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Factors affecting the use of nano silica in concrete

Kamal G Sharobim
Suez Canal University, Egypt

Nano silica had been investigated as a partial replacement of cement by many researchers, regardless its high agglomeration specially when mixed to water. Sonication is one of the methods used to de-agglomerate nano silica particles and to improve the dispersion of nano silica in cement matrix. This research aims to reach the optimum indirect sonication time and solid to liquid ratio that enhances the dispersion of nano silica and consequently increases its reactivity in high strength concrete. Particle size distribution of the sonicated nano silica particles and the corresponding specific surface area were the main keys governing the optimization process of the studied parameters. Using the optimum solid to liquid ratio with the corresponding sonication time, slump and the compressive strength of concrete were examined and compared to the control mix (without nano silica addition) were measured as an indication to the reactivity of nano silica. In addition, the microstructural analysis using SEM and XRD helped in confirming the compressive strength results. The results revealed that the optimum solid to liquid ratio is 1:10. Moreover for every concentration, there is an optimum indirect sonication time. The optimum sonication time found to be 5 minutes for solid to liquid ratio 1:10. By using the optimum concentration an improvement in compressive strength of 32% and 24% after 7 and 28 days were reached as compared to the control mix, where in terms of slump, there is no change in the flow ability of concrete due to the incorporation of nano silica in concrete.

k_sharobim@hotmail.com

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