iCLIMABUILT

Functional and advanced insulating and energy harvesting and storage materials across climate adaptive building envelopes

Volume 4

Project Overview

iclimabuilt's goal is to create an open access ecosystem for developing, upscaling and testing innovations in building envelope materials and technical systems via its 9 Pilot Lines (PLs) to reach Nearly Zero Energy Buildings (nZEB) balance.

Through the iclimabuilt project a cross-domain business ecosystem combining the capabilities of different experts, building the connection between suppliers and users, based on the cooperation within interdisciplinary entities to support new product development/upscaling and testing, satisfy customer needs based on a case-by-case assessment of the underlying barriers of each technology, and eventually incorporate the next round of innovations in building envelope materials and technical systems will be formed.

27	14	10	48
Partners	Countries	Work Packages	Months

Project Overview

iclimabuilt will support the translation of research results into innovations and will help small high-tech firms to scale up and cope with the continuous rising of technological complexity by providing a **Single-Entry-Point** for necessary infrastructures and tools to test, validate and upscale new technological solutions.

iclimabuilt will do so with the aim to accelerate the development of additional leading-edge technology by focusing on:

- **Materials Development**
- **Design and Assembly of Technical Systems**
- **Monitoring and Characterization Strategies to Support Decision-Making**
- **Dissemination and Exploitation Activities**
- **Refined and Expedited Access to Financing Solutions**

An open innovation test bed for building envelope materials

Partners

National Technical University of Athens/R-NanoLab
Eurecat- Technology Centre of Catalonia
Technical University of Dresden
SINTEF
Norwegian University of Science and Technology
Research Institutes of Sweden
INEGI – Institute of Science and Innovation
Innovation in Research and Engineering Solutions
University of Strathclyde
Granta Design
Hamburg University of Technology
Stratagem Energy
Fraunhofer Institute for Solar Energy Systems
Polytechnic University of Turin
Technological Institute of Aragon
Cidetec
E2ARC Architecture Research for Cities
AiDEAS
TEGnology
Fenx
European Research Center for Design and Materials Technologies
Bergamo Tecnologie
Open Source Management
Rubitherm Technologies GmbH
University of Birmingham
BioG3D
Leipzig University of Applied Sciences

OPEN CALL

NTUA

The Open Call of iclimabuilt OITB project has been launched!
Iclimabuilt is an Open Innovation Test Bed, funded by the EU, with the aim to create an open access ecosystem for developing, upscaling and testing innovations in building envelope materials and technical systems.
For the scope of validating the developed ecosystem, iclimabuilt will, through the Open Call, support and help small and medium-sized high-tech firms to scale up and cope with the continuous rise of technological complexity, assisting in the transformation of research results into innovations.
Take advantage of the offered services and be one of the Experimentation Teams that will shape the future of sustainable building materials!
Introduce your technologies and deploy test cases referring to materials for building envelopes towards nZEB. Iclimabuilt's ecosystem will offer you services for free (development, testing, upscaling, validation etc.) and put at your disposal the Pilot Lines of the project. In addition, we will support you by providing 70% funding to your project!
By participating in the Open Call, you have a unique chance to secure funding of up to €150,000 for the development or testing of technologies related to building envelope materials.

Detection of Defects at 3d-printed thermoplastics of Fused Filament Fabrication (FFF) – Image processing

In the frame of iClimaBuilt, partners aim to support the development of material and processes through Integrated Computational Materials Engineering (ICME) approaches, by translating the specific requirements of material and processes from the project's Pilot Lines (PL3, 4, 5, 7, 8) into simulation workflows.
The workflows that have been developed will be utilized to support material systems definition, estimating target material properties and complementing material characterization.

Under the Pilot line (PL3) for customizable 3d-printed components for well-being, AI and computer vision (image processing) for the detection of defects at 3d-printed thermoplastics of Fused Filament Fabrication (FFF) were implemented,using a microcomputer and a high-quality camera, mounted to the 3D printer.
Three types of defects may occur under 3d-printing: underfilling, overfilling and impurity, as depicted in the Figure 1. Image processing was performed with the support of BIOG3D and the model used is a pre-trained real- time object detection algorithm known for its computational speed. First results obtained are promising for all three defect categories, as the algorithm was able to automatically classify defect type, as well as the area of each defect on a sample with high precision.

