MATERIAIS 2022

EASTER SCHOOL ON ADDITIVE MANUFACTURING

ESAM Registration

The Centre for Rapid and Sustainable Product Development (CDRSP) of the Polytechnic Institute of Leiria (IPLeiria), the Portuguese Ceramic and Glass Society (SPCV) and the Portuguese Materials Society (SPM) are organising the **Easter School on Additive Manufacturing (ESAM)**. The aim of the EASM is to contribute to expand AM science and technology in academia and industry through the dissemination of high-impact knowledge, involving materials, processes and value-added products, moving from bench side to the society, believing that we are in the cusp of the 4th Industrial Revolution, which is likely to fundamentally alter the way we work, live and relate to one another. The convergence of physical, digital and biological sciences will bring about profound changes in the way we design products, produce them and the materials they are formed in whether it is from ceramics, metal, glass, polymers, biological materials or composites.

ESAM will take place in **April 10th, Marinha Grande city**, and it will create a forum that brings together students, early stage researchers, professors, and industrialists, to consolidate the fundamentals, recent progresses and applications in AM, focusing on materials for AM and related techniques. The school will be focused on Computer Modelling, Advanced multimaterials and Processes applied to Biomaterials, Ceramics, Metals, Polymers and Composites.

The school will be open to both academy and industry, and we expect numerous attendants from both areas. In this regard, it will be an interesting forum to interchange ideas between both fields, and an opportunity for young researchers to be in contact with industrial partners as well as young professionals to receive novel developments about cutting-edge technologies developed for the materials market.

The **ESAM programme** is composed by a half-day lectures (**5 different lectures** - to learn fundamentals and advances on AM) followed by a half-day of **AM laboratory work** to develop experimental skills on AM. The school will be closed with an "AM round table" to discuss AM future trends. All experimental activities will be developed in the laboratories of the CDRSP.

ESAM programme

EASTER SCHOOL ON ADDITIVE MANUFACTURING (ESAM)

Schedule	SUNDAY, 10th			
8:30 - 9:30	**AMS Registration** Centro Empresarial - Zona Industrial, Marinha Grande			
9:30 - 9:40	**AMS Welcome** Centro Empresarial - Zona Industrial, Marinha Grande			
9:40 - 10:20	***Basic Concepts in Additive Manufacturing,*** Geoffrey Mitchell, CDRSP, PT Centro Empresarial - Zona Industrial, Marinha Grande			
10:20 - 11:00	***Additive Manufacturing Processes for Biomedical Applications,*** Marco Domingos, University of Manchester, UK Centro Empresarial - Zona Industrial, Marinha Grande			
	Coffee-break			
11:20 - 12:00	***In-situ microstructure control during wire and arc additive manufacturing: towards an improvement in mechanical properties,*** João P. Oliveira, Nova University of Lisbon, PT Centro Empresarial - Zona Industrial, Marinha Grande			
12:00 - 12:40	***Multi-Material Additive Manufacturing,*** Filipe Silva, University of Minho, PT Centro Empresarial - Zona Industrial, Marinha Grande			
	Lunch			
14:00 - 14:40	***Recent Developments in Additive Manufacturing,*** Paula Vilarinho, University of Aveiro, PT Centro Empresarial - Zona Industrial, Marinha Grande			
14:40 - 15:30	***European Society of Ceramics(ECERS)*** , José Almeida, SPCV, University of Aveiro, PT Centro Empresarial - Zona Industrial, Marinha Grande			
	AM laboratory work			
15:30 - 16:30	Lab: Direct Digital Manufacturing - Ceramics/Cem. *Responsible of the Lab session: Florindo Gaspar*	Lab: Reverse Engineering and Biomechanics *Responsible of the Lab Session: S. Amado/N.A.*	Lab: Materials Characterisation *Responsible of the Lab Session: Juliana Dias*	Lab: Direct Digital Manufacturing: polymers/composites *Responsible of the Lab Session: Geoffrey Mitchell*
16:30 - 17:10	Lab. Materials Characterisation *Responsible of the Lab Session: Juliana Dias*	Lab: Multiscale Modelling *Responsibleof the Lab Session: Paula Faria*	Lab: Reverse Engineering and Multiscale Modelling *Responsible of the Lab Session: Artur Mateus*	
	Coffee-break			
17:30 - 18:30	Lab: BigPrint *Responsible of the Lab session: Florindo Gaspar*	Lab: Biofabrication *Responsible of the Lab Session: Nuno Alves*	Lab: Direct Digital Manufacturing - Metals *Responsible of the Lab Session: Artur Mateus*	Lab: Materials Characterisation *Responsible of the Lab Session: Juliana Dias*
18:30 - 19:10		Lab: Materials Characterisation *Responsible of the Lab Session: Juliana Dias*		Lab: Reverse Engineering and Multiscale Modelling *Responsible of the Lab Session: Geoffrey Mitchell*
19:10 - 19:30	**Discussion and Closing Remarks** **CDRSP** Seminar Room			
	Group 1 - AM Ceramics/cement for Industrial Applications (max: 12 participants)	**Group 2 - AM Biomaterials for Biomedical Applications (max: 12 participants)**	**Group 3 - AM Metals For Industrial Applications (max: 12 participants)**	**Group 4 - AM Polymers for Industrial Applications (max: 12 participants)**

Group 1 - AM Ceramics/cement for Industrial Applications

Direct Digital Manufacturing: Ceramics/Cement- Materials Characterisation – BigPrint: Large-scale parts

Within the AM Ceramics/cement for Industrial Applications students will explore novel ceramic products using additive manufacturing technologies that allows to transform design thinking into reality. Different characterisation techniques will be used to assure the proper response by the ceramic 3D samples/products. Large-scale objects of various materials, e.g. concrete, ceramics, metal or polymers will be 3D printed in CDRSP PrintBIG lab. Students will understand correlations between materials and processing parameters of those examples explored.

Group 2 - AM Biomaterials for Biomedical Applications

Reverse Engineering and Biomechanics - Multiscale Modelling - Biofabrication - Materials Characterisation

Within the AM Biomaterials for Biomedical Applications students will be able to capture, through reverse engineering, anatomic portions of the human body and understand its usefulness and impact on the design of customised orthosis. Moreover, people will be able to collect data from different movements and assess them from a biomechanical perspective. Within the Tissue Engineering approach several points will be addressed: i) culturing conditions – different bioreactors will be shown; their evolution; and the importance of simulations towards an optimal cellular response; ii) explanation of different techniques for the manufacturing of 3D scaffolds for the different biomedical applications; iii) different characterisation techniques to assure the proper response by the 3D scaffold.

Group 3 - AM Metals for Industrial Applications

Direct Digital Manufacturing: Metals - Materials Characterisation – Reverse Engineering/Multiscale Modelling for AM

Within the AM Metals for Industrial Applications students will explore the developing of metal samples/products using computer-aided modelling and additive manufacturing technologies. Different characterisation techniques will be used to study morphological and mechanical properties of 3D samples. Students will understand correlations between metals and processing parameters of those examples explored. Metal AM future trends will be discussed.

Group 4 - AM Polymers for Industrial Applications

Direct Digital Manufacturing: Polymers/Composites - Materials Characterisation – Reverse Engineering/Multiscale Modelling for AM

Within the AM Polymers for Industrial Applications students will explore the developing of polymers/composites samples/products using computer-aided modelling and additive manufacturing technologies. Different characterisation techniques will be used to study morphological and mechanical properties of 3D samples. Students will understand correlations between materials and processing parameters of those examples explored. Composite/Polymer AM future trends will be discussed.