

Formulation



Niveau
d'étude
BAC +5 /
master



ECTS
2 crédits



Composante
Faculté des
sciences

En bref

- Langue(s) d'enseignement: Français
- Ouvert aux étudiants en échange: Oui

Présentation

Description

1. The main principles of the formulation:

- Generalities
- The classic components of mixtures (binders, solvents and diluents, pigments, fillers, additives, etc.)
- Formulation processes (solubilization, grinding, dispersion, ...)
- Physico-chemical parameters of the formulation (solubility, interfaces, wettability, CPV / CPVC, compatibility of mixtures, stabilization, particle size, etc.)

Case study: paint formulation – physicochemical formulation techniques and parameters; Methods of transfer from laboratory to industry. P. Thobie (CETIM Nantes)

2. Rheology: L. Benyahia (IMMM Le Mans)

- Introduction to rheology.
- Fundamental principle and determining factors (stress, deformation, ...).
- Viscosity definition and energetical considerations.
- Effect of pressure and temperature on the viscosity.
- Time and shear dependence of the viscosity.
- Suspension rheology.
- Rheology of polymer solutions.

3. Printing and coating processes (used in printed electronics): A. Blayo (INP Pagora, Grenoble)

- Printing techniques (screen printing, inkjet, rotogravure, flexography, other processes).
- Main features.
- Properties of associated functional inks.
- Advantages and limits for electronic applications, examples.
- Coating techniques (spin coating, slotdie, blade coating).

– Drying / Annealing techniques (thermal / photonic).

4. Functional inks (inks for printed electronics, in particular): A. Blayo (INP Pagora, Grenoble)

- Specific constraints (graphic inks vs. functional inks).
- Functional materials used for inks:
 - Conductive materials (metallic and carbon particles and nanoparticles, conductive polymers, etc.).
 - Dielectric materials.
 - Semiconductor materials (for PV and OLED applications, for example).
 - X-chrome materials.
- Specific measurements of the properties of the printed film (conductivity, for example).

Practical work : Screen printing techniques (M. Boujtita, Nantes)

Visits of companies will allow students to have concrete applications of the content of this course: ARMOR La Chevrolière, world specialist in ink chemistry and printing processes, and SERIBASE Château-Gontier, a company specializing in screen printing techniques.

Objectifs

Formulation is a multidisciplinary science which consists in associating active materials or active principles and formulation auxiliaries (excipients, additives...) leading to a mixture answering a precise specification. After studying the physico-chemistry of dispersed media (colloidal suspensions, solutions, emulsions, etc.) and related analytical methods (spectroscopy, rheology, etc.), a focus will be devoted to mixtures for organic electronics.

The objective is to understand how to make a functional material printable (conductive, semiconductor or dielectric material, for example). This involves understanding the general principles of the formulation of a liquid, knowing the physico-chemical and rheological properties of liquids, in order to meet the specifications of the implementation processes on the one hand, and the requirements of the intended application, on the other hand.

Heures d'enseignement

CM	Cours magistral	18h
TD	Travaux dirigés	4h
TP	Travaux pratique	8h

Compétences visées

- # Know the main principles of formulation and formatting.
- # Know the main operating principles of characterization techniques.
- # Use the methods of data collection and qualitative and quantitative data processing.
- # Analyze and synthesize data with a view to their exploitation.
- # Define the methods, the means of study and their implementation (adequacy of the characterization technique to the parameter studied).

Infos pratiques

Lieu(x)

➤ Angers

Campus

➤ Campus Belle-beille