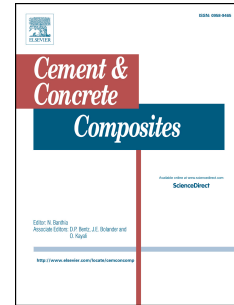


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1 Nano-silica and silica fume modified cement mortar used as 2 Surface Protection Material to enhance the impermeability

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10 **Abstract:** In corrosion environment, corrosion ions can easily penetrate from the
11 surface into the inside of the concrete due to the porous structure of the surface, and in
12 this case, concrete can inevitably suffer from the damage. In this study, an attempt to
13 use nano SiO₂ (NS) and silica fume (SF) modifying cement mortar as a Surface
14 Protection Material (SPM) was made, in order to promote penetration resistance of
15 the whole system. SPM was coated on the surface of matrix, and then interfacial bond
16 strength between matrix and SPM was measured; the shrinkage consistency was also
17 considered; the chloride penetrability of the system was examined as well. To reveal
18 the mechanism, effect of NS and SF on the pore structure, Interfacial Transition Zone
19 (ITZ), hydration process, and compressive strength of SPM were investigated. The
20 results show that matrix coated with SPM on the surface has a good integrity, with
21 excellent interfacial bond strength and little difference in shrinkage, and chloride
22 diffusion coefficient of the system was considerably declined, in comparison with the
23 matrix, showing an excellent penetration resistance. The mechanism behind is that
24 SPM, which was modified with SF-NS, shows the excellent impermeability, and this
25 kind of material existing on the surface can noticeably obstruct the chloride ions
26 penetrating into the inside. In cement hydration process, SF and NS can not only
27 consume a large amount of CH to form dense C-S-H, but also exert the grading filling
28 effect, resulting in the decline in porosity, the increase in density, the improvement in
29 microstructure of ITZ, and the enhancement in mechanical performance. The findings

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