Nanocomposites and nanomaterials

The effect of silica-titania nanostructures on the bactericidal and mechanical properties of cement-based composites

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The material who has received considerable attention in last few years is titanium dioxide (TiO_2) which reveals the ability to decontaminate via photocatalytic processes. A large volume of work has been devoted to the research of TiO_2 induced photocatalysis, and the mechanisms underlying TiO_2 sensitized heterogeneous photocatalysis. Likewise, the combination of TiO_2 with cementitious materials in order to obtain functional photocatalytic product. In last years the development in the nanotechnology field allowed to obtain nanotitania particles which exhibits significantly improved efficiency of photocatlyic process due to its higher specific surface area. At the same time, the high specific surface area is responsible for major problems in proper incorporation of nanomaterials in the cementitious composites.

In the presented work the new approach to the incorporation of nanomaterials has been presented. The scope of the study is to test the influence of mesoporous silica-titania ($mSiO_2/TiO_2$) core-shell structures on the bactericidal and mechanical properties of cement mortars in order to obtain positive properties of both nanomaterials. In the study UV-resistant *E. coli* K12 was used as the test strain, which is a gram-negative bacterium widely selected as a model microorganism in many photocatalytic bactericidal experiments. The strength of the cement composites bactericidal performance is correlated with the illumination time. Studies have shown that the presented structures can be successfully applied in the cementitious composites to exhibit antibacterial activity and overcome main obstacles associated with application of nanomaterials in the cementitious composites.