



LightCoce Project

**Building an Ecosystem
for the up-scaling of lightweight
multi-functional concrete
and ceramic materials and structures**



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 814632

Short Overview

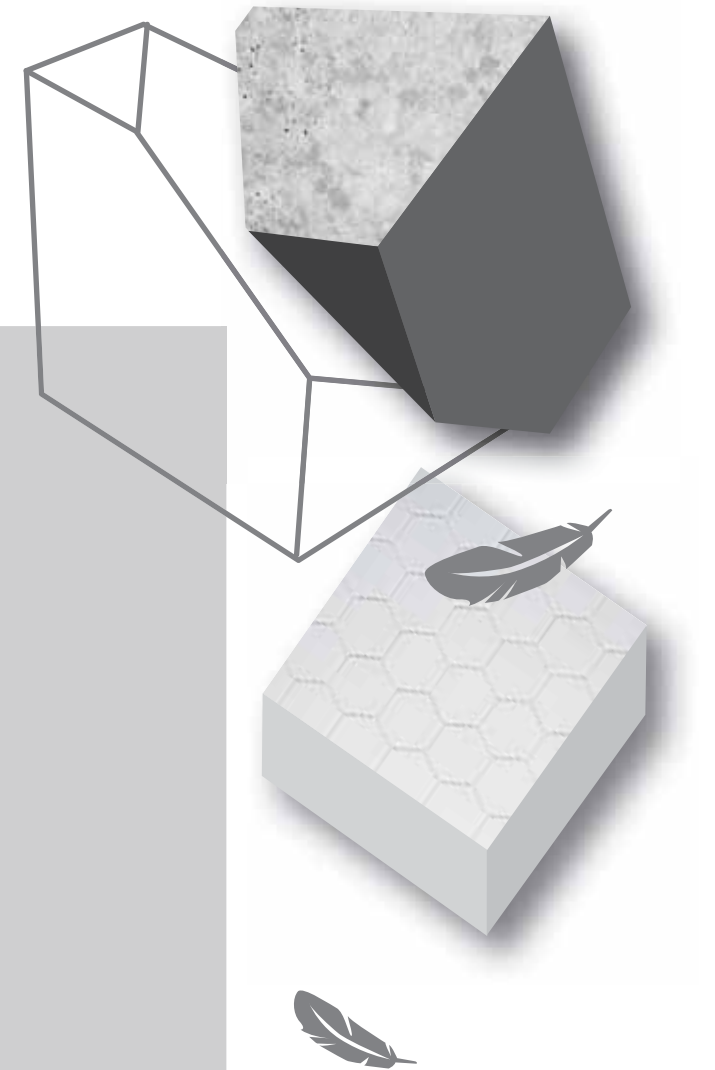


About

LightCoce project will offer 5 upgraded pilot lines, as well as characterisation facilities, process modelling, quality assurance and monitoring, standardisation, safety and innovation management services that will be accessible to the interested customers at fair conditions and cost.

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26 Partners

67 Deliverables

05 Pilot Lines

08 Test Cases

09 EU Countries

1. Project Overview

Mission

LightCoce project aims at **building an Ecosystem for the up-scaling of lightweight multi-functional concrete and ceramic materials and structures.**

It will offer 5 upgraded pilot lines, as well as characterisation facilities, process modelling, quality assurance and monitoring, standardisation, safety and innovation management services that will be accessible to the interested customers at fair conditions and cost.

LightCoce project will create a business ecosystem, **to capture value from technological or business / entrepreneurial innovation**, collaborative processes and activities of customers and other stakeholders, individual firm-level

actualised profit-taking, coopetition of technology intensive industries, **support and enhance SMEs and Midcaps**, as well as provide novel strategies and methods to accelerate the rate at which new and improved lightweight materials are sustainably incorporated into commercial products.

2. Objectives and Goals

LightCoce Ecosystem

The **main objective** of the LightCoce project is to **cover the gap in the upscaling and testing of multifunctional lightweight concrete and ceramic materials** by providing open access to SMEs and Industry to Pilot Lines (PLs) through **a one stop shop ecosystem** consisting of upgraded Pilot Lines (including three clusters of PLs; a. Concrete, b. Conventional Ceramics, and c. Advanced Ceramics), characterisation & testing facilities, process modelling, quality assurance and monitoring, and standardisation, safety and innovation management services that will be accessible to the interested stakeholders (clients) at fair conditions and cost. **The ecosystem will be reached**

from customers through a single-entry point (SEP).

