Surface properties M1

Niveau d'étude
BAC +4

ECTS
3 crédits

Composante
Faculté des Sciences

En bref

- **Date de début des cours:** 1 sept. 2021
- **Langue(s) d'enseignement:** Anglais
- **Méthode d'enseignement:** En présence
- **Organisation de l'enseignement:** Formation initiale
- **Ouvert aux étudiants en échange:** Non

Présentation

Description

This course provides a comprehensive knowledge and tools that relate to surface properties and interfacial behaviour of crystalline and amorphous solids in different media. It contains two parts: (1) Fundamentals of Colloid and Surface Science, divided and porous solids

(2) Surface characterisation techniques and surface analysis

Volumes horaires* :

CM : **17 h**

TD : **8 h**

Objectifs

The common objective of this teaching unit is to provide students with sufficient knowledge and skills to be able to:

1) understand and correctly use the concept of interface,

2) understand the main mechanisms governing the behaviour of powdered solids dispersed in gaseous and liquid media,

3) choose an appropriate characterisation method or analysis to characterize surface properties of a given solid material,

4) promote active engagement of students in their class activities through tutorials, flipped classes, and critical analysis of research papers.

Pré-requis nécessaires

Basic knowledge of fundamental concepts in Chemistry, Physics, and Solid State Science (Bachelor degree program)

Contrôle des connaissances

Students are evaluated by means of continuous assessment (oral presentations, active participation in tutorials and flipped classes, homework assignments) in conjunction with examinations at the end of teaching period. More specifically:

Part 1 and 2: 25% of continuous assessment + 75% of final examination

Part 2: 50 % of continuous assessment +50 % of homework assignment at the end of teaching period.

Syllabus

Part 1: **CM: 8.5 h, TD: 5 h**

An introductory part, *taught in the form of lectures with open discussions intermittently*, is proposed first to understand the main principles governing the behaviour of solids in heterogeneous systems. The concept of surface energy of colloidal-in-size particles together with the various molecular and macroscopic interactions involved (i.e., interparticle van der Waals forces, Ionic double Layer interactions, DLVO theory) constitute the basis for explaining the stability of solid dispersions in gaseous and liquid media, as well as the interfacial phenomena (gas adsorption, immersion, wetting, adsorption from solution) in systems containing divided and porous solids. Particulate diffusion and electrophoresis, scattering of light by solid particles are also presented here. The knowledge of interfacial mechanisms is then put on a more systematic basis to describe the use of probing molecules and ions to determine the surface properties of divided and porous materials. Specific surface area and porosity, surface acidity and basicity, surface hydrophobic and hydrophilic character are the main characteristics to be considered, mainly through analysis of real examples of materials studied experimentally or critical analysis of research papers. This teaching sub-unit takes the form of *integrated courses and tutorials*.

Part 2: **CM: 8.5, TD: 3 h**

This second part is more about Surface specific technics and Surface analysis:

* Definition of interfaces, scales and resolutions.
* Morphological observation surface (electron microscopy MEB, TEM, EBSD, near field microscopies AFM, STM, SNOM)
* Chemical analysis (Spectroscopy AES, XPS, SIMS, HREELS)
* Structural and functional analysis in situ (Surface tension, ATR, SERS, quartz microbalance QCM, ellipsometry, large instruments GiSAXS, SEXAFS)

The competences waiting for this part 2 are knowing in detail the surface analysis techniques: 1)to be able to describe and to schematize the device, 2)to give the benefits and challenges of technology based on the sample type, 3)to get a sense of resolution and sensitivity for each technique, 4) to be able to understand a publication that implements a technical study and explain these results.

The Work in flipped classroom is interesting to be able to take understanding of unknown knowledge, to give back to the group, and to have a constructive exchange through question/ answer with the group.

Informations complémentaires

Contact(s) administratif(s) :

Secrétariat Master Chimie

https://master-chimie.edu.umontpellier.fr/

Infos pratiques

Contacts

Responsable pédagogique

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