



## Teaching Guide

Identifying Data				
Subject (*)			Code	2018/19
Termomechanics of Materials Properties. Advanced Methods			730495004	
Study programme				
Mestrado Universitario en Materiais Complexos: Análise Térmica e Reoloxía (plan 2012)				
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Obligatory	3
Language	English			
Teaching method	Face-to-face			
Prerequisites				
Department	Enxeñaría Naval e Industrial			
Coordinator	Artiaga Díaz, Ramon Pedro		E-mail	ramon.artiaga@udc.es
Lecturers	Artiaga Díaz, Ramon Pedro López Beceiro, Jorge José		E-mail	ramon.artiaga@udc.es jorge.lopez.beceiro@udc.es
Web				
General description	Following the previous subject (Fundamentals Methods), the objective is to deepen the study of the thermal properties describing the overlay charts time / temperature, methods of analyzes modulated to separate different thermal processes (glass transition, relaxation enthalpy).			

## Study programme competences

Code	Study programme competences
A1	Set up and conduct tests using the techniques of thermal analysis and rheology most appropriate in each case, within the scope of complex materials
A2	Identify and evaluate the different types of complex materials
B1	Knowledge and understanding to provide a basis or opportunity for originality in developing and / or applying ideas, often in a research context
B2	The students have the skill to apply their knowledge and their ability to solve problems in new or unfamiliar contexts within broader (or multidisciplinary) contexts related to their field of study
B4	That the students can communicate their conclusions and the knowledge and last reasons behind that conclusions to specialized and non specialized audience in a clear and unambiguous way
B5	That students possess learning skills to enable them to continue studying in a way that will be largely self-directed or autonomous.
B6	Learning to learn
B8	Applying a critical, logical and creative way of thinking
B13	Analysis-oriented attitude
B21	To assess the importance of research, innovation and technological developments in the socio-economic and cultural progress of society
C2	Have a good command of spoken and writing expression and understanding of a foreign language.
C3	Using the basic tools of information technology and communications (ICT) necessary for the exercise of their profession and for learning throughout his life.
C6	Critically assessing the knowledge, technology and information available to solve the problems they face with.
C7	To assume as a professional and citizen the importance of learning throughout life.
C8	To assess the importance of research, innovation and technological development in the socio-economic and cultural progress of society.
C9	Appreciate the importance of research in environmental protection

## Learning outcomes

Learning outcomes	Study programme competences



Correctly set up the tests	AR1	BR1 BR2 BR4 BR8 BR13 BR21	CR2 CR3 CR6 CR7 CR8
To know the different possibilities of separating overlapping process	AR1 AR2	BR2 BR4 BR5 BR6 BR8 BR13	CR2 CR3 CR6 CR7 CR8 CR9

Contents	
Topic	Sub-topic
The glass transition and the enthalpic relaxation	The glass transition. Erasing thermal history. Effect of annealing below the T <sub>g</sub> . Problem of overlapping glass transition and enthalpic relaxation.
Diagrams TTT	Measuring the gelation Measuring the vitrification Construction and meaning of the TTT diagrams.
Separating overlapped processes by thermal-modulated methods	Reversibility as function of observation time Study of the glass transition by dynamic techniques Separation of overlapping processes

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student's personal work hours	Total hours
Guest lecture / keynote speech	A1 A2 B1 B2 B5 B13 B21 C7 C8 C9	10	10	20
Laboratory practice	A1 B1 B6 B8 B13	15	9	24
Supervised projects	A1 A2 B1 B2 B4 B6 B13 C2 C3 C6 C8 C9	2.5	22.5	25
Objective test	A1 A2 B2 B4 B13 B21 C2	1	0	1
Personalized attention		5	0	5

(\*)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	Presentation given by the professor, on a schematic basis, focusing on the main topics, covering both theoretical and practical issues.
Laboratory practice	Performance of practical activities such as demonstrations, exercises, experiments, etc..
Supervised projects	Activities whose purpose is that the students enlarge the study of the topics presented in the program and consolidate their acquired knowledge and capabilities. These activities should also help the students learn and improve their capabilities in literature survey.
Objective test	Exam that will help to evaluate the knowledge and competencies acquired by the students.

Personalized attention
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Methodologies	Description
Supervised projects	The personalized attention to students, understood as a support in the teaching-learning process, will take place in the hours of tutoring of the teacher.  No academic dispensation is accepted.
Guest lecture / keynote speech	
Laboratory practice	
Objective test	

Assessment			
Methodologies	Competencies	Description	Qualification
Supervised projects	A1 A2 B1 B2 B4 B6 B13 C2 C3 C6 C8 C9	Presentation (oral and written) of the supervised work.	60
Guest lecture / keynote speech	A1 A2 B1 B2 B5 B13 B21 C7 C8 C9	Continuous assessment through monitoring of student work in the classroom, laboratory and / or tutorials.	10
Laboratory practice	A1 B1 B6 B8 B13	Continuous assessment through monitoring of student work in the classroom, laboratory and / or tutorials.	10
Objective test	A1 A2 B2 B4 B13 B21 C2	Examination or objective test.	20

Assessment comments

Sources of information	
<b>Basic</b>	<p>Mechanical properties of polymers and composites / Lawrence E. Nielsen, Robert F. Landel Nielsen, Lawrence E. Esc</p> <p>Politécnica Superior -- CM P 154 -- Thermal analysis. Fundamentals and applications to material characterization: proceedings of the international seminar: Thermal analysis and rheology. Ferrol, Spain, 30 Juny-4 July, 2003 / Ramón Artiaga Díaz (ed.), A Coruña: Universidade da Coruña, Servicio de Publicacions, 2005, ISBN 84-9749-100-9</p> <p>Thermal analysis of polymers / edited by Joseph D. Menczel, R. Bruce Prime; Hoboken, N.J.: John Wiley, [2009], ISBN 978-0-471-76917-0</p> <p>Handbook of thermal analysis of construction materials / by V.S. Ramachandran ... [et al.]. Norwich (New York): Noyes Publications/William Andrew Pub., [2003], ISBN 0-8155-1487-5</p> <p>Handbook of thermal analysis and calorimetry. Volume 2, Applications to inorganic and miscellaneous materials / edited by Michael E. Brown, Patrick K. Gallagher, Amsterdam: Elsevier, 2003, ISBN 0-444-82086-8</p> <p>Modulated temperature differential scanning calorimetry : theoretical and practical applications in polymer characterisation / edited by Mike Reading and Douglas J. Hourston, Dordrecht : Springer, [2006] ? ISBN 978-1-4020-3749-X</p> <p>Handbook of thermal analysis and calorimetry. Volume 5, Recent advances, techniques and applications / edited by Michael E. Brown, Patrick K. Gallagher, Amsterdam : Elsevier, 2008 - 978-0-444-53123-0</p>
<b>Complementary</b>	

Recommendations
<b>Subjects that it is recommended to have taken before</b>
<b>Subjects that are recommended to be taken simultaneously</b>
Thermo-mechanical properties of materials. Fundamental Methods/730495003
<b>Subjects that continue the syllabus</b>
<b>Other comments</b>