Value Proposition

The value proposition of LightCoce is based on four main elements of high value for business and in particular SMEs, namely access to Pilot Lines and associated technology and competence (including IPs), access to network, access to finance and access to international markets. In this framework, the overall objective of LightCoce is to **create the European wide reference network of Pilot Lines for the development, expertise, technology validation facilities and transfer services to industry and SMEs** for advanced materials

applications ranging from constructions materials (bricks, ceramic tiles, concrete blocks), and infrastructures (ready mix concrete, prefabricated components), to high tech applications in automotive and aerospace industry.

LightCoce Consortium

In this respect the LightCoce consortium, consisting of **26 organizations**, has been formed by well recognized and world leading experts in their fields: **5 Large Enterprises, 1 Association, 8 RTDs and 12 SMEs**, spread across **9 countries**. It has been organized around a core group of partners which are the owners of the different Pilot Lines and the organizations in charge of delivering the key services to guarantee financial sustainability.

A second group of partners represents an initial layer of customers and end-users for the test beds facilities and will co-invest their resources to support in the upgrade of the facilities and the launch of pilot projects.

The LightCoce Ecosystem will ultimately strengthen the cooperation between stakeholders (technology providers, service providers and the industry), building business models based on **Open Access Cooperative Innovation**.

3. Markets

The main markets of the project are:

- **Constructions industry,**
- **Bricks and Tiles industry,**
- **Aerospace industry,**
- **Automotive industry,**
- **Defence industry.**

During the last decades a trend towards the use of lightweight materials in constructions and infrastructures, as well as for the aerospace, automotive and defence industry is observed.

Lightweight durable components are easy to transport, handle and install and demand less operational energy reducing substantially their environmental footprint, as well as the relative costs. Concrete and ceramics are on the focus of interest due to their wide range of

applications and their durability. Based on end applications **lightweight attributes must be coupled with enhanced properties** and multifunctionalities, such as high wear and mechanical strength, self-sensing, self-cleaning properties, which can be achieved with the addition of nanoparticles (NPs) to formulations (e.g. Al_2O_3 , TiO_2 , SiC , CNT). However, pilots are bulky and expensive facilities which in most of the cases require upgrades to be modular and flexible in application, while administrative burdens often delay project kick-off and funding gaps are difficult to overcome, making the majority of the already existing efforts to remain on a lab or in restricted pilot level with limited exploitation capacity for further industrialization.



