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Practical applications of nano-SiO_2obtained by different synthesis routs in construction materials domain

Abstract

Nowadays, there are various nanomaterials embedded in construction materials to improve their mechanical performances, durability, heating resistance as well as some specific properties such as self-cleaning and healing abilities. In this context, investigations regarding the effect of SiO2 nano-particles embedded in a cement matrix on mechanical properties and microstructure were performed. For this purpose nano-SiO2 powders were obtained by sol-gel method using different molar ratios of TEOS/ethanol/water. The SiO2 particles formation was confirmed by X-ray fluorescence analyses (XRF) and their nanometric sizes by scanning electron microscopy (SEM) technique. The cement based materials admixtures were obtained by using the water/binder ratio (w/b) of 0.5 and nano-SiO2 in the proportions of 0.5%, respectively 0.7 %. The distribution of nano-SiO2 particles within the cement matrix plays an essential role and governs the performance of these products. Therefore, to facilitate the nano-SiO2 particles distribution the mixtures were good homogenized in dry state. The mechanical test results showed that after 28 days of hydration the cement based materials with 0.7% nano-SiO2 content recorded better compressive strengths compared with those of the etalon (E=62MPa vs. M-NS1=72MPa). The microstructure of cement based materials highlighted the presence of Ca(OH)2, ettringite and calcium silicate hydrates as well as nano-SiO2 particles distributed into the cement matrix.