VNIVERSITAT DE VALÈNCIA

Course Guide
44423 Use of supramolecular chemistry for the preparation of nanostructures and nanomaterials

COURSE DATA

Data Subject	
Código	44423
Name	Use of supramolecular chemistry for the preparation of nanostructures and nanomaterials
Cycle	Master's degree
ECTS Credits	3.0
Curso académico	2018 - 2019

Study (s)

Degree	Center	Acad. year	Period
2208 - M.U. en Nanociencia y Nanotecnolog²a Molecular	FACULTY OF CHEMISTRY	1	First term

Subject-matter

Degree	Subject-matter	Character
2208 - M.U. en Nanociencia y Nanotecnolog²a Molecular	7 - Use of supramolecular chemistry for the preparation of nanostructures and nanomaterials	Obligatory

Coordination

Name	Department
CORONADO MIRALLES, EUGENIO	320 - QUđMICA INORGĆNICA

SUMMARY

The aim is to introduce the students, through advanced lectures, into supramolecular chemistry and its utility to obtain nanostructures and nanomaterials of interest for chemical applications (catalysis, sensors), physical applications (magnetism, molecular electronics) and biomedical applications.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

There are no specified enrollment restrictions with other subjects of the curriculum.

OUTCOMES

2208 - M.U. en Nanociencia y Nanotecnología Molecular

- Students can apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
- Students are able to integrate knowledge and handle the complexity of formulating judgments based on information that, while being incomplete or limited, includes reflection on social and ethical responsibilities linked to the application of their knowledge and judgments.
- Students have the learning skills that will allow them to continue studying in a way that will be largely self-directed or autonomous.
- Students have the knowledge and understanding that provide a basis or an opportunity for originality in developing and/or applying ideas, often within a research context.
- To possess the necessary knowledge and abilities to continue with future studies in the PhD program in Nanoscience and Nanotechnology.
- For students from field of knowledge (e.g. chemistry) to be able to scientifically communicate and interact with colleagues from another field (e.g. physics) in the resolution of problems laid out by the Molecular Nanoscience and Nanotechnology.
- To know the methodological approaches used in Nanoscience.
- To acquire supramolecular chemistry conceptual concepts necessary for the design of new nanomaterials and nanostructures.
- To know the main techniques for molecular systems nanofabrication.
- To acquire the conceptual knowledge about molecular systems self-assembly and self-organisation.
- To know the main biological and medical application in this area.

LEARNING OUTCOMES

We expect the students to gain knowledge on supramolecular chemistry and its utility to obtain nanostructures and nanomaterials of interest for chemical applications (catalysis, sensors), physical applications (magnetism, molecular electronics) and biomedical applications.

DESCRIPTION OF CONTENTS

1. Supramolecular chemistry use for preparing nanostructures and nanomaterials.

1. Self-assembly
1.1. Hierarchical self-assembly and auto-organization: functional nanostructures and supra-molecular materials with interesting physical or chemical properties; design of bio-molecular architectures; design of functional molecules and nanomaterials with a high level of communication with biological systems and its biomedical applications.
1.2. Organization of supra-molecular structures in surfaces: Self-assembled monolayers (SAMs).
1.3. Use of self-assembled structures as templates for growing organic and inorganic nanostructures.
1.4. Self-assembly of nanoparticles.
1.5. Chirality in surfaces and its relevance in heterogeneous catalysis. Supramolecular polymers and block copolymers.

2. Crystal engineering
2.1. Crystal engineering.
2.2. Crystal structure prediction.
2.3. Supramolecular interactions: supramolecular synthons, secondary building units and structural databases.
2.4. Crystallization techniques.
2.5. Graph set analysis.
2.6. Crystallography: basics.
2.7. Powder diffraction.
2.8. Graphical visualizers

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	15.00	100
Seminars	5.00	100
Tutorials	4.00	100
Other activities	2.00	100
Preparation of evaluation activities	37.00	0
Preparing lectures	12.00	0
TOTAL	**75.00**	

TEACHING METHODOLOGY

- Theory classes, participatory lectures
- Articles discussion.
- Chaired debate or discussion.
- Practical cases or seminar problems discussion.
- Seminars.
- Problems.
- Laboratory practices and demonstracions and visit to installations.
- Experts conferences.
- Attendance to courses, conferences and round tables.

EVALUATION

Written exam about the subject basic contents	70-90%
Attendance and active participation in seminars.	0-10%
Questions answering	10-20%

REFERENCES

Basic

- J.W. Steed, J.L. Atwood: Supramolecular Chemistry (2nd Ed.) Wiley, 2009.
V. Balzani, M. Ventura, A. Credi: Molecular Machines, Wiley-VCH, 2003.
P.J. Collings, Liquid Crystals: Natures delicate of Mater. 2ª Ed., Princenton University Press, 2002.
Ulman, An Introduction to Ultrathin Organic Films: from Langmuir-Blodgett to Self-Assembly, Academic Press, San Diego, 1991.
J.W. Steed, D.R. Turner, K.J. Wallace: Core Concepts in Supramolecular Chemistry and Nanochemistry. Wiley, 2007.
V. Balzani, A. Credi, M. Venturi, Molecular Devices and Machines: Concepts and Perspectives for the Nanoworld, Wiley, 2008.
K.J. Klabunde, Nanoscale Materials in Chemistry, Wiley, 2001.
Y.S. Lee, Self-Assembly in Nanotechnology, Wiley, 2008.
J.L. Atwood, J.W. Steed, Organic Nanostructures, Wiley, 2008.
Supramolecular Chemistry: From Molecules to Nanomaterials, ed. P. Gale and J. Steed, Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, 2012

Additional

- Organic Nanomaterials: Synthesis, Characterization, and Device Applications, T. Torres, G. Bottari, Eds., John Wiley & Sons, Inc, Chichester 2013.
L. Brammer, Developments in Inorganic Crystal Engineering, Chem. Soc. Rev. 2004, 33, 476489
G. R. Desiraju, Crystal Engineering. The Design of Organic Solids; Elsevier: Amsterdam, 1989
M. C. Etter, Encoding and Decoding Hydrogen-Bond Patterns of Organic Compounds, Acc. Chem. Res. 1990, 23, 120-126
M. OKeeffe and O. M. Yaghi, Deconstructing the Crystal Structures of Metal-Organic Frameworks and Related Materials into Their Underlying Nets, Chem. Rev. 2012, 112, 675702
G. R. Desiraju, Supramolecular Synthons in Crystal EngineeringA New Organic Synthesis Angew. Chem. Int. Ed. 1995, 34, 2311