Construction industry



Bricks and Tiles industry



Aerospace industry



Automotive industry



Defence Industry

4. Ecosystem and Services

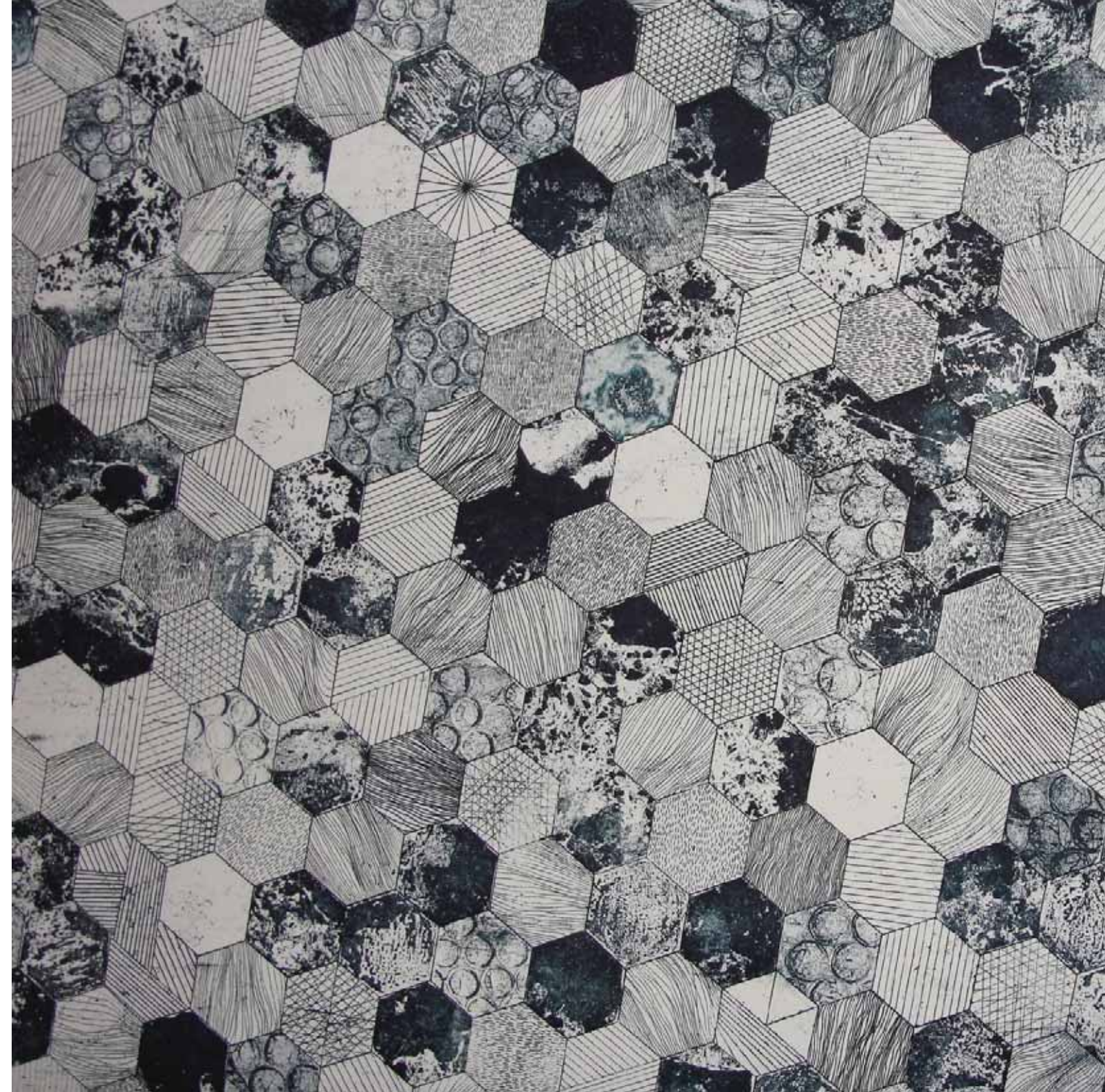
LightCocoe OITB

An **Open Innovation Test Bed (OITB)** is a set of entities, providing common access to physical facilities, capabilities and services required for the development, testing and upscaling of nanotechnology and advanced materials in industrial environments. The objective of the Open Innovation Test Beds is to **bring nanotechnologies and advanced materials within the reach of companies and users** in order to advance from validation in a laboratory (TRL 4) to prototypes in industrial environments (TRL 7).

Open Access in this context means that **any interested user, from Europe and beyond, can access the test beds' facilities, capabilities and services**

independently of whether this user is part of an Open Innovation Test Beds Horizon 2020 consortium or not. **Access should be granted at fair conditions and pricing** and with transparent and mutual obligations with regards to, for instance, security, safety and intellectual property rights. Users can be individuals, teams and institutions from academia, research organisations, small and medium enterprises and industry, from the public as well as the private sectors.

Via a Single-Entry Point, the users would be offered complete and transparent information about the facilities, capabilities and services provided by the Open Innovation Test Bed.





LightCoce SEP

Open Innovation Test Bed provides common access through one Single Entry Point (SEP) which will be the main contact for the ecosystem and represents the interface with the users. **The Single Entry Point will act as a legal entity, having the power to sign contracts on behalf of the Open Innovation Test Bed** and be held accountable for it.

Through the Single Entry Point of the LightCoce Ecosystem customers can send their requests that will be evaluated and priced, based on specific workflows that will be developed after collecting input from the involved group leaders and according to customers' requirements. A catalogue of services will be compiled in

the form of a library which is alive in the sense that people and organizations can develop material technologies in real-time face-to-face.

A **Data Management System** will be built and all contractual aspects will be managed (NDA, access rights and conditions, IPRs, health and safety issues, etc.) in order to ensure the safe delivery of the results to the customers.

The SEP provides a list of services available and requests will be sent through this specially designed platform.

Proposals can be submitted at any time but will be periodically collected for **scientific evaluation**. After submission, the technical feasibility of each research step will be assessed by a Management Board, including representatives from each

of the core partners of the project. **Feasible proposals will then be evaluated and ranked according to scientific merit. The best-ranked proposals will be assigned to the most appropriate LightCoce Pilot Lines and services.**

The manager assigned from the customer company will be notified by LightCoce ecosystem of the results of the technical and scientific evaluation. All users will be asked to accept and undersign the Access Policies set by the ecosystem.

