

The Marie Skłodowska-Curie Innovative Training Network (ITN) "SMARTINCS - PhD Training Network on Self-healing Multifunctional Advanced Repair Technologies in Cementitious Systems" funded by the European Commission (H2020) invites applications for 15 full-time Early Stage Researcher (ESR) positions, with a minimum duration of 36 months (M), starting at 1/12/2019 at the earliest and 1/06/2020 at the latest.

Summary

The appearance of small cracks in concrete is almost unavoidable, not necessarily causing a direct risk of structural safety, but surely impairing its functionality, accelerating its degradation, and diminishing its service life and sustainability. The loss of performance results into the need of increased investments on maintenance and/or intensive repair/strengthening works. The benefits of self-healing concrete, mortar and grout, in which those defects are repaired autonomously, will increase in service life of structures, reduce maintenance and repair costs, save raw materials and reduce waste production, avoid CO₂ emissions and reduce traffic downtime and accidents. SMARTINCS will move this technology well beyond the state-of-the-art by several innovative approaches.

About SMARTINCS

SMARTINCS will train a new generation of creative and entrepreneurial early-stage researchers (ESRs) in prevention of deterioration of (i) new concrete infrastructure by innovative, multifunctional self-healing strategies and (ii) existing concrete infrastructure by advanced repair technologies. The project brings together the complementary expertise of research institutes pioneering in smart cementitious materials, strengthened by leading companies along the SMARTINCS value chain, as well as certification and pre-standardization agencies. The network will deliver world-leading training in this multidisciplinary field through 15 PhDs in interrelated aspects responding to the clear demand to implement new life-cycle thinking and durability-based approaches to the concept and design of concrete structures, minimizing both the use of resources and production of waste.

Job description

ESR1: Optimised vascular network, PhD in Civil Engineering - The ESR will develop an algorithm to optimize the topology of vascular networks used in self-healing concrete and will realize the optimal design through 3D printing.

Host: Ghent University (Belgium) - Secondments: University of Cambridge (United Kingdom, 4.5 M), University of Cardiff (United Kingdom, 5 M), Besix (Belgium, 1 M)

ESR2: Advanced capsule manufacturing techniques, PhD in Engineering - The ESR will explore and scale up the new and promising technique of membrane emulsification for the production of capsules with functionalized surfaces.

Host: Micropore Technologies (United Kingdom) - Secondments: Politecnico di Torino (Italy, 3.5 M), University of Cambridge (United Kingdom, 3.5 M), Consejo Superior de Investigaciones Científicas (Spain, 3.5 M)

ESR3: Self-protected bacteria for healing and corrosion inhibition, PhD in Bio-Engineering - The ESR will select, improve and functionalize self-protected bacterial granules showing both repetitive self-healing and anti-corrosion activity at reasonable cost.

Host: Avecom (Belgium) - Secondments: Ghent University (Belgium, 6 M), University of Cardiff (United Kingdom, 3 M), Delft University of Technology (the Netherlands, 1 M)

ESR4: Optimised mix design, joint (KU Leuven-UPV) PhD in Engineering Technology and Construction Engineering -

The ESR will develop a methodology for the design of optimized self-healing concrete mixes to be used in ready-mixed and prefab concrete applications. Particle packing models will be upgraded for inclusion of self-healing agents in concrete mix designs.

Host: KU Leuven - Ghent Technology Campus (Belgium) - Secondments: Cugla (the Netherlands, 2 M), Universitat Politècnica de València (Spain, 6 M), Besix (Belgium, 1 M), Buzzi Unicem (Italy, 1 M)

ESR5: Science-based modelling of self-healing systems, PhD in Numerical Modelling - The ESR will improve the accuracy and range of applicability of multiscale coupled numerical models for self-healing systems through a science-based approach that is underpinned by the physics and chemistry of healing processes and informed by detailed experimental observations.

Host: University of Cardiff (United Kingdom) - Secondments: Delft University of Technology (the Netherlands, 4 M), Politecnico di Milano (Italy, 4 M), International Federation for Structural Concrete - fib (Germany, 2 M)

ESR6: Crystalline self-healing technology for non-shrinkage cementitious grouts in non-structural applications, PhD in Chemistry - The ESR will design multifunctional non-shrinkage cementitious grouts with enhanced performance in specific non-structural applications.

Host: University of Cordoba (Spain) - Secondments: Cambridge University (United Kingdom, 3.5 M), Politecnico di Milano (Italy, 3 M), Penetron (Italy, 4 M)

ESR7: Self-healing repair mortars, PhD in Civil Engineering - The ESR will embed smart biomimetic advanced functionalities to repair mortar formulations to tackle multi-damage scenario triggers, hence combining both physical and chemical triggers.

Host: University of Cambridge (United Kingdom) - Secondments: Cugla (the Netherlands, 3.5 M), University of Cordoba (Spain, 3.5 M), Consejo Superior de Investigaciones Científicas (Spain, 3.5 M)

ESR8: Self-healing cover zone, PhD in Civil Engineering - The ESR will apply self-healing technologies in the concrete cover-zone, the actual zone which controls the durability of reinforced concrete structures, saving unnecessary use of self-healing material elsewhere.

