Accepted Manuscript

Nano-silica and silica fume modified cement mortar used as Surface Protection Material to enhance the impermeability

Bingliu Zhang, Hongbo Tan, Weiguo Shen, Gelong Xu, Baoguo Ma, Xiaoli Ji

PII: S0958-9465(18)30028-3

DOI: 10.1016/j.cemconcomp.2018.05.012

Reference: CECO 3065

To appear in: *Cement and Concrete Composites*

Received Date: 9 January 2018

Revised Date: 27 April 2018

Accepted Date: 14 May 2018

Please cite this article as: B. Zhang, H. Tan, W. Shen, G. Xu, B. Ma, X. Ji, Nano-silica and silica fume modified cement mortar used as Surface Protection Material to enhance the impermeability, *Cement and Concrete Composites* (2018), doi: 10.1016/j.cemconcomp.2018.05.012.

Nano-silica and silica fume modified cement mortar used as Surface Protection Material to enhance the impermeability

Bingliu Zhang[1,2,3], Hongbo Tan[1]*, Weiguo Shen[1,2,3]*, Gelong Xu[1,2,3],Baoguo Ma[1,2], Xiaoli Ji[1,2,3]

1.State Key Laboratory of Silicate Materials for Architectures, Wuhan University of Technology, Wuhan 430070, P. R. China

2. School of Materials Science and Engineering, Wuhan University of Technology, Wuhan 430070, P. R. China

3. WUT-UC Berkeley Joint Laboratory on Concrete Science and Technology, Wuhan 430070, P. R. China

Abstract: In corrosion environment, corrosion ions can easily penetrate from the surface into the inside of the concrete due to the porous structure of the surface, and in this case, concrete can inevitably suffer from the damage. In this study, an attempt to use nano SiO_2 (NS) and silica fume (SF) modifying cement mortar as a Surface Protection Material (SPM) was made, in order to promote penetration resistance of the whole system. SPM was coated on the surface of matrix, and then interfacial bond strength between matrix and SPM was measured; the shrinkage consistency was also considered; the chloride penetrability of the system was examined as well. To reveal the mechanism, effect of NS and SF on the pore structure, Interfacial Transition Zone (ITZ), hydration process, and compressive strength of SPM were investigated. The results show that matrix coated with SPM on the surface has a good integrity, with excellent interfacial bond strength and little difference in shrinkage, and chloride diffusion coefficient of the system was considerably declined, in comparison with the matrix, showing an excellent penetration resistance. The mechanism behind is that SPM, which was modified with SF-NS, shows the excellent impermeability, and this kind of material existing on the surface can noticeably obstruct the chloride ions penetrating into the inside. In cement hydration process, SF and NS can not only consume a large amount of CH to form dense C-S-H, but also exert the grading filling effect, resulting in the decline in porosity, the increase in density, the improvement in microstructure of ITZ, and the enhancement in mechanical performance. The findings