Characterisation Services

Standardised methods will be applied for the characterisation of materials and structures developed, according to appropriate EN, DIN, ISO and ASTM standards. A network of partners

will collaborate in order to result in fast characterisation workflows, for the determination of **process parameters** (e.g. rheological properties, flowability and workability), **mechanical testing** (bending, compression, strength and durability), **physical properties** (density, porosity), **thermal analysis** (thermal shock, hygrothermal properties, fire resistance), as well as surface abrasion, frost resistance, chemical resistance, self-sensing, and photocatalytic activity, wherever appropriate.

Moreover, non-destructive techniques (NDTs) will be used in order to perform real field test of the integrity of the developed structures. Some of the partners of this group are members in the European Materials



Characterization Council (EMCC) thus will build on collaboration.

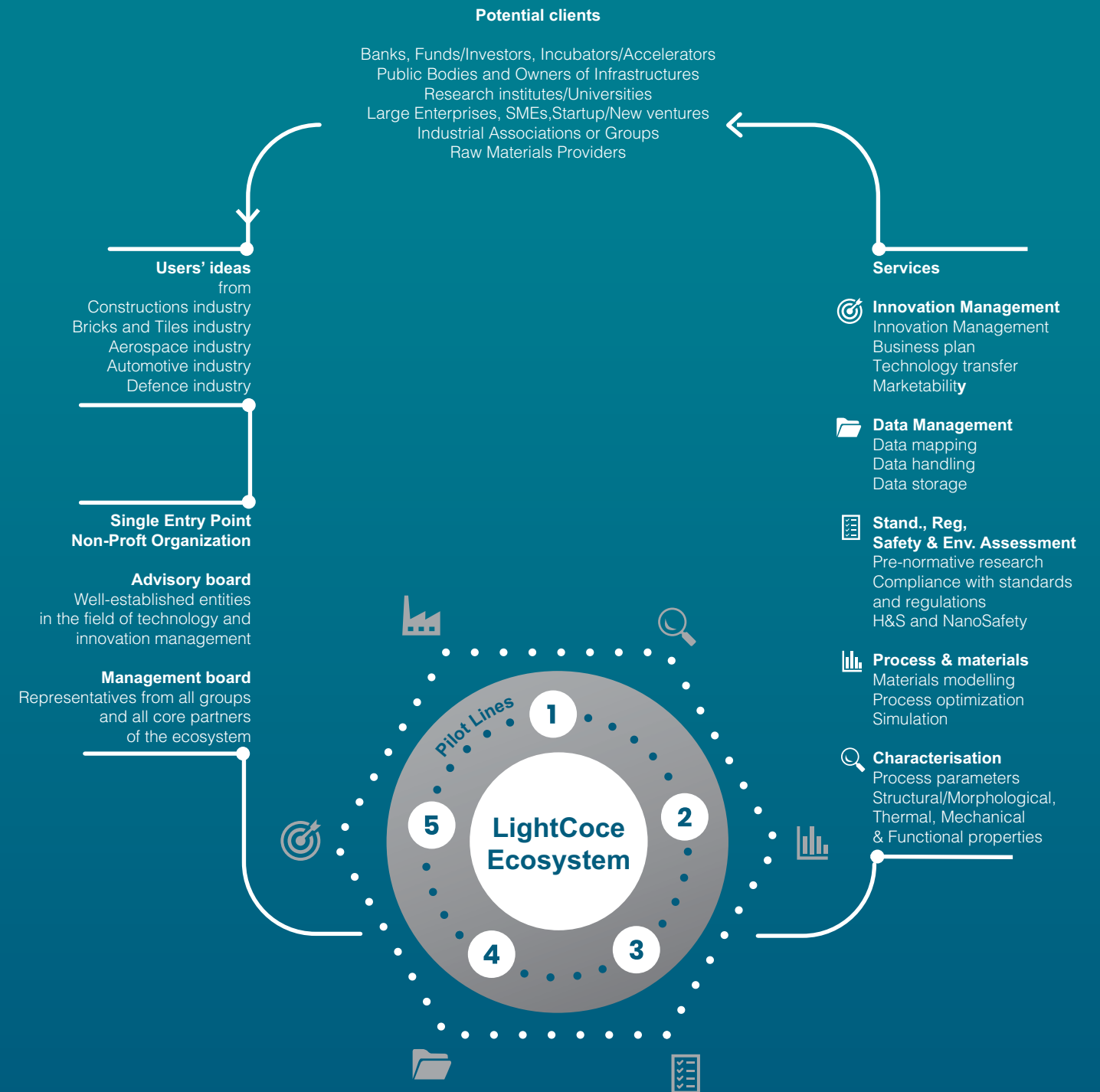
Modelling Services

The Modelling Group focuses on process modelling and simulation through the **development of holistic models** of each of the processes through the multi-scale modelling of materials and unitary operations. Moreover, **predictive modelling** at different levels will be implemented to generate a chain of models that lead to full-scale simulation of real structures, to evaluate the overall performances of the solutions at a global level. Micro-, meso- and continuum models will be developed for this purpose. In addition, targeting to process optimisation, the model will be the basis

for the implementation of the optimisation strategy.

