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.

ESR5 – UGENT

Self-healing in lime based mortars

Objectives: Both analytical science and practical experience have indicated that providing lime mortars with an early strength avoids failure due to environmental conditions such as frost or strong solar radiation. Instead of expensive and/or toxic chemicals, the rapid hardening of lime mortars will be obtained through bacterial CO_2 production and calcium carbonate precipitation. When cracks do occur in lime-based mortars, they possess an autogenous healing capacity, which is a well-known phenomenon, but the conditions have not been the focus of much research until now. Parameters affecting the self-healing capacity (lime composition, water and CO_2 concentration, temperature, among others) will be studied as a basis, and measures for improvement proposed. Application of bacteria that induce precipitation of calcium carbonate at the interface of building stone and lime mortar/plaster may change the surface roughness and improve the bond due to the compatibility between the precipitate and the lime and reduction of the sorption characteristics of the stone. In addition, bacteria will be added into lime mortar, to induce $CaCO_3$ precipitation in occurring microcracks, and their viability will be studied after various time spans. Brick-mortar assemblies with bacteria at the interface or in the mortar, will be loaded to study revival of bacteria and healing of microcracks. Need for protection of bacteria, and use of spores instead of vegetative cells will be considered. Water availability during carbonation of the lime can be tailored by addition of superabsorbent polymers.

Expected Results: The research will aim to reduce the formation of cracks in lime-based mortars and plasters. Bond strength between building stones and mortar will be increased. Setting can be accelerated leading to higher early strength. Autogenous self-healing of lime mortars will be better understood. Self-healing will be stimulated or engineered by special additions.

Keywords: biomimetic, self-healing lime mortars/plasters, microbially induced carbonate precipitation (MICP), superabsorbent polymers.

Applicant Profile: Master level in Bio-engineering (microbial technology), Civil Engineering (building materials) or related field, ideally with background in relevant 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 the Centre of Microbial Ecology and Technology and at the Magnel-Vandepitte laboratory for Structural Engineering and Building materials of Ghent University, and in addition at the Unit of Research Excellence "Carbonates", located at the Dept. Mineralogy and Petrology in the University of Granada in a Joint PhD structure. The ESR will visit also other network partners for secondments (Lhoist, Belgium), and attend the training events of the network.

Main contacts:

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