



## Teaching Guide

Identifying Data					2017/18
Subject (*)	Advanced Techniques for the Characterization of Materials	Code	610509121		
Study programme	Mestrado Universitario en Investigación Química e Química Industrial (Plan 2017)				
Descriptors					
Cycle	Period	Year	Type	Credits	
Official Master's Degree	Yearly	First	Optativa	3	
Language	SpanishGalicianEnglish				
Teaching method	Face-to-face				
Prerequisites					
Department	Química				
Coordinador	Sanchez Andujar, Manuel	E-mail	m.andujar@udc.es		
Lecturers	Sanchez Andujar, Manuel	E-mail	m.andujar@udc.es		
Web					
General description	This course includes a description of the fundamentals and main applications of several characterization techniques widely used in Materials Science and not previously treated in the compulsory subject "Materials Characterization Techniques and Biointerphases" (module M1). These contents are important to complete the training in this module M5 -Nanoquímica and New Materials- and to have a more complete vision of the techniques of characterization of materials and nanomaterials.				

## Study programme competences / results

Code	Study programme competences / results
A1	Define concepts, principles, theories and specialized facts of different areas of chemistry.
A2	Suggest alternatives for solving complex chemical problems related to the different areas of chemistry.
A9	Promote innovation and entrepreneurship in the chemical industry and in research.
B2	Students should apply their knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
B3	Students should be able to integrate knowledge and handle complexity, and formulate judgments based on information that was incomplete or limited, include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments.
B5	Students must possess learning skills to allow them to continue studying in a way that will have to be largely self-directed or autonomous.
B8	Evaluate responsibility in the management of information and knowledge in the field of Industrial Chemistry and Chemical Research
B10	Use of scientific terminology in English to explain the experimental results in the context of the chemical profession
B11	Apply correctly the new technologies to gather and organize the information to solve problems in the professional activity.
C1	CT1 - Elaborar, escribir e defender publicamente informes de carácter científico e técnico
C3	CT3 - Traballar con autonomía e eficiencia na práctica diaria da investigación ou da actividade profesional.
C4	CT4 - Apreciar o valor da calidade e mellora continua, actuando con rigor, responsabilidade e ética profesional.

## Learning outcomes

Learning outcomes	Study programme competences / results		
- The student will obtain an overview of the advanced techniques of morphological, structural and microstructural characterization.	AC1	BC2	CC1
- The student will learn the advantages and limitations of each one of the characterization technique.	AC2	BC3	CC3
- When you need to characterize a material, the student will be able to discern what are the characterization techniques that better fit your needs / possibilities.	AC9	BC5	CC4
		BC8	
		BC10	
		BC11	

## Contents

Topic	Sub-topic



Theme 1. microscopic techniques	Introduction to microscopic techniques. Optical microscopies (fluorescence and confocal), electronic microscopies (TEM, SEM, STEM, electron diffraction), scanning probe microscopies (STM, AFM).
Theme 2. diffractometric techniques	Introduction to diffractometric techniques. X-ray and synchrotron diffraction, neutron diffraction
Theme 3. spectroscopic techniques.	electronic spectroscopic techniques. (EDXS, EELS) electron paramagnetic resonance (EPR)
Theme 4: Characterization of porous materials	Physical adsorption of gases, specific surface area, pore size distribution.
Tema 5: Magnetometric	VSM magnetometry, SQUID magnetometry, AC susceptibility

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student's personal work hours	Total hours
Guest lecture / keynote speech	A1 A2 A9	12	0	12
Seminar	A1 B2 B3 B5 B8	7	0	7
Problem solving	A1 A2 A9 B2 B10 B11 C1 C4	0	24	24
Document analysis	C3 C4	0	12	12
Objective test	A1 A2 A9 B2 B3 B5 B8 B10 B11 C1	1	18	19
Personalized attention		1	0	1

(\*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
Methodologies	Description
Guest lecture / keynote speech	Theoretical classes. Magisterial lessons (with the use of blackboard and computer), complemented with the tools of virtual teaching
Seminar	Practical seminars conducted by teachers of the Master, or invited professionals from companies, the Administration or other universities. Interactive sessions related to the subjects with discussions and exchange of points of view with the students
Problem solving	Resolution of practical exercises (problems, quizzes, processing and interpretation of information, evaluation of scientific publications, etc.).
Document analysis	Personal study based on different sources of information.
Objective test	Preparation of the different tests for verification of obtaining both theoretical and practical knowledges, and the acquisition of skills and attitudes.

