Teaching Guide				
Identifying Data				2016/17
Subject (*)	Deseño e Desenvolvemento de Materiais Avanzados		Code	610509018
Study programme	Mestrado en Investigación Química e Química Industrial (plan 2016)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	Yearly	First	Optativa	3
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Química Fundamental			
Coordinador	Señaris Rodriguez, Maria Antonia	E-mail	m.senaris.rodriguez@udc.es	
Lecturers	Señaris Rodriguez, Maria Antonia	E-mail	m.senaris.rodriguez@udc.es	
Web				
General description	Esta asignatura pertence ao módulo da especialidade ?Nanoquímica e Novos Materiais?, que engloba 4 asignaturas, todas elas intimamente relacionadas: 1.-Deseño e desenvolvemento de materiais avanzados 2.-Técnicas de caracterización de materiais 3.-Propiedades de materiais 4.-Materiais moleculares Esta asignatura é clave no dito módulo para comprender qué son os materialis avanzados, que se espera deles á vista das súas propiedades e cales son as estratexias para o seu deseño e desenvolvemento.			

Study programme competences / results	
Code	Study programme competences / results
A1	Define concepts, principles, theories and specialized facts of different areas of chemistry.
A3	Apply materials and biomolecules in innovative fields of industry and chemical engineering.
A4	Innovate in the methods of synthesis and chemical analysis related to the different areas of chemistry
B1	Possess knowledge and understanding to provide a basis or opportunity for originality in developing and / or applying ideas, often within a research context
B4	Students should be able to communicate their conclusions, and the knowledge and the reasons that support them to specialists and non-specialists in a clear and unambiguous manner
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.
B7	Identify information from scientific literature by using appropriate channels and integrate such information to raise and contextualize a research topic
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.

Learning outcomes			
Learning outcomes	Study programme competences / results		
- The student will learn the main strategies for the design and development of advanced materials. -The student will obtain an overview of the main advances in the development of different types of materials (ionic conductors, dielectrics, ferroelectrics, multiferroics, superconductors , semiconductors, optic materials, catalytic materials , magnetic materials , etc.) aand their applications in technological devices. - The student will understand composition-structure-microstruture- properties relationships - The student will understand the importance of nanomaterials for the development of new materials , and their role in the improvement of devices as well as their advantages as compared to conventional macrosacopic materials	AC1 AC3 AC4	BC1 BC4 BC5 BC7 BC10 BC11	

Contents	
Topic	**Sub-topic**
I.Introduction to Nanochemistry and general Introduction to synthesis of materials	-Introduction to Nanochemistry. Surface/volume ratio. Nanomanipulation. - General Introduction to synthesis of materials. Top-Down and Bottom-Up methods Growth of Single crystals Preparation of polycrystalline materials: Ceramic method vs alternative methods (decomposition of nitrates, coprecipitation, sol-gel, high pressure synthesis , microwave synthesis).
II. Nanomaterials	Metallic, semiconducting and magnetic nanomaterials Synnthesis. Size, shape and surrounding effects Applications.
III. Surface modification of nanomaterials.	Surface modification of nanomaterials. Ligand exchange. Layer by layer method Organic and inorganic coatings
IV. Overview of different outstanding non-molecular materials I: Transition metal oxides	Overview of transition metal oxides with emphasis in mixed oxides. Synthesis, structure, properties and main applications
Theme 5. Overview of different outstanding non-molecular materials II: zeolites, Inorganic-organic hybrids (MOFs) , etc.	-Inorganic-organic hybrids (MOFs): Synthesis, structure, properties and main applications. -Zeolites: Synthesis, structure, properties and main applications.