Host: Delft University of Technology (the Netherlands), possibility to start at 1/12/2019 - Secondments: KU Leuven - Ghent Technology Campus (Belgium, 3 M), Concrefy (the Netherlands, 4 M), Karlsruhe Institute of Technology (Germany, 3 M)

ESR9: Self-sensing for damage monitoring using carbon nanomaterials, PhD in Civil Engineering - The ESR will investigate the potential for a range of carbon nanomaterials to form self-sensing cementitious systems to dictate the moment for repair of traditional concrete structures or to display whether self-healing was successful or not.

Host: University of Cambridge (United Kingdom) - Secondments: Politecnico di Torino (Italy, 3 M), Delft University of Technology (the Netherlands, 3 M), Consejo Superior de Investigaciones Científicas (Spain, 3 M), Concrefy (the Netherlands, 1 M)

ESR10: Cyclic mechanical and thermal actions and impact, joint (PoliMi-UGent) PhD in Structural, Geotechnical and Earthquake Engineering and Civil Engineering - The ESR will develop test methodologies to characterize healing performance in concrete structural elements under sustained loading and/or under repeated cracking and healing cycles, including effects of temperature cycles.

Host: Politecnico di Milano (Italy), possibility to start between 1/2/2020 and 1/5/2020 - Secondments: Ghent University (Belgium, 6 M), Centre Scientifique et Technique de la Construction (Spain, 1.5 M), Karlsruhe Institute of Technology (Germany, 3 M)

ESR11: Self-healing in realistic (extreme) conditions, joint (UGent-KU Leuven) PhD in Civil Engineering and engineering Technology - The ESR will produce a selection matrix for self-healing methodologies that can be tailored to specific real environments such as temperatures of -10 to 60°C, high salt or acid concentrations, etc.

Host: Ghent University (Belgium), possibility to start at 1/12/2019 - Secondments: Micropore Technologies (United Kingdom, 2 M), KU Leuven – Ghent Technology Campus (Belgium, 6 M), Concrefy (the Netherlands, 2 M)

ESR12: Mitigating chloride and carbonation induced corrosion, PhD in Construction Engineering - The ESR will verify durability enhancement, scaling up damage due to crack healing and obtain basic parameters for service life quantification.

Host: Consejo Superior de Investigaciones Científicas (Spain) - Secondments: Universitat Politècnica de València (Spain, 3 M), Ghent University (Belgium, 3 M), Research and Developments Concrete (Spain, 3 M)

ESR13: Integration of self-healing functionalities in structural and service-life design, PhD in Construction Engineering - The ESR will integrate self-healing technologies in the structural design practices of concrete structures and develop (new or adapted) service life models for self-healing concrete.

Host: Research and Developments Concrete (Spain) - Secondments: Universitat Politècnica de València (Spain, 3 M), University of Cardiff (United Kingdom, 2 M), Consejo Superior de Investigaciones Científicas (Spain, 2 M)

ESR14: Life Cycle Assessment, PhD in Civil Engineering - The ESR will realize a well-founded cradle-to-grave LCA for the different self-healing materials and elements studied in the project to underpin the environmental benefits that can be realized with those novel systems.

Host: Ghent University (Belgium), possibility to start at 1/12/2019 – Secondments: Politecnico di Milano (Italy, 3 M), Research and Developments Concrete (Spain, 3 M)

ESR15: Technology-tailored commercialization of self-healing methods and systems, multidisciplinary PhD in Business Economics - This ESR will investigate how the technical knowledge, generated in this project, can be optimally brought to the market.

Host: Ghent University (Belgium) - Secondments: Micropore Technologies (United Kingdom, 1 M), University of Cambridge (United Kingdom, 1 M), Avecom (Belgium, 1 M), the Belgian Construction Certification Association (Belgium, 1 M), Penetron (Italy, 1 M), Consejo Superior de Investigaciones Científicas (Spain, 1 M), Delft University of Technology (the Netherlands, 1 M), Politecnico di Milano (Italy, 1 M), University of Cardiff (United Kingdom, 1 M)

Job requirements

Applicants should have a master's degree (or equivalent) in Bio / Chemical / Civil / Structural / Construction Engineering, Engineering Technology, Numerical Modelling, Chemistry or Business Economics (depending on ESR position you want to apply for) or related studies, with a strong interest in concrete technology, durability and sustainability assessment and modelling. Above all, applicants should have a high interest in scientific research; an independent and well-organized working style, demanding high quality of your own work; well-developed social skills directed towards working in an interdisciplinary team, excellent interpersonal and communicative skills; strong motivation to succeed in scientific research, excellent presentation and scientific writing skills, excellent English language skills (verbally and written).

Applicants must (at the time of recruitment) not have more than 4 years' (full-time equivalent) research experience and not yet hold a PhD. Researchers can be of any nationality and are required to undertake trans-national mobility. Researchers must not have resided or carried out their main activity (work or study) in the country where the host is based for more than 12 months in the 3 years prior to their employment.

Application

Applications must contain the following documents:

- a personal (motivation) letter and curriculum vitae,
- a copy of degree certificates and associated certificates,
- a transcript of records of the bachelor and master curriculum,
- a copy of degree projects and any previous publications,
- a proof of English language skills,
- two recommendation letters (or the names and email addresses of two references).

The documents should be sent to smartincs@ugent.be with in the title of the mail a clear reference to the ESR position(s) you apply for. The mails needs to be addressed to the SMARTINCS recruitment coordinator: Professor Kim Van Tittelboom, Ghent University.

Deadline

15/08/2019