Personalized attention	
Methodologies	Description
Seminar Problem solving Document analysis	Individual or small group tutoring.

Assessment			
Methodologies	Competencies / Results	Description	Qualification
Guest lecture / keynote speech	A1 A2 A9	Valorarase o traballo do alumnado, as súas respostas, o seu nivel de coñecemento, e a súa participación activa no debate cos seus compañeiros.	5



Seminar	A1 B2 B3 B5 B8	SESIÓN MAXISTRAL, SEMINARIOS, SOLUCIÓN DE PROBLEMAS: computaranse conxuntamente (25% da calificación global)	20
Problem solving	A1 A2 A9 B2 B10 B11 C1 C4	SESIÓN MAXISTRAL, SEMINARIOS, SOLUCIÓN DE PROBLEMAS: computaranse conxuntamente (25% da calificación global)	15
Objective test	A1 A2 A9 B2 B3 B5 B8 B10 B11 C1	Computará o 60% da calificación global.	60

## Assessment comments

1. Assessment procedure. The assessment of this subject will be done through a system whose sections and their respective weighting is detailed:

Assessment system (Weighting):

- Final examination (60 %)
- Continuous evaluation (40 %) through:

-- problems solving and case studies and

-- continuous evaluation of the student

by means of written and oral questions during the course and eventual oral presentation of papers and reports.

According to this, the final exam will have a weight of 60% in the qualification of the subject. Continuous evaluation will have a 25% weight in the qualification of the subject. The student score is obtained as a result of applying the following formula:

$$\text{Final score} = 0.6 \times N1 + 0.4 \times N2$$

being N2 and N1 the numerical scores of the corresponding continuous assessment (scale 0-10) and the final examination (scale 0-10), respectively.

Face-to-face teaching activities (seminars and tutorials) are compulsory.

Repeater students will have the same regime of classes to those who are studying the subject for the first time.

2. Recommendations with regard to the evaluation.

The student should review the theoretical concepts introduced in the various topics using the supporting material provided by teachers and the literature recommended for each theme. The degree of success in the resolution of the exercises provides a measure of the student's preparation to deal with the final examination of the subject. Students who find difficulties in working the proposed activities should consult with the teacher, with the goal that it can analyze the problem and help solve these challenges.

3. Recommendations with regard to the recovery.

Teacher will discuss with students who do not successfully overcome the evaluation process, and want it, the difficulties encountered in learning the contents of the subject. The teacher will also provide additional material (questions, exercises, exams, etc.) to reinforce the learning of the subject.

4. Others.

Attendance at face-to-face activities (face to face lectures, seminars and tutorials) is mandatory. The faults must be documentary supported, accepting reasons referred to in the University regulations.

## Sources of information



<b>Basic</b>	<p>- A.R. West: "Basic Solid State Chemistry". Wiley, 2 ed., 1999. - A.R. West: "Solid State Chemistry and its Applications". Wiley, 2 ed., 2014. - L.E. Smart, E.A. Moore: "Solid State Chemistry: An Introduction". CRC Press, 4 ed., 2012.- G. Cao: "Nanostructures and Nanomaterials: Synthesis, Properties and Applications". Imperial College Press, 2004. - J. M. Köhler: "Nanotechnology: an introduction to nanostructuring techniques", Weinheim : Wiley-VCH, 2007- J.-P. Eberhart: "Structural and chemical analysis of materials : X-ray, electron and neutron diffraction, X-ray, electron and ion spectrometry, electron microscopy ". Wiley, 1991.- Angus I. Kirkland and John L. Hutchison (Eds.): "Nanocharacterisation?". RSC Publishing, Cambridge, 2007.- Kenneth J. Klabunde (Ed.): "Nanoscale materials in chemistry?". Wiley-Interscience, New York, 2001.- J.A. Schwarz, C.I. Contescu, K. Putyera (Editores): "Dekker Encyclopedia of nanoscience and nanotechnology" (5 volumes). Marcel Dekker, 2004.- John P. Sibila: "A guide to materials characterization and chemical analysis?". VCH Publishers, 1998. Ademais recomendaranse para cada tema textos complementarios (artigos, páxinas web, textos específicos) no momento da impartición da materia.</p>
<b>Complementary</b>	

**Recommendations**

**Subjects that it is recommended to have taken before**

**Subjects that are recommended to be taken simultaneously**

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**Subjects that continue the syllabus**

**Other comments**

(\*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.