

High Performance Mortar with 100% Recycled Aggregate using Titanium Dioxide Nanoparticles

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ABSTRACT

Concrete and mortar are materials commonly used in construction. Their main compounds are cement, aggregates (sand and gravel) and water. In an effort to increase the sustainability of these materials, the idea of using recycled aggregates from ground old concrete and using it to make mortar and concrete has gained more interest. It has two advantages: it reduces the need to mine for raw materials and lessens the amount of old and defective concrete that is typically put in landfills. But, the use of recycled concrete aggregate lowers the strength of mortars and concretes because the residual compounds in the recycled sand reduces bonding with the cement paste. This research studies the use of Titanium Dioxide nanoparticles (TiO_2) as a potential additive to increase the strength and improve the bonding of mortar with 100% recycled aggregates. Using mixtures with different percentages of TiO_2 by the weight of cement (0% -reference-, 0.5%, 1% and 2%) the compressive and flexural strength was studied. With 0.5% of TiO_2 nanoparticles, an improvement of 10 % of the compressive strength and 7% of the flexural strength with respect to the reference mortar at 7 days were achieved. Results of compressive and flexural strength at 90 days will be obtained during the next weeks. The effect of TiO_2 on the hydration product through Thermogravimetric analysis (TGA) is being studied. Additionally, the effect of TiO_2 on the microstructure of the mortar will be investigated using scanning electron microscope (SEM) analysis (ongoing analysis).

KEYWORDS

Sustainability, mortar, recycled aggregate, titanium dioxide nanoparticles