, and their applications.

Students will need to integrate notions, contextualize them and then be able to decontextualize them to project them into an adidactic situation.

Necessary prerequisites

Basic mathematical analysis: functions of several variables, derivatives, integrations, differential equations.

General concepts of the thermodynamics of physical-chemical systems.

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

 Toulouse

Objectives

At the end of this module, the student should have understood and be able to explain (main concepts):

- The laws of matter diffusion in solid materials.
- The nomenclature of defects present in solid materials, the mechanisms by which defects are created and annihilated, the electronic and optical