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.

ESR3 – UGR

Lime-based mortars and plasters with added functionality: a biomimetic approach

Objectives: The objective is the development and testing of novel methods to add extra functionalities to lime-based mortars and plasters via a nanoparticle-based, biomimetic strategy. Lime-based mortars and plasters are exposed to water/humidity and pollutants/dirt accumulation that can ultimately lead to soiling and degradation, hampering their longterm durability. To avoid these problems, two strategies will be tested and validated here. One involves the modification of the surface properties (wettability) via the application of nanoparticles that can be integrated in the fresh mix or applied afterwards on the set material surface. Such nanoparticles can impart nano- and microrugosity, fostering a transition from a Laplace regime to a Cassie-Baxter regime leading to enhanced hydrophobicity or even superhydrophobicity. This strategy is based on nature, which through million years evolution have designed (super)hydrophobic structures, such as the Lotus leaves which through hierarchical nano- and microstructures enable extreme hydrorepellency. To enhance surface protection nanoparticles will also be applied along with polydimethylsilane (PDMS). Specific nanoparticles with known photocatalytic activity, e.g., anatase (TiO2), will be also tested for self-cleaning functionality. Interestingly, such nanoparticles could also contribute to surface rugosity, thereby potentially playing a dual functional role: self-cleaning and (super)hydrophobicity, aspects that need to be explored and validated.

Expected Results: The research results will lead to the design and implementation of novel formulations and surface treatment for an enhanced durability of lime-based building materials. They will also contribute to the optimization of novel surface protective coatings that not only would prevent water-related decay problems, but also contribute to the prevention of soiling or the development of biodeterioration, because, for instance, the photocatalytic oxidative functionality imparted by TiO2 nanoparticles, is also effective for the prevention of bacterial proliferation, or the development of other microorganisms (fungi, algae).

Keywords: biomimetic, new functional lime mortars/plasters, self-cleaning, nanoparticles, superhydrophobicity

Applicant Profile: Master level in Geology, Physics, Chemistry 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 Unit of Research Excellence "Carbonates", located at the Dept. Mineralogy and Petrology in the University of Granada, but also to visit other network partners for secondments (Lhoist and University of Ghent), 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/