CERIS Civil Engineering Research and Innovation for Sustainability

InnoCreteTech – Towards climate resilience from upcycle waste technologies for the construction industry – Innovative concrete solutions

Summary

Scope – Concrete is one of the most consumed materials in the world, accounting for close to 8% of the anthropogenic emissions of carbon dioxide (CO_2) on the planet. In addition to CO_2 emissions, another latent problem in cement and construction industries is the overexploitation of natural resources, both in cement manufacturing and in the production of other concrete components, such as mineral aggregates. In this context, it is necessary to develop alternative solutions with a positive impact (regenerative) or with a reduced impact (sustainable). The main objective of the InnoCreteTech project was to map, characterise and disseminate technical and scientific information about available Portuguese industrial waste and by-products, supporting the selection of the best transforming technologies to develop innovative regenerative and sustainable building materials. Thus, a Waste-to-Value Methodology which allows the evaluation of waste and by-products according to different technologies was proposed.

Main objective

Strengthen research, technological development and innovation.

In line with the circular economy models encouraged by the European Commission, which foresees both the reduction of waste generated and its reuse, this project had as its main objective the recovery of waste and industrial by-products through innovative technologies in concrete solutions.

Project activities and expected results

The InnoCreteTech project had a total duration of 18 months and the work was developed according to the following structure:

Task 1 – Waste materials and by-products identification and mapping

This task was based on a rigorous research survey that allowed the identification and systematisation of different types of waste and by-products at the national level. The identification, mapping and categorisation of these materials was carried out taking into account their characteristics, in order to evaluate their respective upcycling potential in terms of annual production, current disposal and management costs.

Task 2 – Characterisation of waste materials and by-products and selection of technologies

In this task, the physical and chemical characterisation of the previously identified waste materials and by-products was performed, in order to selected the best transforming technologies within the scope of the project: accelerated carbonation curing, alkali-activation, supplementary cementitious materials and recycled aggregates.

Task 3 – Reaction potential/performance and experimental validation

The reaction potential and performance of the best technologies were evaluated in this task. Considering some characteristics, such as elemental and mineralogical properties of the different waste materials and by-products, it was possible to assess the technologies' reaction potential. Experimental validation was also carried out considering the specific characteristics of each waste material, as well as up-cycling technologies.

Task 4 – Technical and sustainability validation of innovative concrete solutions

In this task, different prototypes were developed and tested, in order to validate several requirements, such as those imposed by product standards, considering the specific application, functionality, efficiency and sustainability, without compromising durability throughout the whole service life of the products. Additionally, life cycle assessment studies were carried out, which made it possible to demonstrate the environmental performance of the products developed.

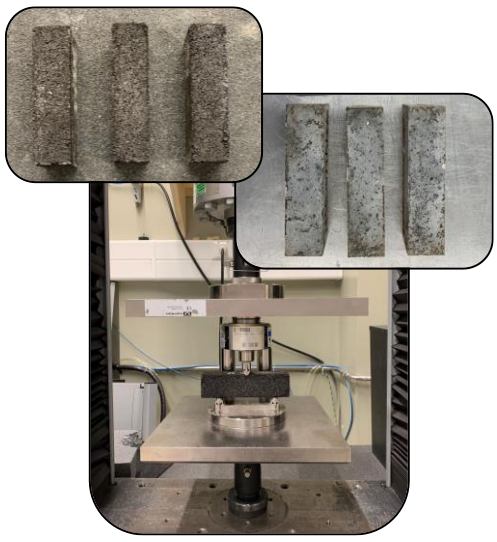

Figure 1. Cementitious composites incorporating wastes from the steel industry developed taking into account different up-cycling technologies: supplementary cementitious materials and accelerated carbonation curing.

Project Reference

EXPL/ECI-EGC/1585/2021

Leading Institution

Itecons – Instituto de Investigação e Desenvolvimento Tecnológico para a Construção, Energia, Ambiente e Sustentabilidade (Portugal)

Partners

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CERIS

Coimbra Hub: 50 000.00€

Project Website

https://www.itecons.uc.pt/services/projects/114