SUBLime
Sustainable Building Lime
Applications via Circular Economy
and Biomimetic Approaches

Marie
Skłodowska-Curie
Actions

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.

ESR10 – UGent
3D multi-scale structural characterization and long-term performance related to efflorescence

Objectives: Characterize the 3D microstructure of current lime-based mortars and new generation of lime-based mortars and plasters using multi-scale high resolution X-ray imaging. Experimentally, the product's performances will be validated with special attention towards efflorescence and salt damage. This ESR will be in close collaboration with the other ESR's as the microstructural characteristics can be used as a tool for the modelers and the 3D imaging can serve as an input for validation. The composition of the newly developed mortars (binder, additives, grain size) is known to influence greatly the efflorescence. Other important elements are the variability of the pore structure of the mortar during hydration and carbonation, and the change once in contact with porous bricks. Efflorescence will be tested using an accelerated efflorescence test, which involves a series of wetting-wicking cycles under specific climatic conditions on a combined specimen of mortar and brick. This test can be preceded by an accelerated carbonation of the mortar, which allows testing the mortar at various ages. This study will be complemented by dynamical monitoring of physical changes inside the mortars during salt efflorescence using dynamic X-ray imaging and ESEM.

Expected Results: a) A multi-scale 3D characterization of the different mortar formulations, b) a clear link between the 3D characteristics and the long-term behaviour of lime-based (new developed) mortars, particularly regarding salt damage and efflorescence development, c) a validation tool of the developed models, 4) an innovative method to monitor dynamic (salt crystallization, fracture development) damaging processes inside lime-based mortars.

Keywords: 3D characterization, efflorescence, X-rays, new function lime mortars/plasters.

Applicant Profile: Master level in Geology, Physics, Civil Engineering (building materials) or related field, ideally with background in experimental 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 PProGRess (Pore-scale Processes in Geomaterials Research group, Member of the Centre for X-ray Tomography) and at the Magnel-Vandepitte laboratory for Structural Engineering and Building materials from Ghent University. The ESR will also visit other network partners for secondments (University of Granada, Wienerberger), and attend the training events of the network.

Main contacts:
Veerle Cnudde, Full Professor, veerle.cnudde@ugent.be (supervisor)
Nele De Belie, Full Professor, nele.debelie@ugent.be (co-supervisor)
Carlos Rodríguez Navarro, Full Professor, carlosrn@ugr.es (co-supervisor)

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