



2ND INTERNATIONAL WORKSHOP

ADDITIVE MANUFACTURING
AND SUSTAINABILITY

BOOK OF ABSTRACTS

IWAM 24



OCTOBER 4TH, 2024

2nd International Workshop on Additive Manufacturing and Sustainability

IWAM 24

Bragança - Portugal

October 4th, 2024

Interreg



Cofinanciado por
la Unión Europea
Cofinanciado pela
União Europeia

España – Portugal

natur(**FAB**)



ENERIDUO



Bragança
Município



FABIPB
MACRO 2 NANO TECHNOLOGY

Title: 2nd. International Workshop on Additive Manufacturing and Sustainability (IWAM): book of abstracts

Editors:

João da Rocha e Silva, Instituto Politécnico de Bragança, Portugal;

João Eduardo Pinto Castro Ribeiro, Instituto Politécnico de Bragança, Portugal

Jorge Santos, Instituto Politécnico de Bragança, Portugal

Rui A. Lima, Universidade do Minho, Portugal

Publisher:

Instituto Politécnico de Bragança

Campus de Santa Apolónia

5300-253 Bragança - Portugal

Publishing: 2025

ISBN: 978-972-745-347-4

Handle: <http://hdl.handle.net/10198/29735>

COMMITTEES

ORGANIZING COMMITTEE

João Rocha, Instituto Politécnico de Bragança, Portugal
João Eduardo Ribeiro, Instituto Politécnico de Bragança, Portugal
Jorge Santos, Instituto Politécnico de Bragança, Portugal
Rui A. Lima, Universidade do Minho, Portugal

INTERNATIONAL SCIENTIFIC COMMITTEE

Ana Moita, Academia Militar / IN+(IST), Portugal
Alvaro Prieto, Centro tecnológico CARTIF, Spain
Ana Fernández-Abia, University of Leon, Spain
Ana Moita, IST - Universidade de Lisboa, Portugal
Borja F. Villar, Centro tecnológico CARTIF, Spain
Delfim Soares, University of Minho, Portugal
Diana Pinho, CMEMS-UMinho, University of Minho, Portugal
Donata Putnaite, Kaunas Technikos Kolegija, Kaunas, Lithuania
Eleonora Santecchia, Università Politecnica delle Marche, Italy
Fátima Vaz, IST - Universidade de Lisboa, Portugal
Flora Silva, Instituto Politécnico de Bragança, Portugal
Helder Puga, Universidade do Minho, Portugal
Isabel Lopes, Instituto Politécnico de Bragança, Portugal
João da Rocha e Silva, Instituto Politécnico de Bragança, Portugal
João Eduardo Pinto Castro Ribeiro, Instituto Politécnico de Bragança, Portugal
Joaquin Barreiro García, University of Leon, Spain
Jolanta Pileckiene, Vilnius College of Technologies and Design, VTDK, Lithuania
José Gonçalves, Instituto Politécnico de Bragança, Portugal
Leonel Domingues Deusdado, Instituto Politécnico de Bragança, Portugal
Manuel Rodríguez-Martín, University of Salamanca, Spain
Marius Mazeika, Kaunas Technikos Kolegija, Kaunas, Lithuania
Óscar Carvalho, University of Minho, Portugal
Paula M. Barros, Instituto Politécnico de Bragança, Portugal
Renato Goulart Jasinevicius, Escola de Engenharia de São Carlos - USP, Brazil
Roberto García-Martín, University of Salamanca, Spain
Romeu Rony Cavalcante da Costa, Federal Technological University of Paraná, Brazil
Rui A. Lima, University of Minho, Portugal
Sara Giganto, University of Leon, Spain

Susana O. Catarino, University of Minho, Portugal

Susana Martínez-Pellitero, University of Leon, Spain

Teresa Guarda, Faculty of Systems and Telecommunications, UPSE, Ecuador

Viviane Teleginski, Universidade Tecnológica Federal do Paraná, Brazil

Technical Editing: Inês Afonso, Instituto Politécnico de Bragança

Technical Support: Clarisse Pais, Instituto Politécnico de Bragança

WELCOME

We are pleased to present the International Workshop on Additive Manufacturing and Sustainability Book of Abstracts. This compilation brings together researchers, professors, and innovators from around the world who are advancing additive manufacturing (AM) and sustainable practices.

As the global community prioritizes environmental responsibility, additive manufacturing has emerged as a transformative technology capable of revolutionizing industries while reducing ecological footprints. This workshop unites advanced research, innovative applications, and progressive strategies to examine how additive manufacturing can enhance sustainability.

