

HERACLES

HERitage **R**esilience **A**gainst **CL**imate **E**vents on **S**ite

Deliverable D9.14
Summer school, including dissemination material such as flyer and poster M18

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Executive Summary

The Deliverable 9.14 “*Summer school, including dissemination material such as flyer and poster M18*” presents the objectives of the first HERACLES Summer/Fall School planned in the Grant Agreement, its organizational structure and the dissemination strategy of the event. It also includes other event information.

1 Introduction

1.1 Document Organisation

The present document is organised in 8 Sections as follows:

Section 1: presents the Document Organisation, Scope& Objectives, Reference Documents used, Acronyms & Abbreviations used in the document and relation with other HERACLES deliverables.

Section 2: provides a description of the HERACLES Fall School Program

Section 3: presents a brief description of the expertise and scientific interest of the school teachers.

Section 4: presents a brief description of the HERACLES Fall School audience.

Section 5: presents the way how the HERACLES Fall School was disseminated/communicated.

Section 6: includes some photos with a brief explanation, to give a taste of the event.

Section 7: summarises the conclusions

1.2 Scope & Objectives

Even if, this event was planned as Summer school, due to the scheduled period was then indicated as HERACLES *Fall School*. The “**Characterization Techniques in Cultural Heritage**” HERACLES **Fall School** is part of the activities proposed for WP9 – *Dissemination, Communication, Education & Training*. This activity responds to the WP9 objectives defined in HERACLES Grant Agreement *to promote knowledge exchange between specialists and to elaborate training programs towards academy*. The organization and implementation of this school is under the responsibility of UNINOVA, partner n. 9 of the HERACLES Project consortium.

Cultural Heritage (CH) consists of tangible and intangible, natural and manmade, movable and immovable assets inherited from the past. It represents our legacy to pass on to future generations. Thus, CH access, preservation and education are essential for humankind evolution representing an irreplaceable source of life, inspiration and unity.

There is a general need for further studies and research to better understand the nature, the degradation mechanism and the way to protect CH assets. Material science studies on the different kind of materials involved in the CH field, provide a



great contribution along this direction. Generally, advanced characterization techniques are used.

As *ex-situ* analyses are one of the main expertise of UNINOVA, the theme of the Fall School was focused on the laboratory techniques used for CH materials characterization. The selected topics concerned *ex-situ* techniques used to characterise CH samples as that ones from the HERACLES test beds. Furthermore, other techniques commonly used in cultural heritage studies, either in built monuments or in historical objects, were presented, to broaden the knowledge on the analytical techniques overview, their possibilities, specificities and applications. They included PIXE and (LA) ICP-MS.

The HERACLES Fall School organisation included both theoretical knowledge, real application to cultural heritage issues, and practical experiences in the CENIMAT laboratories. Furthermore, according to the HERACLES project philosophy, in improving the societal awareness, the Fall School program was concluded with a lecture on "Engineering education and the history of technology", intending to give a societal perspective of the advancement of technologies and to highlight the importance of safeguarding cultural heritage assets.

1.3 Reference Documents

Document name	Reference number
HERACLES – Annex 1: Description of Work	Grant Agreement nr. 700395
HERACLES - Project Handbook	Deliverable D11.1
HERACLES – Survey of the state –of-the-art of the technologies of interest for HERACLES	Deliverable D1.4
HERACLES - Definition of a systematic protocol related to the diagnostic and analytical strategies for each different monument to be studied on the basis of the different structures, materials and weathering states	Deliverable D3.1
HERACLES - Development of an in-situ diagnostic protocol for quick assessment and monitoring of the weathering state and its progress on the areas of interest for the studied test beds	Deliverable D3.2
HERACLES - Intermediate analysis of the experimental and theoretical aspects underlying the state-of-the art application of in-situ sensing technologies	Deliverable D3.4
HERACLES - Development of a detailed analytical protocol for laboratory analysis for the determination of materials and their alteration for the studied test beds using high-resolution sophisticated state of-the art analysis and microscopy	Deliverable D3.5



