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USE OF CERAMIC WASTES TO DEVELOP LOW CARBON CEMENT FOR MADE IN ITALY INDUSTRY

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Abstract

The integration of ceramic wastes into low carbon cement is a sustainable and innovative approach to reduce the environmental impact in the construction industry. Ceramic production generates substantial amounts of ceramic waste, posing significant environmental and disposal challenges. By recycling this waste into concrete, this study aims to reduce the carbon footprint of cement production, address waste management issues, and promote circular economy principles.

Ceramic wastes showed pozzolanic properties, which contribute to the strength and durability of concrete. The presented research explored the most significant sources of ceramic wastes available in the North of Italy and collected different samples from various origin: wastes generated at different ceramic production stages, wastes from selective construction and demolition, crushed ceramic tiles from grinding companies. The materials were analysed and treated to make them suitable as cement substitute. The cement formulation used achieves a CO₂ emission reduction of over 40% compared to ordinary Portland cement while maintaining acceptable mechanical strength. The evaluation of mortar properties concerns the behaviour at the fresh state and at the hardened state, according to initial material properties like particle size distribution, specific surface area and density. The results show that ceramic waste can effectively substitute calcined clay in low-carbon mortars, reducing CO₂ emissions, admixture demand, and production costs. This strategy supports industrial application and offers scalable benefits for a more sustainable cement industry in Italy and worldwide.

Key words: ceramic waste, circular economy, low-carbon cement, recycling

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