

#### 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 physicalchemical 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

### **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

### Location(s)

Toulouse