1.4 Acronyms and Abbreviations

ACRONYM	FULL NAME
C2TN	Centro de Ciências e Tecnologias Nucleares (Centre for Nuclear Sciences and Technologies)
CENIMAT	Centro de Investigação de Materiais (Centre for Materials Research)
CERENA	Centro de Recursos Naturais e Ambiente (Center for Natural Resources and Environment)
CH	Cultural Heritage
DCM	Departamento de Ciência dos Materiais (Department of Materials Science)
DCR	Departamento de Conservação e Restauro (Department of Conservation and Restoration)
DECivil	Departamento de Engenharia Civil, Arquitetura e Georrecursos (Department of Civil Engineering, Architecture and Georeferences)
DCSA	Departamento de Ciências Sociais Aplicadas (Department of Applied Social Sciences)
DF	Departamento de Física (Department of Physics)
FCT	Faculdade de Ciências e Tecnologia
FL	Faculdade de Letras
GA	Grant Agreement
IPT	Instituto Politécnico de Tomar
IST	Instituto Superior Técnico
LA-ICP-MS	Laser Ablation – Inductively Coupled Plasma - Mass Spectroscopy
OM	Optical Microscopy
PIXE	Particle Induced X-ray Emission
SEM-FIB	Scanning Electron Microscopy – Focused Ion Beam
UE	Universidade de Évora
UL	Universidade de Lisboa
UNINOVA	Instituto de Desenvolvimento de Novas Tecnologias, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa
UNL	Universidade NOVA de Lisboa
UV-Vis	Ultra Violet and Visible Spectroscopy
VICARTE	Vidro e Cerâmica para as Artes (Glass and Ceramic for the Arts)
WP	Work Package
XRD	X-ray Diffraction
XRF	X-ray Fluorescence



1.5 Relation with other deliverables

D1.4 Survey of the-state-of-the-art of the technologies of interest for HERACLES – M 12

D3.1 (FORTH) Definition of a systematic protocol related to the diagnostic and analytical strategies for each different monument to be studied on the basis of the different structures, materials and weathering states - M 12

D3.2 (FORTH) Development of an in-situ diagnostic protocol for quick assessment and monitoring of the weathering state and its progress on the areas of interest for the studied test beds - M 12

D3.4 (CNR) Intermediate analysis of the experimental and theoretical aspects underlying the state-of-the art application of in-situ sensing technologies - M13

D3.5 (CNR) Development of a detailed analytical protocol for laboratory analysis for the determination of materials and their alteration for the studied test beds using high-resolution sophisticated state-of-the art analysis and microscopy – M18



2 HERACLES Fall School “Characterization Techniques in Cultural Heritage” Program - 11-12 October, 2017 @ FCT/UNL- Lisbon, PT

The Fall School was structured for a duration of two days, October 11-12, 2017, and was held in the amphitheater of the UNINOVA building.

Each day included a set of presentations on the analytical techniques generally used, held by recognized experts with extensive experience on each subject. In addition, case-studies, given by postdoctoral researchers, were shown. In this way, both theoretical knowledge and the real application to cultural heritage issues were widely discussed.

According to the HERACLES project philosophy, in improving the societal awareness, the Fall School program was concluded with a lecture on “Engineering education and the history of technology”, intending to give a societal perspective of the advancement of technologies and to highlight the importance of safeguarding cultural heritage assets. As well, the role of the modern technician, scholar and researcher in preserving and passing our cultural heritage to future generations, was underlined.

On the second day, the afternoon session was devoted to practical experiences in the laboratories. The CENIMAT technical staff illustrated the equipment that can be used for the analysis of cultural heritage assets and the operational procedures to follow. The groups were formed in order to assure an interactive session. The equipment selected was: Micro Raman, XRD, XRF, Thermal Analysis, SEM-FIB, OM and UV-Vis.

The organizing committee of the Fall School was formed by Prof. Rodrigo Martins, Prof. Elvira Fortunato, Prof. Pedro Barquinha, MSc. Fernanda Carvalho and Prof. Joao Pedro Veiga (Chair of the event).

Info related to the topics presented, to the specific case-studies and additional material can be found at the orcid.org link, provided in Section 3, for each Teacher.

In the following the HERACLES Fall School Program including technical lectures, case studies and practical experiences in lab, is presented.

