Semi-Conductive Materials, Properties and Applications

In brief

Course langage: French

Presentation

Learning objectives

To know the basic physical processes at work in the operation of semiconductor components (band structure, density of states, charge carrier distribution, mobility, generation/recombination,...), the operation of elementary components (different types of junction, Light Emitting Diodes, Photovoltaic Sensors).
Use this knowledge to understand and dimension applications in the field of photonics on the basis of scientific, technological and economic considerations.

Description of the programme

Semiconductors are present in most of the modern electronic and optoelectronic devices you use. They have a complex dual function that allows them to have, depending on the conditions of use, the properties of a conductor, and the properties of an insulator. This elective aims to teach the basic elements of semiconductor physics and in particular the light-matter interactions in these materials, in order to approach their most common applications in the field of light generation and detection (Telecoms, Lighting, photovoltaics).
The course is divided into 3 parts:

-Part 1: Introduction to semiconductor materials and basic components (8h lecture, 2h TD). Crystal structure - Electronic states in semiconductors - Charge carrier distribution - Equilibrium SC/non-equilibrium SC - Different types of junctions
-Part 2: Photon-Semiconductor Interactions, Light Emitting Diodes (8h lecture, 2h lab). Generation, Recombination, Charge injection - Photon/semiconductor interactions - Light emitting diodes.
-Part 3: Photovoltaics, from resources to latest developments (8h lecture, 2h lab). Solar resources, mineral and organic photovoltaic technologies and the latest developments - TD: cell properties and sizing.

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Generic central skills and knowledge targeted in the discipline

The skills and knowledge targeted are those of scientific and technical innovation
The aim is to develop the scientific and technical knowledge base of the Centrale engineer, particularly in the fields related to high-tech.
Semiconductor technologies are at the heart of all electronic systems. Understanding the basis of their operation is essential for mastering the complexity of systems. The technological innovations that result from them meet the need to create value through scientific and technical innovation.

How knowledge is tested

Examen de 2h

Bibliography

-Fundamentals of Photonics, B. E. A. Saleh, M. C. Teich (2019, Ed. John Wiley & Sons, Inc.)
-« les énergies renouvelables aujourd'hui et demain » J. Hladik (2011, Ellipses)
-« Energie solaire – calculs et optimisation » J. Bernard (2011,Technosup, Ellipses)
-« Energie solaire photovoltaïque » de A. Labouret et M. Villoz (2009, Dunod)

Teaching team

Laetitia Abel-Tiberini, Caroline Fossati, Laurent Gallais-During

Sustainable Development Goal



Affordable and clean energy



Building Resilient Infrastructure

Total des heures		**30h**
CM	Master class	24h
TD	Directed work	6h

Useful info

Name responsible for EU

Lead Instructor

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