A **multidisciplinary design optimisation (MDO) approach** will be used to carry out the optimisation of the process parameters attending to material performance, environmental and economic criteria.

After the implementation of the model, it can be used as a simulation tool to replicate the target process in different industrial landscapes and scenarios. Therefore, the developed model can be used as a decision support tool to help to define the business plan and the marketability for the target development. Already the partners that will work towards





this are leading members in the European Materials Modelling Council (EMMC) and will ensure the high collaboration and compliance.

Standardisation, Regulatory & Safety Assessment Services

Standardisation and regulatory compliance are key issues for further exploitation and commercialisation of innovations. The harmonisation of the new materials or products with dedicated standards, including Eurocodes (for constructions), ISO 10545, standard EN 14411 (for tiles) and standards developed under ISO TC 163 (for thermal performance and fire resistance) and TC 89 (for the building physical performance of components), as well as

with relevant regulatory framework, will be addressed. All testing will be in alignment with international standards (CEN, ISO, ASTM, etc.) and regulatory framework aiming to develop products towards EU standards.

A safe-by-design perspective will be followed, promoting safe practices during production and installation (pilot lines and industrial scale) especially taking into account the handling and use of nanomaterials, and supporting the test cases/clients on the development of safer and sustainable processes by conducting a risk assessment (on the occupational health & safety and environmental point of view), environmental impact (life cycle analysis), life cycle cost and ecoefficiency assessment studies.

Data management Services (DMG)

DMG designs and implements **a solid Plan for the collection, storage, exploitation and the evaluation of the data**, through the establishment of an Open Innovation Environment (OIE).

Openness, accessibility to beneficiaries and reusability of the produced data are also be ensured by the **Data Management Plan**.

Data sharing and data usage is be maximised taking into consideration Data Security and Privacy as well as GDPR compliance. Communication and data sharing between partners is achieved through a platform designed for this purpose, where data generated from disparate sources will be combined into meaningful and valuable information (Data Mapping).

Innovation Management (IM) Services

The project provides **a wide range of services that will be enabled by the LightCoce platform** ensuring a smooth connection of different stakeholders within an ecosystem with the ultimate goal to foster innovation in the area of materials, namely: Research institutes/Universities, Large Enterprises, SMEs, Start-ups/New ventures, Industrial Associations or Groupings, Banks, Funds/Investors, Public Bodies and Owners of Infrastructures. A catalogue of services will be defined (technical and non-technical) to support material technology adoption by industry and end users.

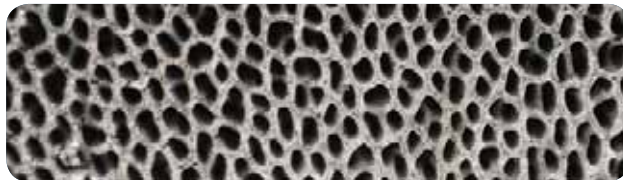
The innovation services are open access under specific fees to all parties

and will include development of business model, marketability assessment, suggesting the technology to enable the value proposition, embodying the technology in a product/service in favour of the user, ensuring the proper protection of the IP developed and identifying the funding opportunities offered through additional public funding at local or EU scale, as well as investment funds. Moreover, a dissemination plan is already designed to reach the largest audience possible and to inform EU stakeholders about the LightCoce project's objectives, services and results.

5. Pilot lines



PL1 - Smart lightweight concrete and components



PL2 - Cellular lightweight concrete



PL3 - Pressed ceramics



PL4 - Extruded lightweight ceramics



PL5 - Spark plasma sintering

6. Test Cases

Nano Enabled Lightweight Concrete

Nano Modified Cellular Lightweight Concrete

Load Bearing, Light Weight Sandwich Concrete Panels

Multifunctional Lightweight Bridge Decks Reinforced With Frp Rebars

Lightweight Porcelain Tiles For Improving Air Quality

Extrusion Of Lightweight Bricks With Nanoscale Porosifying Agents

Lightweight High Durability Valves For Satellites

Lightweight Re-Entry Vehicles Parts

7. Consortium Partners



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Partners