Within these pages, you will find a diverse array of abstracts showcasing ground-breaking work in areas such as:

- Sustainable materials and processes in AM,
- Energy efficiency and waste reduction,
- Circular economy and lifecycle analysis,

Each contribution reflects a commitment to addressing the challenges and opportunities at the intersection of technology and sustainability. We hope this collection not only informs but also inspires collaboration and innovation among participants.

We are profoundly grateful to the authors, reviewers, and organizers whose unwavering commitment has enabled the publication of this book. A special thank you to our sponsors and partners for their unwavering support in bringing this workshop to life.

We appreciate your participation in this wonderful adventure. Let's work together to advance sustainability and innovation!

Warm regards,

The IWAM 2024 Organizing Committee,

João Rocha

João E. Ribeiro

Jorge Santos

Rui Lima

TABLE OF CONTENTS

Process Optimization of a Green Composite Containing a 3D Structure Produced via Additive Manufacturing..... 13

Artificial Intelligence for Additive Manufacturing: preliminary analysis of trends and challenges 14

Experimental Study of Green Nanofluids: Evaluation of Wettability, Viscosity, and Thermal Conductivity Properties 16

Increasing motivation and learning in digital manufacturing: Blended Intensive Programs for STUDENTS..... 17

3D Print Technologies Applied in Robotics Prototyping..... 18

Study of Electro Discharge Machining (EDM) to manufacture holes in Selective Laser Melted (SLM) parts. 19

Utilisation of feedstock material in additive manufacturing technology of ceramics by UV laser vat-photopolymerisation (VPP-UVL/C) 20

MEX and VPP-UVL Technologies for Printing Complex Alumina Parts..... 21

Design of a novel bi-phasic biomimicking auxetic 3d printed structure with fluids that biomimic the hysteretic behaviour of articular cartilage for medical phantoms..... 22

Developing optical mimicking phantoms of the head tissues – a new approach for transcranial photobiomodulation research..... 23

Optimization of PDMS Curing in SLA Resin Molds: Techniques and Approaches..... 24

Development of a hydrophone for measuring the propagation of acoustic waves in biological tissues 26

Development of wood and cork derivative panels for sustainable construction 27

Valorisation of Olive Mill Wastewaters for Industrial Applications 29

Progress on fire safety of sustainable timber construction 30

Effects of extensive green roofs on rainwater drainage from a metalworking industry building 31

Strategies for Modifying PDMS Wettability and Potential Applications..... 33

Microfabrication of a capillary-driven microfluidic device: Surface wettability 34

Microfabrication of a capillary flow-driven microfluidic plasma separator..... 35

Development and fabrication of a microfluidic device for mechanical characterization of malaria-infected red blood cells..... 36

3D Hollow microneedles fabrication for microfluidic applications..... 37

Linear transformations in an engineering course – Matrices and dynamic representations 39

Awareness of sustainability practices in construction: Learning in a real context 40

Study, design, and manufacturing of 3D-printed orthoses

B. Nogueira¹, João Rocha^{1,2}

¹Instituto Politécnico de Bragança, 5300-253, Bragança, Portugal

²GICoS, Instituto Politécnico de Bragança, 5300-253, Bragança, Portugal

(*)Email: a51814@alunos.ipb.pt

This study highlights the growing presence of three-dimensional (3D) printing in everyday life, particularly in the manufacture of customized medical devices. In the field of additive manufacturing (AM), Material Extrusion (MEX), ISO/ASTM 52900:2023, (fused deposition modeling (FDM)) has become a widely used technique due to its affordability, accessibility, and ability to create personalized solutions.

In this case, a 3D-printed hand orthosis was designed to assist a woman suffering from tendinitis in her thumb. The orthosis was designed to reduce pain and provide support to improve her daily functionality. Material Extrusion (MEX), FDM technology was used to build the device layer by layer, resulting in a lightweight yet durable structure tailored to the patient's needs.

One of the key benefits of 3D printing in orthotic design is the ability to create customized, patient-specific solutions at a lower cost than traditional manufacturing. In addition, rapid prototyping allows for quick modifications based on patient feedback, improving comfort and effectiveness.

This study reinforces the potential of 3D printing in medical applications and demonstrates how FDM-printed orthotics can help alleviate pain and improve quality of life for people with musculoskeletal conditions. As the technology continues to evolve, personalized healthcare solutions will become more accessible and efficient.

Keywords: 3D Printing in Orthotics, Material Extrusion (MEX), Fused Deposition Modeling (FDM), Customized Hand Orthosis, Additive Manufacturing in Healthcare