Wednesday, October 11th

14h00 – Opening session

14h15 – Rui Silva (DCM, FCT/UNL) – **“A microscopic view of archaeologic metallic materials by OM and SEM”**

14h50 – Luís Cerqueira Alves (C2TN, IST/UL) – **“Particle induced X-ray emission (PIXE) in cultural heritage studies: examples of application”**

15h25 – Maria Luísa Carvalho (DF, FCT/UNL) – **“X-ray Fluorescence and Raman Spectroscopy in Manueline foral charters and other Art Work characterization”**



16h05 – Coffee break

16h20 – **Case Study I** – Elin Figueiredo (CENIMAT, FCT/UNL) – “**Metallurgy in Ancient Times: an experimental approach**”

16h35 – **Case Study II** – Vanessa Antunes (DF, FCT/UNL) – “**Searching for Portuguese roots in India: material and technical assessment to Goa Cathedral former altarpiece**”

Thursday, October 12th

09h00 – Welcome

09h10 – Márcia Vilarigues (DCR, FCT/UNL) – “**Discovering the matter of colour – UV-Vis spectroscopy of historical materials**”

09h45 – Amélia Dionísio (CERENA/DECivil, IST/UL) – “**Contribute of chemical and mineralogical analytical techniques in conservation of stone cultural heritage**”

10h20 – Coffee break

10h40 – José Mirão (Lab. HERCULES, U. Évora) – “**(LA-)ICP-MS in Heritage and Material Culture Studies**”

11h15 – **Case Study III** – Mathilda Larsson Coutinho (VICARTE, FCT/UNL) – “**Biological colonization on majolica glazed tiles**”

11h30 – **Case Study IV** – Susana Coentro (VICARTE, FCT/UNL) – “**An Iberian Heritage: Hispano-Moresque Architectural Tiles from Portuguese and Spanish Collections**”

11h45 – Maria Paula Diogo (DCSA, FCT/UNL) – “**Engineering education and the history of technology**”

12h20 – Lunch

14h30 – **In-house, hands-on approach to technical solutions for cultural heritage characterization available at CENIMAT (FCT/UNL)**

- Micro-Raman
- X-ray diffraction (XRD)
- X-ray fluorescence (XRF)
- Thermal Analysis
- SEM-FIB
- Optical Microscopy (OM)
- UV-Vis



3 Fall School Invited Teachers

In this section, the profile of the invited Teachers, showing their expertise and scientific interests, is provided.

Wednesday, October 11th



Rui Silva

Assistant Professor

DCM, FCT/UNL

<http://orcid.org/0000-0002-0914-8517>

PhD in Material Science, specialization Metallurgy (1999, FCT-UNL, Lisbon, Portugal). Graduation in Metallurgical Engineering (1985, IST-UNL, Lisbon, Portugal).

Main interest in:

- Physical metallurgy: structural characterization of metallic materials. Structural, thermal and mechanical effects, resulting from thermo-mechanical processing of metallic alloys. Archaeometallurgy applications for copper based alloys.
- Corrosion (electrochemistry): kinetic evaluation of corrosion/passivation mechanisms and corrosion products identification. Optimization of reductive electrochemical processes. Diagnosis and Conservation of metallic (archaeological and museological) objects.



Luís Cerqueira Alves

Researcher

C2TN, IST/UL

<https://orcid.org/0000-0001-5369-5019>

PhD in Physics, specialty of Nuclear Physics (2004, Faculdade de Ciências, UL, Lisbon, Portugal). Graduation in Physics, Microphysics (1986, Faculdade de Ciências, UL, Lisbon, Portugal).

Scientific interest:

- Application and development of ion beam analysis techniques, using ITN's Van de Graaff accelerator, Sacavém.
- Experimental implementation related to the development of data control and data processing equipment and software, with particular attention to those related to the CFNUL / ITN Nuclear Microprobe.

Main areas of activity: applications in materials science, archaeometry, environment (aerosols) and mineralogy.



Luísa Carvalho

PhD in Atomic Physics (1984 at UL, Lisbon, Portugal). Aggregation in Physics (2000 at UL, Lisbon Portugal).

Scientific interest:

- X- Ray Fluorescence Spectrometry;
- Development of devices and methods in analytical techniques for trace elements content;
- Micro and trace elemental analysis using X-rays and synchrotron radiation in: Objects of art and cultural heritage;
- Environmental contamination; Bio-medical samples;



Full Professor
DF, FCT/UNL
<http://orcid.org/0000-0002-9004-1134>



Elin Figueiredo
Researcher
CENIMAT, FCT/UNL
<http://orcid.org/0000-0002-4821-3895>

- Raman Spectroscopy in objects of art and cultural heritage and environment for molecular identification and speciation.