Planning				
Methodologies / tests	**Competencies / Results**	**Teaching hours (in-person & virtual)**	**Student?s personal work hours**	**Total hours**
Guest lecture / keynote speech	A1 A3 A4 B5	12	0	12
Seminar	B4 B7 B10	7	0	7
Document analysis	B5 B7 B11	0	12	12
Problem solving	A3 A4 B1 B4 B5	0	24	24
Objective test	A1 A3 A4 B1 B4 B5 B7 B10 B11	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	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
Document analysis	Personal study based on different sources of information.
Problem solving	Resolution of practical exercises (problems, quizzes, processing and interpretation of information, evaluation of scientific publications, etc.).
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 Document analysis Problem solving	Individual or small group tutoring.

Assessment			
Methodologies	Competencies / Results	Description	**Qualification**
Guest lecture / keynote speech	A1 A3 A4 B5	GUEST LECTURE + SEMINARS + PROBLEM SOLVING: 25% of global qualification	0
Seminar	B4 B7 B10	GUEST LECTURE + SEMINARS + PROBLEM SOLVING: 25% of global qualification	0
Problem solving	A3 A4 B1 B4 B5	GUEST LECTURE + SEMINARS + PROBLEM SOLVING: 25% of global qualification	25
Objective test	A1 A3 A4 B1 B4 B5 B7 B10 B11	5% of global qualification	75

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 (75%)
- Continuous evaluation (25%) 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 75% 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:

Final score = 0.75 x N1 + 0.25 x 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

Basic	1. A.R. West: "Solid State Chemistry and its Applications". Wiley, 2 ed., 2014 2. C. N. R. Rao, Chintamani Nagesa Ramachandra Rao ?New Directions in Solid State Chemistry?. 2nd edition, Cambridge University Press, 19973. C.N. R. Rao and B. Raveau, ?Transition metal oxides?, John Wiley & Sons ,1998.4. P. Gómez-Romero, C. Sanchez ?Functional Hybrid Materials? (eds.), Wiley-VCH, 2003, 5. G. A. Ozin, Nanochemistry: A Chemical Approach to Nanomaterials, , 2005 6. Gunter Schmid, Clusters and colloids : from theory to applications, , 19942. D.L. Feldheim, C.A. Foss Jr., Metal Nanoparticles, , 20013. G. Schmid, Nanoparticles. From Theory to Application, , 20044. Brongersma, M. L.; Kik, P. G. Surafce plasmon nanophotonics, Springer, 2007. 5. Shalaev, V. M.; Kawata, S. Nanophotonics with surface plasmons, Elsevier, 2007.7. G. Cao: "Nanostructures and Nanomaterials: Syntesis, Properties and Applications". Imperial College Press, 2004. 8. U. Schubert, N. Hüsing: "Synthesis of Inorganic Materials". Wiley-VCH, 2 ed., 2004. 9. K. T. Ramesh: "Nanomaterials: Mechanics and Mechanisms", Springer-Verlag, 2009.10. D. Vollath: "Nanomaterials : an introduction to synthesis, properties and applications". Weinheim, Wiley-VCH, 2013.11. Kenneth J. Klabunde (Ed.): ?Nanoscale materials in chemistry?. Wiley-Interscience, New York, 2001.12. J.A. Schwarz, C.I. Contescu, K. Putyera (Editores): "Dekker Encyclopedia of nanoscience and nanotechnology" (5 volumes). Marcel Dekker, 2004.13. M. Lazzari, G. Liu, S. Lecommandoux (Editores): ?Block Copolymers in Nanoscience?. Wiley-VCH, 2006.14. L. C. Sawyer, D. T. Grubb, G. F. Meyers (Editores): ?Polymer Microscopy? Springer, 2008.15. V. Rotello, S. Thayumanavan (Editores) ?Molecular Recognition and Polymers?Además se recomendarán para cada tema textos complementarios (artículos, páginas web, textos específicos) en el momento de impartición de la asignatura.
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Propiedades de Materiais/610509020 Técnicas de Preparación e Caracterización de Materiais/610509019
Subjects that continue the syllabus
Other comments
In this module it is essential to make a global approach to materials, trying to understand the close relationship that exists between the different materials synthetic procedures and their structural and microstructural characteristics, with their properties and, therefore, with their applications.

(*)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.