

Experimental investigation of the size effects of SiO₂ nano-particles on the mechanical properties of binary blended concrete

ABSTRACT

In the current study, the size effects of SiO₂ nano-particles on compressive, flexural and tensile strength of binary blended concrete were investigated. SiO₂ nano-particles with two different sizes of 15 and 80 nm have been used as a partial cement replacement by 0.5, 1.0, 1.5 and 2.0 wt.%. It was concluded that concrete specimens containing SiO₂ particles with average diameter of 15 nm were harder than those containing 80 nm of SiO₂ particles at the initial days of curing. But this condition was altered at 90 days of curing. Also from the viewpoint of free energy, it can be concluded that the C₃S₆H gel formation around the particles with average diameter of 15 nm was more at the primary days of curing. This can be as a result of more nucleation sites that causes acceleration in early age strength. On the other hand, the growth probability of C₃S₆H gel around the 80 nm particles was more at 90 days of moist curing. This is due to the fact that the nucleus of strengthening gel could simply reach to the critical volume of nucleation that causes increase in the strength.

Keyword: A. Nano-structures; A. Particle-reinforcement; B. Strength; D. Mechanical testing