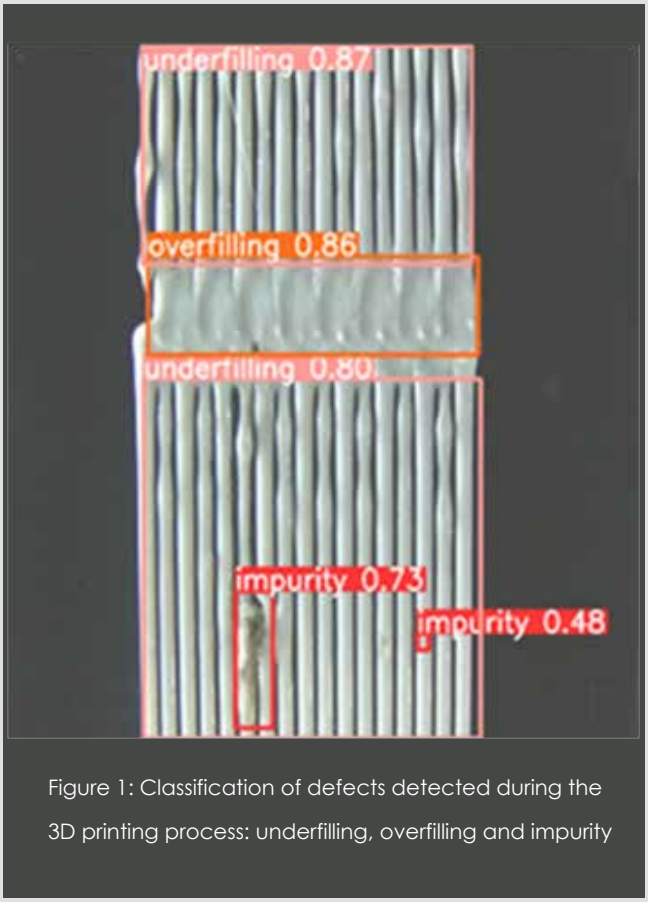

Figure 1: Classification of defects detected during the 3D printing process: underfilling, overfilling and impurity

Aerogels

Aerogels, known as lightweight and high-insulation materials, can improve the properties of nearly zero energy buildings. Our pilot line aims for a large-scale production plant to produce 1500 L aerogel particles per year.

The production of aerogels contains 4 steps: dissolution of precursor, gelation, solvent exchange and supercritical drying with CO2. In this project, we scale-up our existing plant in each of these steps.

In the last month we focused on the the completion of the gelation and solvent exchange plant. In the gelation plant, 100 liters of gels can be produced in one batch. During solvent exchange, the water in the pores is replaced with ethanol so that the gels are dried supercritically.

By scaling up the plant, we can now generate sizeable amounts of aerogel, enabling adequate sample distribution to potential users for testing their applications. This represents a significant step towards commercialising aerogels.

Tests composite wall panels in «living laboratories» across Europe

A new wall panel made of composite materials, created by INEGI, promises to be a light constructive solution for greater thermal and acoustic comfort inside buildings. The prototype created by the Institute's team will be tested in various «living laboratories», having already been installed in Dresden, Germany, and Amposta, Spain.

"By being introduced into a real building, but in a controlled environment, it will be possible to analyze the performance of the prototype in terms of its durability, thermal and acoustic efficiency", explains Susana Sousa, responsible for the project at INEGI.

The product was created within the scope of an European project that aims to boost the creation of new material solutions to improve sustainability and energy efficiency in buildings of the future.

INEGI is one of 27 partners, and is already working on creating new prototypes to be tested in «living laboratories» in other parts of Europe, as it is essential to test materials in different climate zones.