PhD in Conservation Science (2010, UNL, Lisbon, Portugal), Post-Graduation in Pre-History and Archaeology (2006, FL-UL, Lisbon, Portugal), 5-year degree in Conservation and Restoration (2004, FCT-UNL, Caparica, Portugal).

Main interests:

- Ancient metal studies; Archaeometallurgy; Experimental metallurgy and conservation science.

Has published works on copper based metallurgy from Chalcolithic, Bronze Age and Iron Age from Portuguese archaeological sites and on the long-term corrosion of copper base alloys such as bronze. Study of tin sources and production for ancient bronze metallurgy.



Vanessa Antunes
Researcher
DF, FCT/UNL
<http://orcid.org/0000-0001-7240-6956>

PhD in Art, Heritage and Restoration (2014, FL, UL, Lisbon Portugal). 5-year Degree in painting C&R (2002, IPT, Tomar, Portugal).

Integrated researcher of LIBPhys-UNL, Laboratório de Instrumentação, Engenharia Biomédica e Física da Radiação, DF, FCT, UNL and ARTIS-Instituto de História da Arte da FL UL. Subjects of interest are preparatory materials in the golden age of Portuguese painting, the projects "The invisible ground layer and its influence in Portuguese paintings of the 15th and 16th centuries", "PRIM'ART-Portugal Rediscovering Mural ART" and "De artibus in Auream Goa".

Thursday, October 12th



Márcia Vilarigues
Assistant Professor
DCR, FCT/UNL
<http://orcid.org/0000-0003-4134-2819>

PhD in Conservation Sciences, on Stained Glass Corrosion (2008, FCT-UNL, Lisbon, Portugal). Graduation in Physics (FCT/UNL) and MSc in Surface Science and Technology (FC, UL). Since 2010 she is the director of the Research Unit VICARTE-Glass and Ceramics for the Arts, devoted to trans-disciplinary research applied to glass and ceramics, focusing on where art and science intersect, and stimulating the sharing of knowledge, experiences and methodologies.. Expert in conservation and restoration of cultural heritage in the area of technical art history and materials degradation. Subjects of interests include materials and techniques used in stained glass, historical glass and paintings.



Amélia Dionísio
Assistant Professor
CERENA/DEcivil, IST/UL
<http://orcid.org/0000-0001-8016-4029>

PhD in degradation of stone of historic buildings (2002, IST, Lisbon, Portugal). Graduated in Mining Engineering (1993, IST, Lisbon Portugal).

Participant in several studies of conservation of rocks of Portuguese monuments, such as the Lisbon Cathedral, the Main Altar of the Jerónimos Monastery, the convent of St. Augustine (Leiria), the Roman Theater of Lisbon, the Mother Church of Vouzela, the Porta Especiosa in Coimbra, the Thermal Hospital of Caldas da Rainha and the Graça Church in Santarém.



José Mirão
Assistant Professor
HERCULES Lab,
Universidade de Évora
<http://orcid.org/0000-0003-0103-3448>

PhD in Geology (2004, UE, Évora, Portugal), member of the Department of Geosciences and the Center of Geophysics of Universidade de Évora and vice director of the Laboratory of Microscopy and Microanalysis of the HERCULES Lab - Cultural Heritage, Studies and Safeguard, devoted to the study and valorisation of cultural heritage, focusing on the integration of physical and material sciences methodologies and tools in interdisciplinary approaches.

The scientific activity of Jose Mirão has been oriented by the development of new analytical methodologies and their application, especially to materials of geological origin and patrimonial assets.



Mathilda Larsson Coutinho
Researcher
VICARTE, FCT/UNL
<http://orcid.org/0000-0002-3802-1363>

PhD in Conservation and Restoration with specialization in Conservation Sciences (2015, FCT/UNL, Lisbon, Portugal) with the thesis “Biological colonization on majolica glazed tiles: biodeterioration, bioreceptivity and mitigation strategies”; 5-year degree in Conservation and Restoration (2006, FCT-UNL, Caparica, Portugal) and Master thesis (2008, FCT-UNL, Caparica, Portugal).

Main interests:

- Study and preservation of ceramic cultural heritage;
- Biodeterioration processes and mitigation strategies;
- Technical Art History and conservation sciences.



