



## Teaching Guide

| Identifying Data           |  |               |                            |                |
|----------------------------|--|---------------|----------------------------|----------------|
|                            |  |               | 2021/22                    |                |
| <b>Subject (*)</b>         | Termomechanics of Materials Properties. Advanced Methods   | <b>Code</b>   | 730495004                  |                |
| <b>Study programme</b>     | Mestrado Universitario en Materiais Complexos: Análise Térmica e Reoloxía (plan 2012)  |               |                            |                |
| Descriptors                |  |               |                            |                |
| <b>Cycle</b>               | <b>Period</b>  | <b>Year</b>   | <b>Type</b>                | <b>Credits</b> |
| Official Master's Degree   | 2nd four-month period  | First         | Obligatory                 | 3              |
| <b>Language</b>            | English  |               |                            |                |
| <b>Teaching method</b>     | Face-to-face   |               |                            |                |
| <b>Prerequisites</b>       |  |               |                            |                |
| <b>Department</b>          | Enxeñaría Naval e Industrial   |               |                            |                |
| <b>Coordinador</b>         | López Beceiro, Jorge José  | <b>E-mail</b> | jorge.lopez.beceiro@udc.es |                |
| <b>Lecturers</b>           | Artiaga Diaz, Ramon Pedro  | <b>E-mail</b> | ramon.artiaga@udc.es       |                |
|                            | López Beceiro, Jorge José  |               | jorge.lopez.beceiro@udc.es |                |
| <b>Web</b>                 | <a href="http://eps.udc.es/diderot">http://eps.udc.es/diderot</a>  |               |                            |                |
| <b>General description</b> | 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). |               |                            |                |



Contingency plan

1. Modifications in the contents.

The content is not modified.

2. Methodologies

\* Teaching methodologies that are maintained

Master session (through teams)

Tutored works (tutored by teams or email)

Objective test (online)

\* Teaching methodologies that change

Laboratory practice. It is replaced by the presentation of practical cases in the master sessions and the reading and discussion of scientific articles (analysis of documentary sources).

3. Mechanisms for personalized attention to students.

- E-mail: every day. Useful for making queries, requesting virtual meetings to resolve doubts and following up on supervised work.

- Microsoft Teams: personalized student tutoring

- Moodle: will be used as a repository for documentation provided to students.

1. Modificaciones en los contenidos

2. Metodologías

\*Metodologías docentes que se mantienen

\*Metodologías docentes que se modifican

3. Mecanismos de atención personalizada al alumnado

4. Modificacines en la evaluación

\*Observaciones de evaluación:

5. Modificaciones de la bibliografía o webgrafía

4. Modifications in the evaluation.

Master session 10% - Continuous assessment through evaluation of active participation and with use.

Mentored work 60% - Presentation of supervised work.

Objective test 20% - Presentation of supervised work will be done orally.

Analysis of documentary sources 10% - Reading and discussion of articles in scientific journals related to the firm

\* Evaluation observations: -

5. Modifications to the bibliography or webography



No modifications



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

| Contents  |  |
|---|--|
| Topic   | Sub-topic  |
| The glass transition and the enthalpic relaxation | The glass transition.<br>Erasing thermal history.<br>Effect of annealing below the T <sub>g</sub> .<br>Problem of overlapping glass transition and enthalpic relaxation. |
| Diagrams TTT                                      | Measuring the gelation<br>Measuring the vitrification<br>Construction and meaning of the TTT diagrams.   |



|  |   |
|--|---|
| Separating overlapped processes by thermal-modulated methods | Reversibility as function of observation time<br>Study of the glass transition by dynamic techniques<br>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<br>B21 C7 C8 C9      | 8                    | 12                            | 20          |
| Laboratory practice            | A1 B1 B6 B8 B13                         | 8                    | 24                            | 32          |
| Supervised projects            | A1 A2 B1 B2 B4 B6<br>B13 C2 C3 C6 C8 C9 | 2                    | 18                            | 20          |
| Objective test                 | A1 A2 B2 B4 B13 B21<br>C2               | 1                    | 0                             | 1           |
| Personalized attention         |   | 2                    | 0                             | 2           |

(\*)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         |  |
|--------------------------------|--|
| 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. |
| Guest lecture / keynote speech |  |
| Laboratory practice            | No academic dispensation is accepted.  |
| Objective test                 |  |

| Assessment                     |   |   |               |
|--------------------------------|---|---|---------------|
| Methodologies                  | Competencies                            | Description   | Qualification |
| Supervised projects            | A1 A2 B1 B2 B4 B6<br>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<br>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<br>C2               | Examination or objective test.  | 20            |

| Assessment comments   |
|---|
| Academic waiver is not accepted.<br>The evaluation criteria for the second opportunity and the extraordinary opportunity are the same as for the first opportunity. |



## Sources of information

|                      |  |
|----------------------|--|
| <b>Basic</b>         | Mechanical properties of polymers and composites / Lawrence E. Nielsen, Robert F. Landel Nielsen, Lawrence E. Esc 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 84-9749-100-9Thermal analysis of polymers / edited by Joseph D. Menczel, R. Bruce Prime; Hoboken, N.J.: John Wiley, [2009], ISBN 978-0-471-76917-0Handbook of thermal analysis of construction materials / by V.S. Ramachandran ... [et al.]. Norwich (New York): Noyes Publications/William Andrew Pub., [2003], ISBN 0-8155-1487-5Handbook 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 0-444-82086-8Modulated 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-XHandbook 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 |
| <b>Complementary</b> |  |

## Recommendations

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

### Subjects that are recommended to be taken simultaneously

Thermo-mechanical properties of materials. Fundamental Methods/730495003

### Subjects that continue the syllabus

### Other comments

To help achieve a sustained immediate environment and meet the objective of action number 5: "Healthy and sustainable environmental and social teaching and research" of the "Green Campus Ferrol Action Plan":The delivery of the documentary work carried out in this subject:They will be requested in&nbsp;virtual&nbsp;format and/or computer supportIt will be done through Moodle, in digital format without the need to print them.If it is necessary to make them on paper:Plastics shall not be usedDouble-sided priing shall be carried out.Recycled paper will be used.Printing of drafts shall be avoided.A sustainable use of resources and the prevention of negative impacts on the natural environment must be made.

(\*)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.