Insights on the influence of nano-Titanium dioxide and nano-Zinc oxide on mechanical properties and inhibiting of steel reinforcement

This paper focuses on investigating the effect of different percentages of milling nanoparticles, nano TiO2 (NT) and nano ZnO (NZ), on the performance of reinforced concrete and comparing their results, especially their performances of corrosion rate of rebar. They were used as additives materials to concrete by percentage (0.5%, 1%, and 1.5%) by weight of cement. It includes a study on their effect on workability, compressive strength of concrete at 7, 28, and 90 days, flexural strength of concrete at 28 days, while the corrosion rate of reinforced concrete at 30, 90,and 180 days after exposure half of specimens to aggressive medium and another half to natural medium. The results indicated that concrete samples containing NT achieved the best results compared to concrete samples containing NZ for mechanical properties. The improvement range of NT specimens was about 6% – 36% for compressive strength and 8% – 27% for flexural strength. The worst effect of NZ is taking a long time to de-mold elements and reducing the degree of hydration; all of that is due to the reaction between ZnO and CH, accordingly; the effect of height percentages of it on mechanical properties of concrete was bad. But NT accelerates hydration and produces a huge amount of C-S-H; as shown in the SEM test so; it improves the properties of concrete. Although the corrosion rate of 1% NZ was better than the corrosion rate efficiency of 1.5% NT in an aggressive medium by 11.91% and 12.64% at 90 and 180 days, respectively. At later ages (90&180) days, the improvement of inhibition efficiency (ŋ) was about 53–90% for NT specimens and 60–90% for NZ specimens, which was more than the improvement of inhibition efficiency (ŋ) at 30 days as shown in Tafel curves. Thus powder NT & NZ materials enable the long-life cycling of concrete.