Susana Coentro

Researcher
VICARTE, FCT/UNL
<http://orcid.org/0000-0003-2338-8960>

PhD in Conservation and Restoration (2017, FCT, UNL, Portugal) with the thesis: “An Iberian Heritage: Hispano-Moresque Architectural Tiles in Portuguese and Spanish Collections”. Graduated in Conservation and Restoration (2008, FCT/UNL) and a Master’s degree in 2010 (FCT/UNL). Specialized in Glass and Ceramics with a thesis entitled “Study of the pictorial layer in 17th century Portuguese tiles”. Researcher at VICARTE (Research Unit “Glass and Ceramic for the Arts”). Her main field of research has been Portuguese glazed tiles (Azulejos). Other research interests focus on the study and preservation of cultural heritage, with emphasis on Technical Art History and the evolution of artistic techniques in ceramics and glass throughout History.



Paula Diogo

Full Professor
DCSA, FCT/UNL
<http://orcid.org/0000-0003-1504-9248>

BA in History, Master in Historical Demography, PhD in Epistemology of Science - History of Science, and Aggregation in History of Technology. She teaches at the FCT/UNL since 1986. Presently she is Full Professor, President of the Department of Applied Social Sciences and Head of the Interuniversity Center of History of Science and Technology - Pole UNL. Having pioneered the field of History of Technology in Portugal, her research focuses on the History of Technology and Engineering in Portugal and Colonies (XVIII-XX centuries); History of Science in Portugal (XVIII, XIX and XX); Processes Globalisation / Globalization of Science and Technology (knowledge transfer, networking, relationships center (s) / peripheral (s)). Coordinates several research projects, is member of several international research networks, and holds leadership positions in magazines and national and international organizations, namely the Society for the History of Technology (SHOT).



4 Fall School Participants

The participation to the *HERACLES Fall School* was free and open, requiring an email registration. The preferred target audience was composed by the academic community: students, researchers and professors. In fact, in order to derive the maximum benefit from the course, participants should possess basic knowledge of chemistry, physics and material science.

Forty-two people participated in the event. Attendees were mostly students and researchers of the Materials Science Department and of the Conservation and Restoration Department. This number of attendees indicates a high participation level in this kind of events.

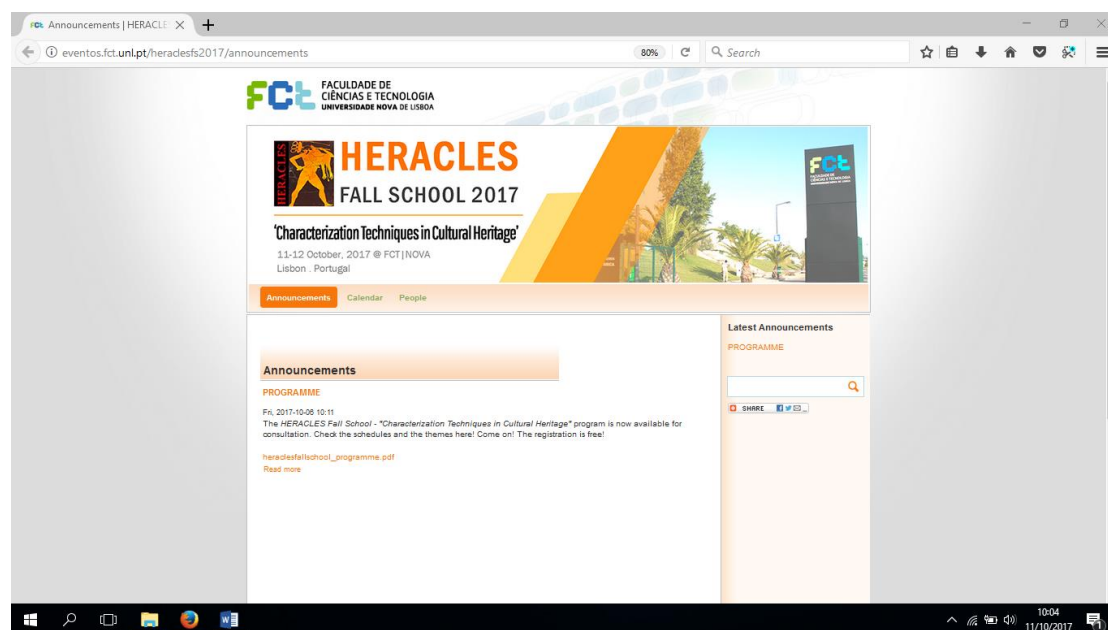
5 Dissemination Material

A special banner was created to disseminate the event. It included the HERACLES logo, the Name of the event (Fall School 2017), the thematic to be discussed (Characterization Techniques in Cultural Heritage), the dates, location and the event chair with indication of his email for registration or for other information request.