BIOG3D, IRES

Toxicity, hazard, and safe handling of iClimaBuilt materials and components

To identify hazards and to minimize health and safety issues involved within the iClimaBuilt technologies, specifically of processes involving nanomaterials, **IRES** developed a Computational Fluid Dynamics (CFD) model based on the processes ofLiquid Deposition Modelling (LDM) ceramic-based additive manufacturing (Figure 1), **for Pilot line 3 (PL3) for customizable 3d-printed components for well-being**, led by **BIOG3D**.The model allowed the exploration of the air flow patterns during processing and the evaluation of different configurations, leading to potential optimisation of engineering controls in place and lowering the risks from exposure to airborne substances.

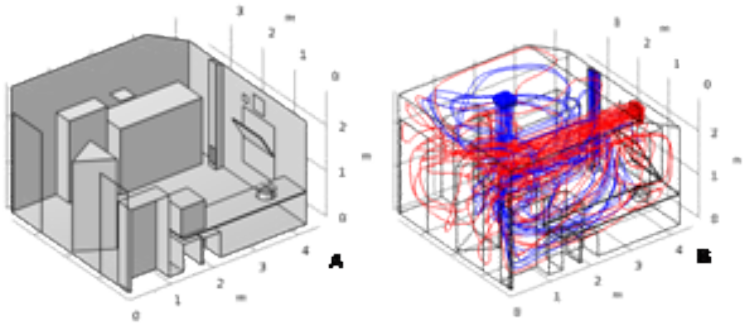

Figure 1. - Exploration of computational fluid dynamics model

BIOG3D, IRES

Toxicity, hazard, and safe handling of iClimaBuilt materials and components

Following the on-site exposure campaignsat the pilot lines of BIOG3D (PL3: 3D printed components) and HTWK (PL4: Textile Reinforced Concrete), toxicological assessment of the collected air samples and the respective raw materials has been performed through in vitro studies by BIOG3D (Figure 2). Toxicological assessment is a crucial aspect of ensuring the safety of individuals who may come into contact with the developed materials during processing activities, whether in occupational settings, operation, or in the environment and of identifying potential health risks associated with the exposure to specific materials. The assessment included hazard identification and morphological analysis using SEM/EDX, and cytotoxicity studies (cell viability studies, oxidative stress, and inflammation measurements)to assess the toxicity of materials.

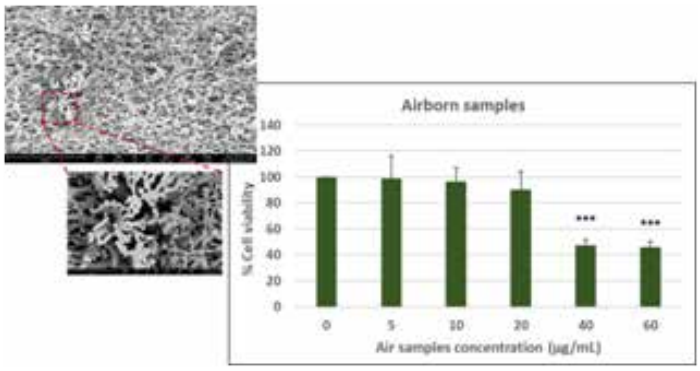

Figure 2. Toxicological and morphological assessment

IRES participated in FEMS EUROMAT23presenting the work related to the Risk & Safety aspects of the LDM along with the developed CFD model, under the title "Occupational risk assessment in Liquid Deposition Modelling material feedstock preparation and Additive Manufacturing of ceramic-paste based materials".

Implementation from Test Case 3 into CUBE BOX Wall

TC3 element

Handling the TC3 element

Implementation from Test Case 3 into CUBE BOX Wall

Detail of TC3 element

Connecting with the Data management

Implementation from Test Case 6 into CUBE BOX Wall

TC6 element

Handling the TC6 element

Implementation from Test Case 6 into CUBE BOX Wall

Detail of TC6 element

Attaching the sensors for outside and inside temperature and heat flow

30M progress meeting

iClimaBuilt 30M progress meeting, 27-28 September 2023. The meeting is held by project partner, Eurecat, in Plaza de la Ciencia, Manresa, Spain.

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