MODELLING STRATEGY AT THE LIGHTCOCE PROJECT: AN ECOSYSTEM FOR ADVANCED MATERIALS

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Key Words: *Multiphysics Problems, Industrial impact, translation.*

Contributions The full title of the project summarizes its objectives "Building an Ecosystem for the up-scaling of lightweight multi-functional concrete and ceramic materials and structures". LightCoce is a research H2020 project that belongs to the Open Innovation Test Beds group. 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 has been 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. Among other materials, 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. 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. The main objective of the LightCoce project is to cover the gap in the upscaling and testing.

A multiscale material model methodology has been applied to correlate the material composition, structure and manufacturing process with their physical performance. Combining atomistic, coarse grained, meso finite element models and macro models, relationships between composition, porosity or volume fraction with the final mechanical, thermal, hygrothermal or self-sensing material properties have been established. In order to minimize the energy, a link between the energy consumption and the most critical industrial processes have been determined. Finally, an easy-to-use methodology to estimate the optimal materials' properties combined with minimising manufacturing energy consumption has been proposed. The methods developed consider the impacts on the cost and emissions avoided during the manufacturing process performing the multidisciplinary design optimisation (MDO) of the material. The resulting output represents the best manufacturing option to obtain the final product optimised in energy consumption and material properties.

In the coming months, Lightcoce project plans to launch an open call, inviting new cases to enter into the eco-system, and benefit of the Lightcoce project services (including modelling) free-of-charge. The proposed test cases should be in the area of lightweight, nanoenabled concrete, traditional ceramics and advanced ceramic materials and the starting TRL should be at least 4-5. The call is expected to be launched towards the end of April and more information will be available at a later date in the program web-site: www.lightcoce-oitb.eu .