



SUBLime

Sustainable Building Lime
Applications via Circular Economy
and Biomimetic Approaches



OPEN PhD POSITION in European Training Network

We are looking for a dedicated and highly motivated Early Stage Researcher (ESR), who will join our team to craft the future of lime mortars/plasters in new construction and conservation of the built heritage.

SUBLime description (4 years ETN project starting February 2021)

Lime is one of the earliest industrial commodities known to man and it continues to be one of the essential building blocks of modern Society. The global lime market is anticipated to approach the value of 44 Billion Euros by the end of 2026 and resulting in various growth opportunities for key players. The SUBLime network aims to develop the most advanced technology in lime-based materials modelling and characterization for industrial use that will go beyond the limitations of existing solutions in new construction and conservation in the built heritage. It is dedicated to recruit and train fifteen PhD students in multiple scientific and engineering fields towards a better understanding and development of sustainable innovations in both added functionalities and sustainability aspects in lime mortars and plasters, strongly based on novel biomimetic and closed loop recycling approaches. The cross-disciplinary approach throughout the SUBLime value chain, leveraging the knowledge of the academic (6) and industrial members (11), such as lime producers, mortar/plaster/block producers, and end-users for the prioritization of industrial needs, will dramatically increase the transfer of scientific knowledge to the lime-consuming industries in the EU.

ESR11 – UMINHO

Thermo-physical and short term mechanical properties of lime-based mortars: upscaling from micro to macro scale

Objectives: The objective is to bridge the gap between knowledge generated at the micro and macro scales, towards the prediction of actual mortar behaviour, acting as a construction material. This ESR focuses mainly in thermo-physical and short term mechanical properties, such as: thermal conductivity, specific heat, moisture diffusion, compressive/tensile strength, bond (e.g. brick vs mortar) and E-modulus. This work will be focused on strategies for upscaling properties obtained at the microstructural level to larger scales, using two distinct approaches: (a) a fully numerical approach based on lattice models or finite element models that upscale the REV's throughout the scales; (b) a fully or semi-analytical strategy based on extending standard procedures such as the Mori-Tanaka or other schemes for homogenization. At the larger scales, 3 particular challenges are expected: (a) the need to consider Interface Zone between the matrix and the aggregates, which still remains difficult in other materials that have been subject of significant research in the past (e.g. cement-based mortars); (b) the inherent challenges to upscaling from mortar-brick towards masonry behaviour; (c) issues related to understanding and being able to predict efflorescence of salts on masonry units, with salts coming from the mortars. The models will be implemented in a commercial software as an external user subroutine (or API), allowing the industrial partners to apply them.

Expected Results: A framework for upscaling of material properties from the micro-scale up to the scale of the masonry itself. Two tracks are considered: fully numerical and semi-analytical. Included properties: thermal conductivity, specific heat, moisture diffusion, compressive/tensile strength, bond and E-modulus. Benchmarking examples will be deployed.

Keywords: thermo-mechanical behaviour, lime, mortar, masonry, numerical modelling, analytical analyses.

Applicant Profile: Master level in Civil Engineering or related field, ideally with background in numerical research. Excellent communication skills (both written and oral) in English.

PhD main locations: The recruited ESR is given the opportunity to conduct 3 years of PhD studies at [ISISE](#) (Institute for Sustainability and Innovation in Structural Engineering) from the [University of Minho](#) but also to visit other network partners for secondments ([TU Delft](#), [Tarmac](#)) and to attend the training events of the network.

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More details about SUBLime project, requirements for the candidates and recruitment procedure: www.sublime-etn.eu/jobs/