A site for the event was specially created in an allocated slot at the FCT/UNL page, dedicated to projects and special events organized by FCT/UNL. The site was updated in real time according to any change considered necessary and including the program of the event, speakers, their short CV and the location of the event.

<http://eventos.fct.unl.pt/heraclesfs2017/announcements>



The file of the program in pdf format was sent by e-mail to a mailing list that includes departments of the FCT UNL, Materials, Conservation and Restoration and Historical Studies departments in other Universities, too. Also included were the links to the event site and the HERACLES Portal, where the news of the event was made available with the link to the updated program.

Available on the official HERACLES Project website:

<http://www.heracles-project.eu/news/heracles-fall-school-2017-will-be-held-fctnova-october-11-12-2017>

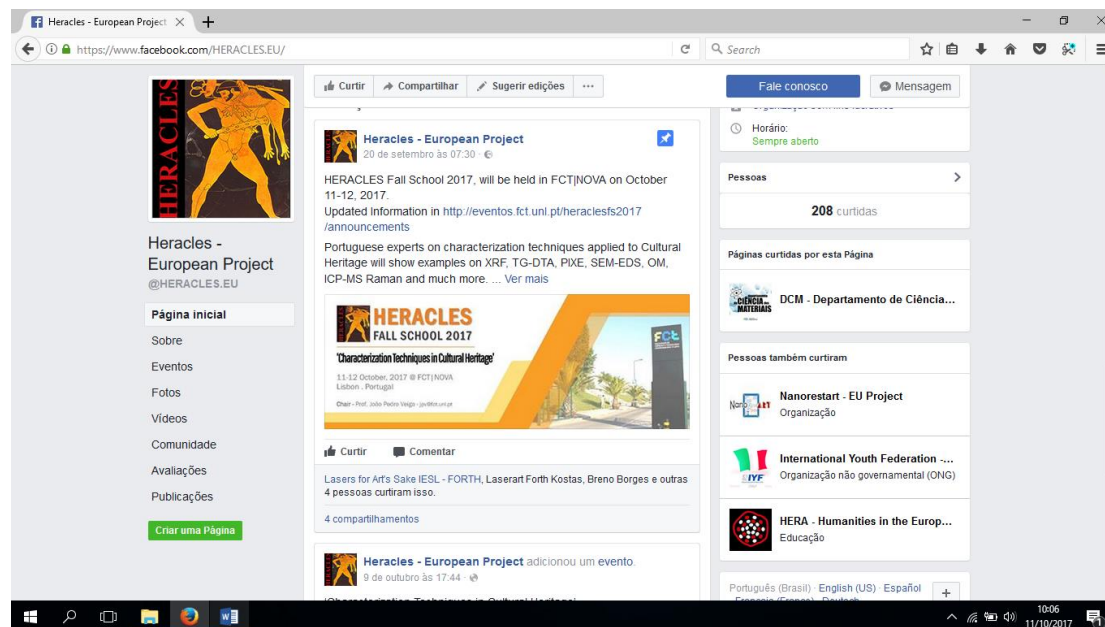




In addition, the Fall School and the program were released on Facebook on a dedicated post:

- Official facebook page of HERACLES Project:

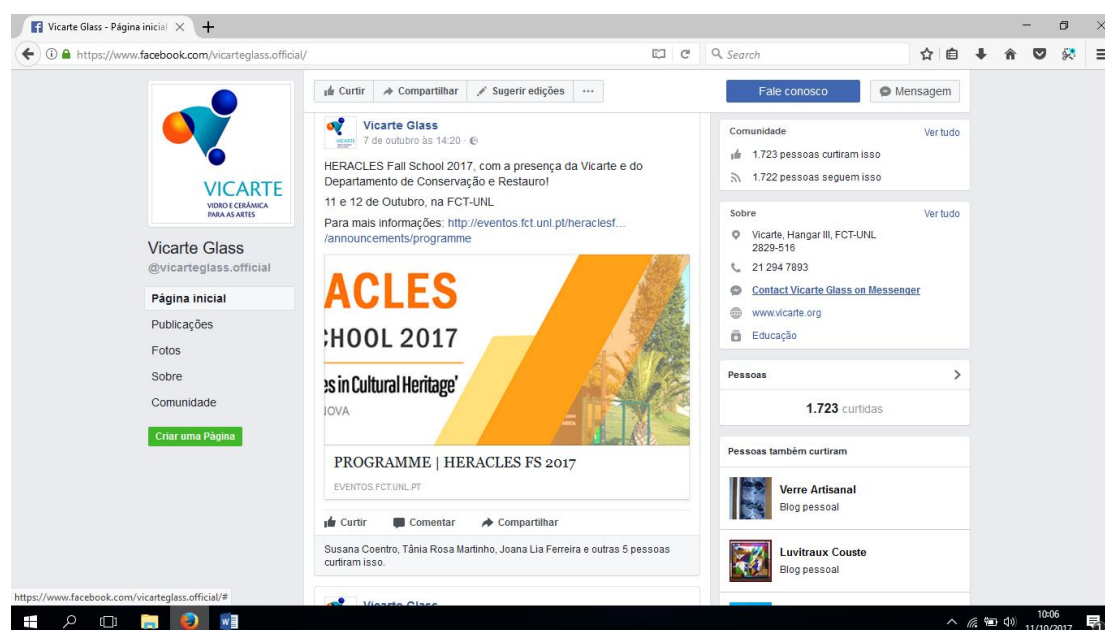
<https://www.facebook.com/HERACLES.EU/>



The UNINOVA Conservation and Restoration Department, through its Research Centre VICARTE, also disseminated the HERACLES Fall School 2017.

- Official page of Vicarte

<https://www.facebook.com/vicarteglass.official/>





The UNINOVA Materials Science Department also disseminated the HERACLES Fall School 2017 through its official facebook page

<https://www.facebook.com/DCM.FCT/>



As all the events occurring at FCT/UNL, dissemination was also done through a general mailing list including 8000 students and 450 teachers.

Print materials:

- The last Newsletter of the HERACLES project was printed in order to distribute it to the Fall School participants (including the speakers).
- The program was printed for distribution to the event participants.
- The HERACLES Project presentation flyer was also printed and made available to participants.
- Two posters of the HERACLES Project were placed in the amphitheater (one inside and the other one at the entrance of the amphitheater).

6 Photos taken at the event

Some pictures were taken during the event.

Also, a short film was produced for dissemination purposes through facebook and can be found at the official HERACLES facebook page under the separator “Videos”.

Some photos are included in this document to show the opening session, lectures of the two days and of the visit to UNINOVA-CENIMAT Laboratories.



Amphitheatre Entrance and Lecture Hall with Prof. J.P. Veiga, chair of the HERACLES Fall School



Teacher: Prof Rui Silva



During the Coffee break



Visit at CENIMAT: sample preparation lab



Visit at CENIMAT: the SEM-FIB Lab



7 Conclusions

The scope of the present document is to provide a summary overview on the first HERACLES school.

The aim of the school was to increase the awareness of the audience toward the importance of understanding the CH asset materials in order to protect and preserve them. As well, to underline the importance of Material Science and the related use of advanced characterization techniques along this direction.

The success of such a technical school was clear from the high number of participants and from the high degree of interactions among the attendees and teachers, since students had the opportunity to discuss with experts from the field and in some cases opening doors to future collaborations (lively debates and questions to the experts, permitting younger researchers, PhD and MSc students to interact with renowned experts).

The HERACLES Fall School agenda, provided useful information on the CH field at different levels:

- Basic theoretical knowledge on different CH materials and on state-of-the-art characterization techniques
- Real case studies application, referring to specific issues, evidencing the need of multidisciplinary approaches and the involvement of different expertise and knowledges (e.g.: scientists and conservators).
- Practical experiences in the Labs: hands-on approach from CH sample preparation to their analysis

In a more general plan of dissemination activities and outreach to society, the HERACLES Fall School had a high impact on the community and on social networks through the dissemination actions that took place, and described in Section 6.

According to the HERACLES project philosophy, in improving the societal awareness, the Fall School program was concluded with a lecture on *“Engineering education and the history of technology”*, intending to give a societal perspective of the advancement of technologies and to highlight the importance of safeguarding cultural heritage assets.