

The effects of lime solution on the properties of SiO₂ nanoparticles binary blended concrete.

ABSTRACT

In this study, the effects of SiO₂ nanoparticles on both mechanical properties (compressive, split tensile and flexural strength) and physical properties (water permeability, workability and setting time) of binary blended concrete have been investigated. SiO₂ nano-particles have been used as a partial cement replacement by 0.5, 1.0, 1.5 and 2.0 wt.%. Curing of the specimens has been carried out in water and lime solution for 7, 28 and 90 days after casting. For the specimens cured in water, the optimal replacement level of cement by SiO₂ nanoparticles for producing concrete with improved strength, was set at 1.0 wt.%. However, by curing the specimens in lime solution, Portland cement could be advantageously replaced by 2.0 wt.% of SiO₂ nanoparticles. It was concluded that the SiO₂ nanoparticles can improve the filler effect and its ultra high pozzolanic activity causes more C–S–H gel formation when cured in lime solution. Although curing in the lime solution can reduce the strength of control concrete, Curing the specimens containing SiO₂ nanoparticles in lime solution causes faster setting time together with higher strength and residence to water absorption.

Keyword: Nano-structures; Strength; Mechanical testing; Thermal analysis